Manta TRUST

Maldivian Manta Ray Project

Baa Atoll | End of Season Report 2014

A report for the Ministries of Environment and Fisheries, Maldives; EPA and MRC

MALDIVIAN MANTA RAY PROJECT

Executive Summary

This report presents data collected by the Maldivian Manta Ray Project (MMRP) on Baa Atoll's reef manta ray (*Manta alfredi*) and whale shark (*Rhincodon typus*) populations in 2014.

Baa Atoll has an international reputation as one of the most reliable places in the world to see manta rays and whale sharks. These animals frequent the waters of Baa Atoll due to the conditions created by the South Asian Monsoon which provides an abundant source of food for these planktivorous creatures in this region. In Baa Atoll these animals have been continuously studied since 2007 by the Maldivian Manta Ray Project (MMRP), a non-profit, independent conservation and research focused organisation; and the founding project of the UK charity, The Manta Trust.

Key findings of the MMRP in 2014 include a total of 3,363 sightings of 733 individual manta rays, recorded during the year in Baa Atoll. This equates to a 9% increase in sightings compared to the previous year and a slight increase of 4% in the number of individual manta rays seen. Overall these numbers reflect closely the results of the 2013 season, where a continued increase in manta sightings from the lows of 2011 and 2012 further supports our hypothesis that there is a direct correlation between manta sightings and the strength of the South Asian Monsoon. It is also worth noting however that, as for the 2012 and 2013 seasons, the increased number of sightings has also been influenced by a greater level of effort in research in recent years. When the data is standardised and compared to previous years, 2014 sightings were in fact less on average than in 2008-2010.

Each of the 733 different individual reef manta rays recorded in 2014 was observed on average 4.59 times during this season, a slight increase from 2013 (average 4.33 sightings per manta). The proportion of rays seen on more than one occasion also increased, reaching the highest ever recorded since data collection began in 2007, rising from 68% in 2013 to 73% this year. Together, these observations suggest longer residency periods for each manta in Baa Atoll, strengthening the hypothesis that increased monsoon strength leads to greater productivity in Baa Atoll drawing more manta rays to the region.

Chain feeding reef manta rays (*Manta alfredi*) cruise through Hanifaru Bay Marine Protected Area in Baa Atoll, Maldives

It is interesting to note that unlike in previous years, during 2014 the total number of manta rays observed peaked in July at 676 encounters and showed another slight increase in October and November (respectively 574 and 556 sightings), while in previous years this peak has historically occurred during the month of August. The sightings trend this year was more of a constant presence of mantas throughout the season, reflecting reasonable zooplankton concentrations throughout the entire survey period. The August sighting peak observed in pre 2011 years may not be the norm, but instead may have been linked to particularly intense monsoonal activities in those years. Fluctuation of wind strength and thus monsoonal intensity within the season is probably what drives high concentration of zooplankton and, in return, intense manta activity.

A reef manta rays (*Manta alfredi*) hovers above the cleaning station at Dharavandhoo Corner in Baa Atoll, Maldives while dozens of small cleanerfish remove parasites from its body.

It is worth noting that during the 2014 Southwest monsoon a large number of reef manta ray encounters were recorded at the cleaning station of Dharavandhoo Corner on the outside edge of the atoll (occasionally over 40 individuals recorded within a few surveying hours). The proximity of this site to the Dharavandhoo channel, along with in-water observations suggest that large feeding aggregations are likely to be occurring at depths greater than recreational scuba diving limits outside the Dharavandhoo channel. Recent findings from other Manta Trust project locations globally also suggest that reef manta rays spend time feeding in large aggregation at depths ranging between 100-200 meters where the deep scattering layer often occurs. Oceanographic studies coupled with tagging would allow testing for these hypotheses in the Maldives.

For the first time in four years reproductive activity (courtship, mating behaviour and pregnancies) was recorded in 2013 in Baa Atoll. 2014 saw a continued increase in reproductive activity. Throughout the year 37 individuals were observed pregnant (compared to the 8 recorded in 2013), while fresh mating scars and courtship behaviour was frequently recorded. The increased reproductive activity is a reassuring event suggesting a further increase in food availability and a gradual return to the pre 2010 conditions which saw much higher levels of reproductive activity.

Due to the strong correlations observed in the past years between environmental variables and manta ray abundance, the MMRP continued to collect data such as wind speed, wind direction and other weather variables. All of these environmental factors appear to have a strong influence on the numbers of manta rays seen in the atoll during the Southwest Monsoon, although wind speed especially appears to have a direct impact on manta ray numbers. This trend was again apparent in the 2014 data set. During the season the highest wind speed was recorded during June and July, the latest

being the month with the highest number of manta sightings. We can only speculate about the reasons for the decreased wind speeds recorded in recent years, but it seems likely that they are linked to broader scale climatic events such as the Indian Ocean Dipole (IOD) and El Niño-Southern Oscillation (ENSO). These large scale fluctuations in the regional climate and weather patterns in the Maldives need to be studied in more detail, as the negative implications for the fecundity of the manta population, and the overall health of the reef ecosystem as a whole, are very concerning if recent trends reappear in the coming years.

Direct human influence is also a factor considered by the MMRP in their research. Tourism in Baa Atoll has seen a significant increase over the last few years particularly due to the presence of the high numbers of manta rays and whale sharks in these waters. Recognising this, the Maldivian government has taken numerous steps to protect key areas for these species and in 2011 Baa Atoll was designated as a UNESCO World Biosphere Reserve, recognised upon its designation as having "*great potential for demonstrating sustainable development throughout the Maldives and the region, while relying on a green economy*" and Hanifaru Bay was designated as a core Marine Protected Area (MPA) within the Biosphere Reserve. In 2012 the Hanifaru Bay Management plan came into full effect with a daily team of rangers whose presence helped monitoring tourism activities and implemented the stricter regulations for site uses. During the 2014 season the Management plan has been successfully implemented and EPA Rangers have been present in Hanifaru Bay MPA most days resulting in a drastic decrease of regulations' infractions compared to 2013.

As the measures to conserve and manage the environment and human impacts in Baa Atoll become constant and more rigorous, there is much to look forward to in 2015 and beyond. It is, however, crucial that active research into manta rays and other marine life continues in order to monitor the effects of both tourism and environmental change. Manta rays are an incredibly important economic resource for the Maldives bringing tens of thousands of people to the country each year to dive and snorkel with them, generating millions of USD for the economy annually. Being able to pinpoint the reasons for any observed trends in, or threats too, the Maldivian manta ray population is crucial for the ongoing management and protection of these animals.

A reef manta rays (*Manta alfredi*) feeds upon zooplankton at the water's surface as the monsoon storms whip up the waves and pummel rain down upon the ocean.

Understanding the Southwest Monsoon

As outlined in previous MMRP reports, understanding the effects of the Maldives Southwest Monsoon is critical to understanding the reasons for the abundance of manta rays and whale sharks that are seen in Baa Atoll during this season.

The monsoons, which dictate the weather in the Maldives, are characterised by their winds, which blow consistently and reverse their direction seasonally. The Maldives Southwest Monsoon, or Hulhangu, runs from May-October, while the Northeast Monsoon, or Iruvai, runs from December-March each year, with the months of November and April acting as transitional periods of change in between. The Southwest Monsoon typically brings with it much more rain and cloud cover, with reduced visibility and rougher seas.

During the Southwest Monsoon the strong winds in turn create oceanic currents which flow from the southwest towards the northeast. The Maldivian islands and atolls, rising some 2,000 meters from the sea floor, act like a barrier to these currents, displacing the water as it flows through and around the atolls creating deep-water

upwelling. These upwellings bring nutrient rich water within reach of the suns life giving energy and through photosynthesis kick start the food chain, first with phytoplankton, then with zooplankton which predates upon the phytoplankton. Zooplankton is the prey of manta rays (and whale sharks) and as strong lunar currents flow into the shallows of the atolls through the channels, the concentrated zooplankton is so abundant that the Maldivian waters support the world's largest known population of reef manta rays.

During a typical Southwest Monsoon the wind blows consistently and steadily from the southwest, causing the greatest concentrations of the mantas planktonic food on the monsoonal down-current edges of the atolls. Stronger monsoonal winds generate stronger currents, more upwelling and more primary productivity, which in turn generate more of the zooplankton food, therefore attracting higher numbers of these animals into the shallow waters. When tidal exchanges bring water from the outside of the atoll in through the channels along the atoll's eastern edges they become, temporarily, dense plankton funnels and these are the sites at which we are more likely to observe planktivorous megafauna in the greatest concentrations.

Study Period and Sampling

Surveys to look for manta rays were carried out in Baa Atoll between the 22nd May and the 1st December 2014 on as many days as possible where conditions allowed. Survey trips were made on 161 days within this 194 day survey period.

As per the 2013 season, management measures (see section below) meant that access to the main study site Hanifaru Bay MPA was more restricted than in the years prior to 2011. Therefore both Hanifaru and other sites around the eastern border of Baa Atoll were surveyed, as per the protocol implemented during 2011. To account for changes in sampling efforts at key sites data from all years, data was standardised where possible to give comparable results.

On each research trip location, wind speed, wind direction and other environmental weather variables were noted alongside manta ray numbers and prevalent behaviours. In-water, individual mantas were documented by photographing the unique spot patterns on their undersides (ventral surface). The whole team were experienced free divers, using this advanced snorkelling technique to allow them to take photo-ID shots with the minimum of disturbance to the animals. For the purposes of this report a *sighting* is defined as a confirmed photo identification of an individual manta ray on a given day.

Management Changes and Initiatives

Management initiatives at Hanifaru Bay MPA are continuing to be implemented as per 2012. The main regulations include a ban on SCUBA diving inside Hanifaru Bay MPA, a fishing ban inside the bay and within a buffer zone surrounding it, a schedule for the alternation of entrance days between liveaboard and resort boats and boats' entrance speed limit and the use of a specific entrance path.

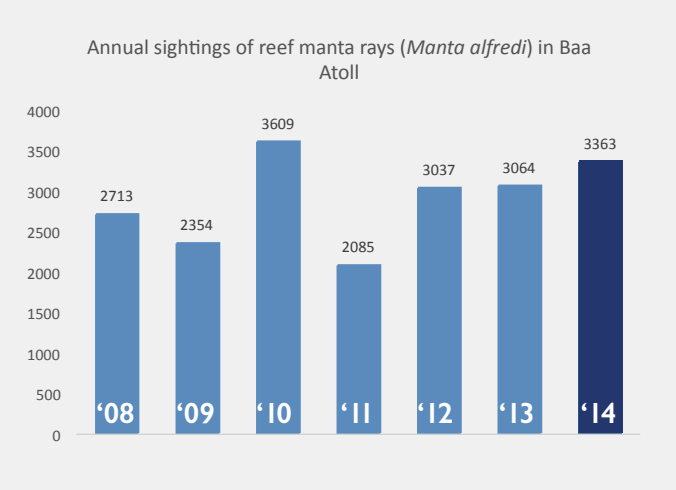
Snorkel guides using Hanifaru Bay were also required to sit an exam qualifying them to guide tourists inside the bay. Minimum levels of in-water/dive qualifications and first aid certifications were also required for these guides.

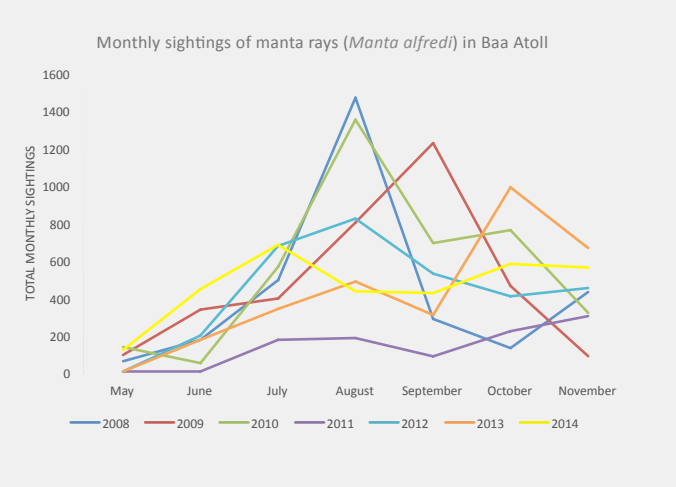
Differently from 2013, this season has been characterised by the heavy presence and patrol of EPA Rangers on site which resulted in a large decrease of infractions such as SCUBA diving inside the bay, disrespectfulness of scheduled alternation days (Liveaboards/Resorts), fishing inside the bay and throughout the buffer zone and more. Few illegal activities have been reported compared to 2013 (during which EPA Rangers have been rarely seen) and Rangers have intervened promptly when necessary. Entry tokens have been regularly collected resulting in an estimated US$ >30.000 income to the Biosphere Reserve. We strongly hope that such exemplary conduct will be replicated in 2015 season and we recommend that the alternate day access system be removed for all as we feel it is no longer needed given the positive advances in management of this site.

Manta Ray Sightings

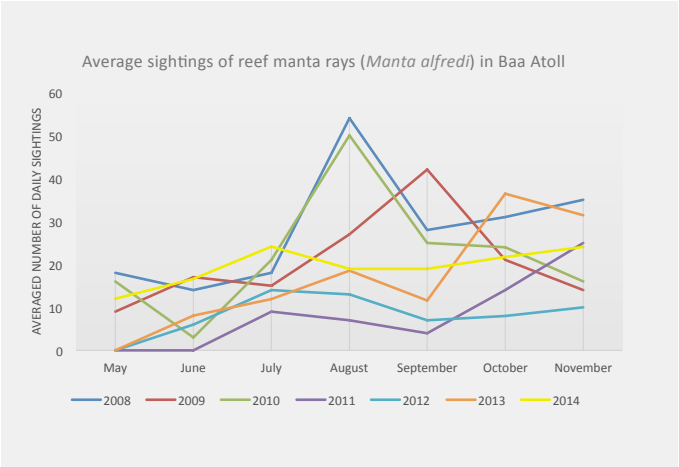
Total Baa Atoll Sightings

Sightings across the whole of Baa Atoll in 2014 have further increased from the total collected in 2013, although this is likely to be a result of increased number of survey days in 2014. The monthly breakdown shows a slight peak in July and the lack of the historical August's peak observed in 2007-2010. The graphs below depict total number of sightings over the study years:



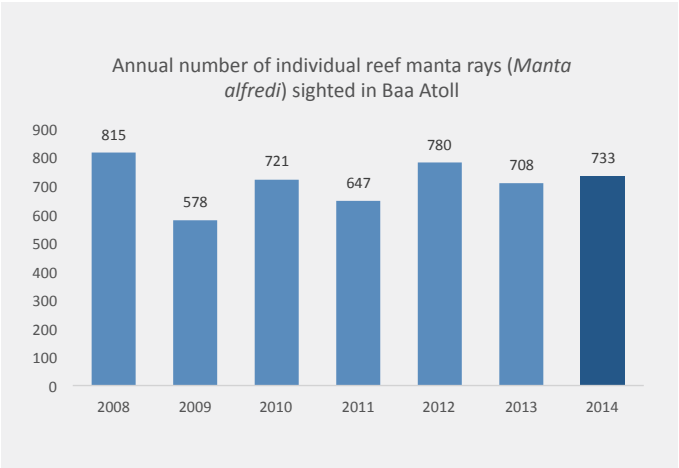


When the number of sightings per month is standardised for survey effort there is a general trend for increased sightings as the Southwest Monsoon progresses. However, the peak sighting month varies considerably between years.

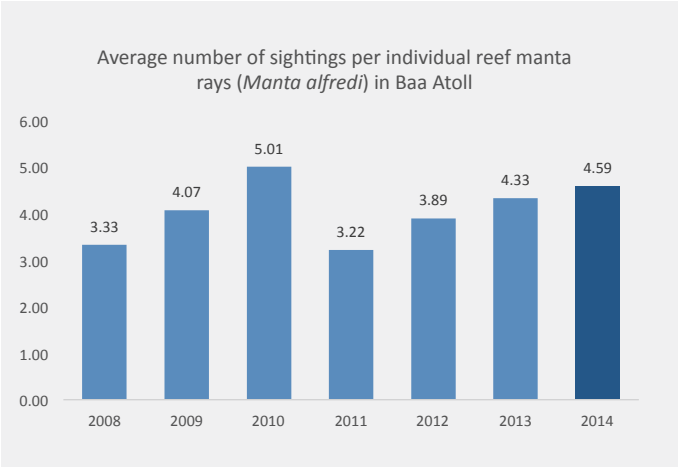


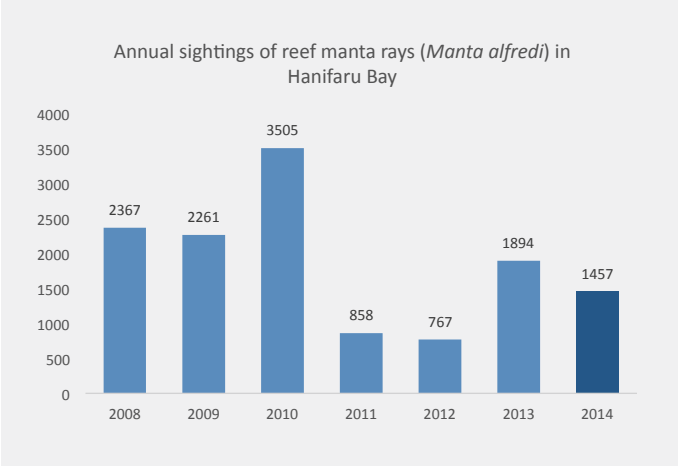
Total Number of Manta Rays

A total of 723 different individual manta rays were recorded in Baa Atoll during the 2014 southwest monsoon (733 throughout the year), which is 20% of the total recorded Maldivian population of 3,725 individuals. In the last six years the total number of different individual mantas which have been recorded in Baa Atoll is 1,800, or 48% of the total recorded population in the Maldives.

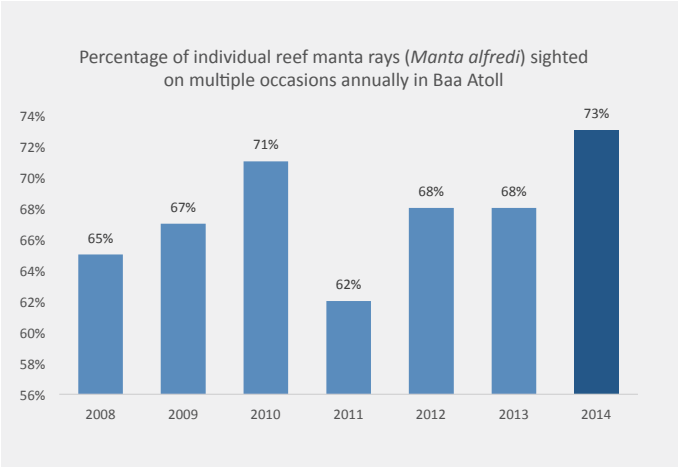


Throughout the season each manta was observed 4.59 times, a slight increase from 2013 (average 4.33 sightings per individual). The proportion of rays seen on more than one occasion also increased, reaching the highest ever recorded since data collection began in 2007, rising from 68% in 2013 to 73% this year.





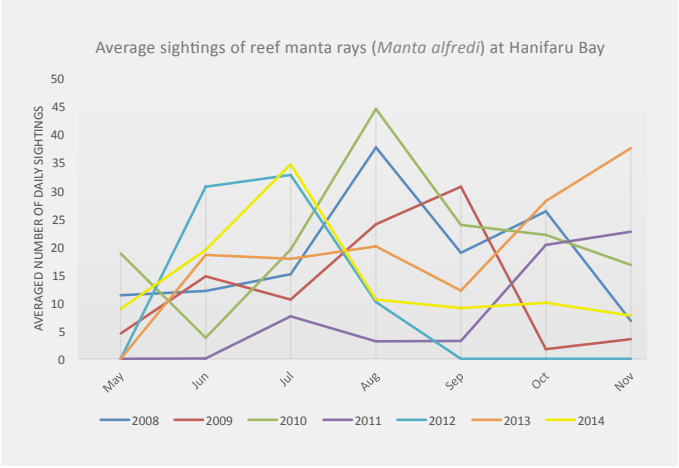
Complementing the averaged sighting data it is interesting to note the percentage of individual manta rays sighted on multiple occasions per season compared between years (see graph below). During the 2011 survey period there was a marked reduction in the number of individuals sighted on multiple occasions suggesting a more transient population of mantas during this time. This transient behaviour is likely to be linked to a reduction in the localised abundance of the manta ray's planktonic food source. In 2012, 2013 and 2014 the sighting frequency returned to levels exhibited in the first three study years.



Sightings at Hanifaru Bay

Sightings of manta rays at Hanifaru Bay MPA in 2013 and 2014 saw a significant increase compared to the previous two years, although this is partly due to the access restrictions which led to insufficient data collection within Hanifaru Bay from August to November in 2012. Despite increased survey effort in 2013 and 2014, sightings in both these years were significantly lower than during the first three years of data recording.

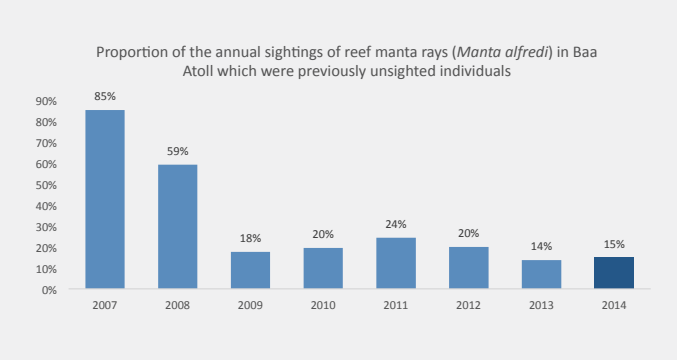
To account for the changes in sampling effort over the last 7 years the graph below shows the average daily numbers of manta rays (standardised for effort) observed each month (May-December) between 2008 and 2014. The graph shows that while manta ray sightings peaked in July 2014 they dropped off as the Southwest Monsoon progressed.

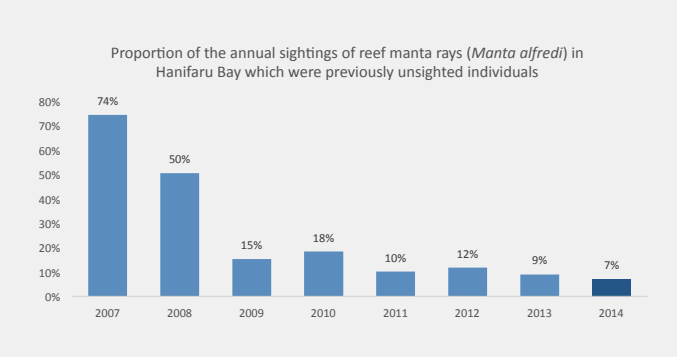


New Individual Manta Rays

In total 109 previously unsighted individual reef manta rays were identified in Baa Atoll in 2014 (102 during the Southwest Monsoon). The two graphs below show how the proportion of newly sighted individuals recorded between 2007 and 2014 reduces over time, both in Baa Atoll as a whole and more specifically in Hanifaru Bay. As expected the number of new mantas seen as a proportion of the population follows a downward trend, as more years pass and more data is collected, new mantas become less frequent. After seven years of continual data collection we have photo-ID captured the great majority of all individual reef manta rays which inhabit,

or migrate through, the waters of Baa Atoll each year.

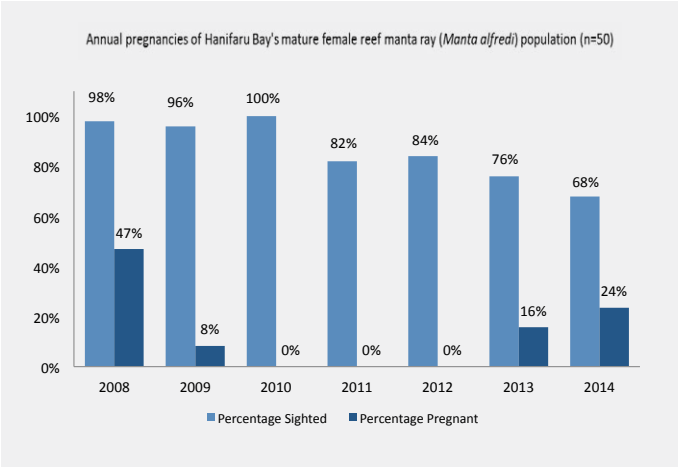




The slight increase in the proportion of previously unsighted individuals in Baa Atoll observed in 2011 and 2012 was due to the addition of several new survey sites (Veyofushi Faru, Hurai Faru, Bathalaa Kandu) which were established in the region when daily access to Hanifaru became limited. After the fourth year of regular surveying of those new sites the percentage of newly identified individuals is now down to 15% suggesting that most of Baa Atoll's reef manta ray population has been recorded and identified. The 1% increase from 2013 in 2014's Baa Atoll previously unsighted individuals can be attributed to an increased surveying effort in the south and west of the atoll at the manta aggregation sites of Maaneigaa, Maarogaali and Maavaru.

Reproductive Fecundity

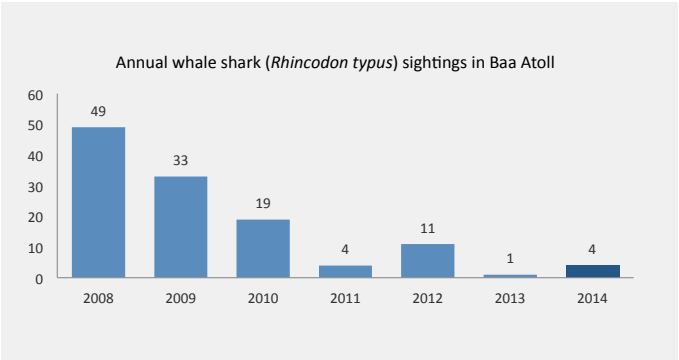
After three consecutive years without pregnancies recorded, at the end of the 2014 season we had observed signs of certain pregnancy in 37 different females, reducing our concerns for the health of the Maldivian reef manta ray population. The graph above at right shows the annual percentage of pregnancies recorded within a core group of Hanifaru Bay's most frequently sighted mature females.



Courtship behaviours as well as signs of mating activity further increased in 2014 compared to 2013 and may reflect steady and increased planktonic food availability. Furthermore, a similar trend have been observed throughout the country, positive signs for the future of the Maldivian manta population.

Whale Shark Sightings

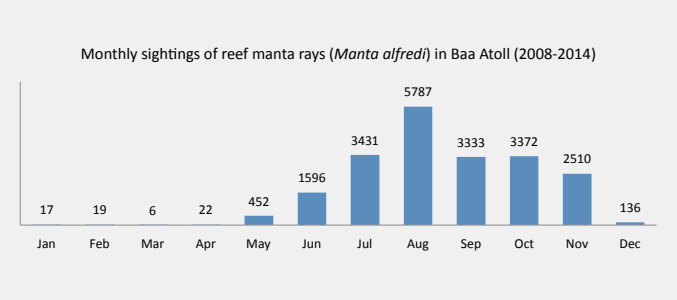
Surveys for manta rays as described above also looked for whale sharks as the two species often aggregate at the same locations to feed. During the 2014 season in Baa Atoll whale sharks sightings remained extremely low (4 confirmed and 3 reported unconfirmed sightings) when compared to pre 2011 figures. The lack of whale sharks in the region is somewhat puzzling when compared to the relative abundance of manta rays, especially given that sightings of whale sharks in South Ari Atoll have remained fairly consistent in recent years.

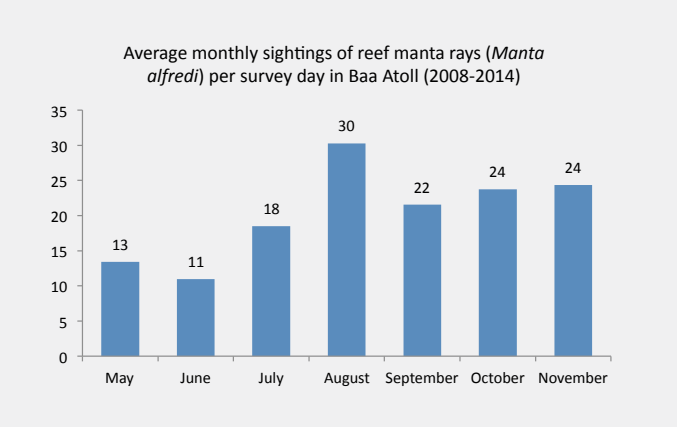


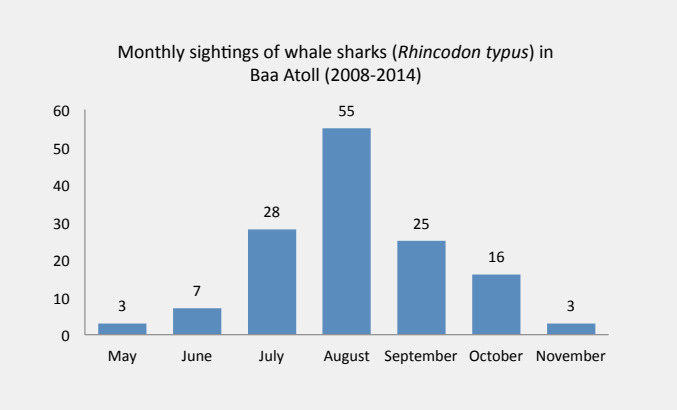
Intra-annual Sighting Variation

The three graphs below clearly show the concentration

of sightings for both manta rays and whale sharks occur in the months of June through November, with 28% and 40% of the total yearly manta and whale shark sightings respectively occurring in the month of August alone. Overall these data suggest a higher presence of manta rays during the second half of the Southwest Monsoon compared to the first half.

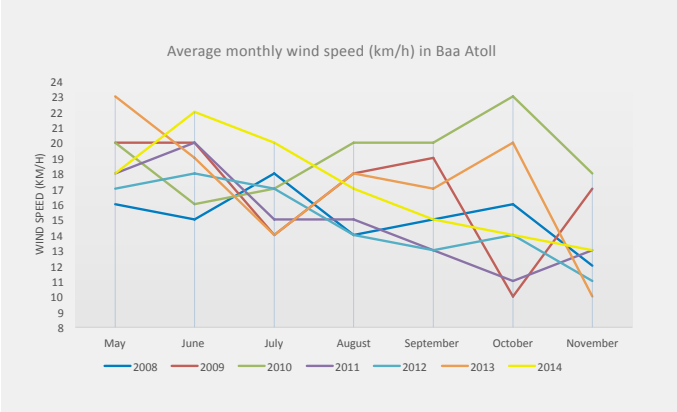




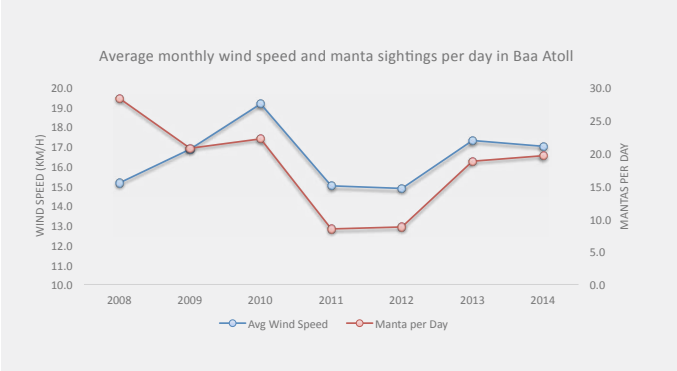


Weather and Climatic Variation

As a continuation of the investigation in 2011 to look into the possible links between manta ray sightings and the strength of the Southwest Monsoon, the MMRP continued to look at the correlations between weather patterns and megafauna abundance in 2014. The average wind speed observed in 2014 was 17.0 Km/h (the third highest recorded - 19.14 Km/h in 2010 and 17.34 in 2013) and followed a similar monthly pattern to that observed in 2012, with wind speed peaking in July and dropping in the following months. Interestingly, manta sighting patterns for 2014 also matched the one observed in 2012, further suggesting an important role in wind strength as a key factor in driving manta sightings.



Without the wind and therefore the strong monsoonal currents required to kick start the plankton production through upwelling, food availability for these planktivorous species is greatly reduced. The graph below shows a strong link between yearly average wind speed and average manta sightings per day in Baa Atoll.



These observations might be part of a natural cycle of variable weather patterns which occur within the Maldives over time, or more worryingly, they may be connected to larger climatic phenomenon such as the Indian Ocean Dipole (IOD) and the El-Niño Southern Oscillation (ENSO), both of which are linked to the increased fluctuations in climate change recorded in the Indian Ocean in recent decades. Only on-going and

A group of tourists happily imitate manta rays after a wonderful encounter with these graceful giants at Hanifaru Bay Marine Protected Area in Baa Atoll, Maldives.

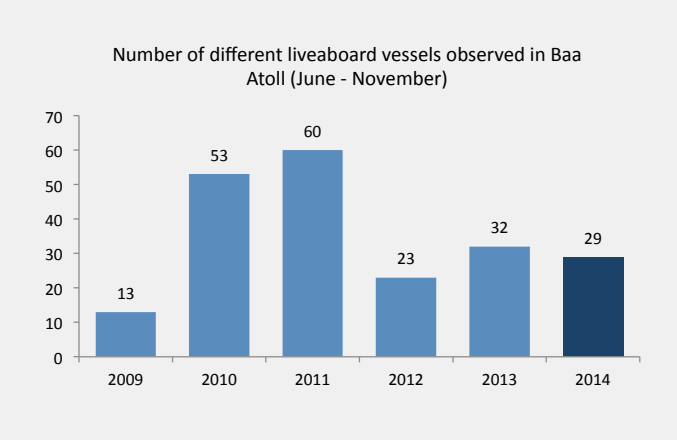
consistent monitoring will show what might be causing such changes, and therefore what measures need to be taken to manage them. Regardless of cause, and leaving aside the ecological ramifications, these observations should be considered very seriously because of the negative economic consequences they can have. Not only will these trends affect manta ray tourism directly, but also on a wider scale they will affect the rest of the tourism and fishing industries which heavily rely upon the ocean's productivity, and therefore the strength of the monsoons.

It is very likely that this lack of food, brought about by the weakened Maldives monsoon, is responsible to some extent for the lack of pregnancies observed in the Maldivian manta ray population in recent years. Elasmobranch reproduction varies widely between species and reproduction within the genus *Manta* is very poorly understood, with much of what we know coming from just a few studies globally. Sharks and rays within the subclass Elasmobranchii have a wide range of reproductive techniques with some species able to store sperm or to repress or stagger pregnancies. It is likely these strategies have been developed in order to provide offspring with the best chances of survival. It can be suggested that manta rays are using similar strategies to ensure that their offspring are born during years which have a greater abundance of food to increase their chances of survival.

Tourism

Continuing the mandate put in place in 2011, liveaboard dive vessels and resorts had access to Hanifaru Bay MPA only every other day on an alternating schedule. The ban on SCUBA diving in Hanifaru that came into effect starting January 2012, have had a significant impact on the number of safari boats observed, despite the good manta ray sightings inside the MPA in 2013 and 2014.

Many liveaboard vessels cater strictly to SCUBA divers and have a diving intensive schedule. As a result, these boats will not take the time to travel to Hanifaru Bay if they cannot dive, while those vessels that clearly market the benefits of snorkelling with manta rays at this site have continued to run successful trips. For many live-aboard operators however, the lack of diving coupled with poor manta sightings in 2011, the alternate day restrictions which make it very hard for liveaboard to schedule a practical itinerary, and the increased cost of fuel, have all contributed to a significant reduction in the number of liveaboard vessels which are prepared to travel up to Baa Atoll in the last two years. The resorts have continued to visit the MPA as in previous years.



Baa Atoll Biosphere Reserve Education Programme

During this 2014 season the Manta Trust continued and increased the Baa Atoll Educational Programme which was started in 2013 with the aim to introduce school children of all ages to the world of marine biology, using mantas as the charismatic species to drive the wider conservation and educational message. While many tourists are increasingly educated about the marine life by biologists and scientists based on the resort islands and on-board dive liveaboard vessels, the local communities are for the most part unaware of the ecological and economical value of their country's natural wealth. In order to successfully protect the resident population of manta rays and the wider marine environment in the Maldives it is essential that the next generation of Maldivians become aware of the increasing threats

The Manta Trust team gave presentations to over 500 school kids in the Maldives in 2014.

facing the oceans and their inhabitants. The ultimate objectives of the Baa Atoll Biosphere Reserve Education Programme are to increase awareness and understanding of the natural world and the threats it faces, whilst benefiting the local community.

In 2014 the educational and outreach programme expanded to include other atolls (North Malé and Laamu Atolls). The MMRP team visited eight local islands and attended two awareness events in Malé region. Specifically presentations and activities have been given to Thulhaadhoo, Kihaadhoo, Dharavandhoo and Kudarikilu in Baa Atoll, Bodu Huraa and Malé in North Malé Atoll and Hithadhoo and Maamendhoo in Laamu Atoll. The MMRP team has actively participating to "Katti Hivvaru Festival" organised by the local NGO DYM and the "Villingili clean-up Challenge" organised by the local NGO Save the Beach and the "Marine Expo" organised by the Liveaboard Association of Maldives in collaboration with the Ministry of Fisheries and Agriculture. We recognised a high level of engagement and interest in our work amongst local school children as well as amongst the youth generation in Malé region. Overall we estimated having reached over 5000 young Maldivians through the numerous educational activities performed in 2014 season. Students and non-students were all keen to learn more about mantas and the wider marine environment, they were especially eager to learn how they could become further involved in the science being carried out on their doorstep.

To further increase the awareness of our work to the

Moosa Mohamed the manta gives the schools kids at Hithadhoo in Laamu Atoll a lesson on looking cool, even when dressed in a manta costume.

local population we continued organising *Manta Awareness Events* for the Four Seasons employees. During such events the Resort employees were given a brief presentation about manta rays, shown short documentaries and finally engaged in games as well as given the possibility to name some of the newly identified mantas recorded throughout the season.

We believe the involvement and appreciation of young Maldivians for the marine environment is crucial for long term conservation and management of the unique marine resources found in the Maldivian waters. We look forward to working in collaboration with Maldivian governmental bodies and other environmental organisations in order to further improve and expand this educational programme in 2015.

Study of the social behaviour of reef manta rays (*Manta alfredi*) in the Maldives

(PhD project – Annie Murray, University of York)

Although a staple favourite amongst SCUBA divers worldwide, there is much which we still do not understand about manta rays. Both species are classed as vulnerable on the IUCN Red List; they are easy targets for fisheries due to their large size, curious nature and aggregating behaviour leaving them highly vulnerable to human threats. Mantas are targeted by fisheries for their branchial filaments – gill plates – which are in growing demand on the Asian market as a traditional remedy. But they are also caught as by-catch in purse seine fisheries. As a consequence of these rapid declines, there is an urgent need for a greater understanding of these species. Little is known about their behaviour and social structure. But there are tantalising hints from previous research that they might have the most complex social behaviour of any fish.

This study looks directly at the social interactions and network structure of individuals among the resident population of mantas which we commonly sight in Baa Atoll. By using a combination of newly collected video and photographic data, combined with archived records collected from the region since 2005 this study aims to examine the makeup of aggregations and study various aspects of their behaviour. Firstly feeding behaviour; mantas display interesting social interactions during feeding events, commonly displaying cooperative behaviour including the formation of long feeding chains, making it the optimum time to observe their behaviour. During the 2014 manta season in Baa Atoll Annie was able to capture many such interactions, recording 972 cases which will form the basis for the initial analysis. The study breaks down these cooperative displays exploring various variables; the individual ID of mantas involved, examining whether sex, age or size class makes an impact of the dominance displayed, which is a key aspect in the project. As yet it is unknown whether there is any form of individual dominance or hierarchy amongst aggregations but the resident nature of the population allows to observe individuals repeatedly therefore examining how their sociality evolves over time and whether this changes in relation to the presence/absence of other individuals.

Using social network analysis programs Annie is preparing the data to take a more detailed look at the structure of the population; here she is faced with the decision of on what scale to examine this behaviour. With the large amount of archived data and continuing sightings input from marine biologists and dive staff around the country there is the opportunity to form a broad-scale study of the general atoll population, taking into consideration individuals' movements outside the local area. A second option is to perform a fine-scale examination of aggregations observed when feeding and cleaning specifically


GUY STEVENS | MANTA TRUST

within the atoll. Annie is currently working with academics based at the University of York who specialise in animal social networks, many with similar marine experience to make such decisions and define the boundaries of the study.

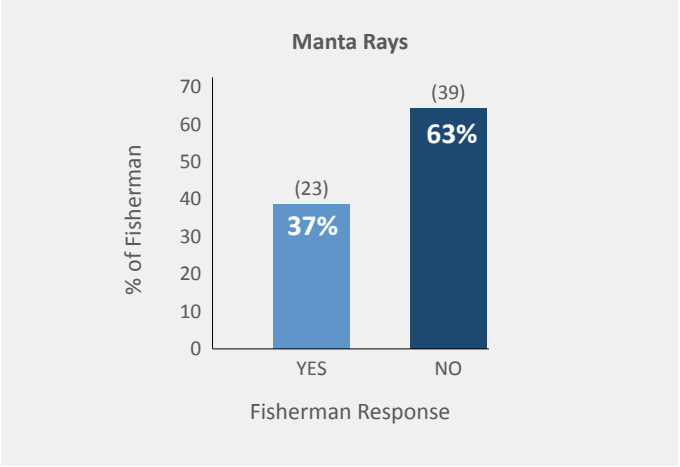
Initial statistical and social network analysis based on the first seasons data will be performed by the beginning June and the plan will be adjusted for data collection during the 2015 manta season. As this is a little explored area of study for manta rays we hope to examine some novel aspects of manta social behaviour.

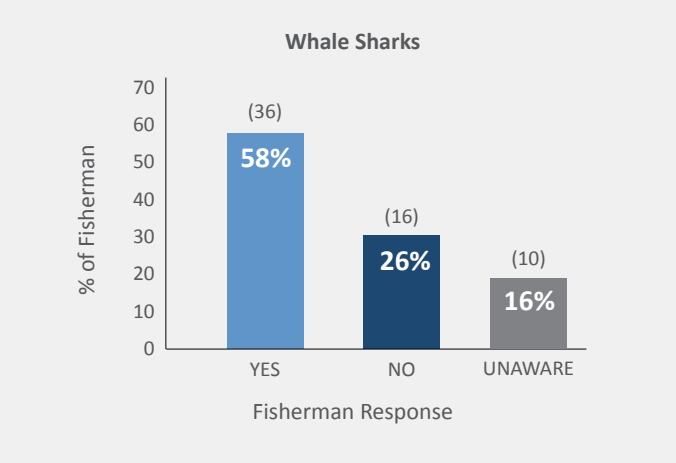
Study on the Value of Traditional Knowledge in Manta Ray Conservation in the Maldives

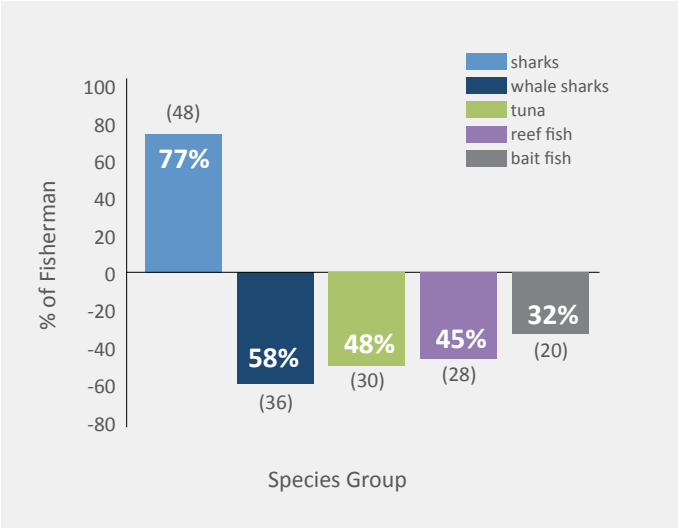
During this season Tamaryn Sawers, MSc candidate at the University of York (UK) completed her MSc thesis studying the historical abundance of mantas, whale sharks and other economically important marine species. This study aimed to gather the historical knowledge of local fishermen to evaluate how manta ray abundances may have changed over time by drawing comparisons between this traditional knowledge and current day observations. Part of the study has also been dedicated to evaluate local perception of marine conservation.

Sixty two semi-structured interviews were conducted between July and August across nine inhabited islands within Baa Atoll, Maldives. Fishermen were questioned on their local ecological knowledge of charismatic species, with particular reference to manta rays, their awareness of regulations regarding the protection of this species, and their attitudes towards conservation in the region. The survey aimed to ascertain whether any direct anthropogenic impacts pose a potential threat and to help identify how management can improve their conservation. The findings reveal a consensus amongst local fishermen to protect manta rays with 98% of the respondents recognizing the importance of safeguarding mantas for tourism, to identify places with abundant baitfish and for intrinsic values.

All fishermen (100%) said that the timing of manta seasonal occurrences and the most likely sites for viewing mantas had remained the same throughout their fishing careers. Moreover 63% believed the abundance of manta rays had not changed since they began fishing, while 37% said there had been a change (see graph below). Sixty one per cent of those who thought there had been a change said numbers had increased and attributed this to the protection of mantas in Maldives.







All fishermen (100%) said the most likely locations for whale shark sightings had remained unchanged throughout their fishing careers. However, questions pertaining to population numbers showed that only 26% believed whale shark abundance had remained stable while 16% were unsure of any variations in whale shark population status (see graph above). The majority of the fishermen interviewed (58%) mentioned a change in whale shark numbers. All of these respondents that noted a change stated that there had been a decrease in sightings.

The research conducted also afforded the opportunity to assess changes in the abundance of other charismatic species frequenting the region with results highlighting concern over declining abundances of whale sharks, tuna, reef fish, and baitfish (noted by 58%; 48%; 45% and 32% of the respondents respectively) and suggesting an increase in shark populations, mentioned by 77% of the fishermen. The use of traditional knowledge has also proved to have been instrumental in the identification of 'hotspots' for manta and whale shark aggregations in need of future monitoring and protection and has exposed weaknesses in the management of the Baa Atoll UNESCO Biosphere Reserve.

Fishermen were asked how they thought conservation efforts and scientific work in the Maldives could be improved to benefit them or their community. Fifty two per cent openly said they would like the younger generation to be taught conservation practices and 48% felt teaching the whole community about conservation would ensure concerted effort for the protection and preservation of the area.

These findings also indicate a need for improved education and communication between authorities and the public and highlight the value of traditional knowledge in complementing scientific information for improved conservation management in the Maldives.

Conservation and Management

The declaration, at the end of June 2011, that Baa Atoll was to become a UNESCO World Biosphere Reserve remains an important milestone for the Maldivian manta rays, with great implications for their ongoing protection, especially given the designation of Hanifaru Bay MPA as a core zone of the reserve. Management of these newly protected areas is crucial and we look forward to a more constant commitment in the near future by the Maldivian government's Environmental Protection Agency (EPA) and the Baa Atoll Biosphere Reserve Office to manage this site and the tourism that takes place within.

A World Biosphere Reserve strives to better understand the human impact and help safeguard natural ecosystems for the future. Long term, consistent data collection is crucial to grasp the influence and impact of tourism on this very unique population of animals and gain a broader understanding of manta rays worldwide. Without access to consistent and reliable manta ray sightings and the constant monitoring of tourism, little weight can be placed on any data collected. Interrupted and inconsistent data collection is much harder to accurately analyse

or extrapolate trends from, resulting in more inconclusive results. Although previously gathered data is useful as a baseline, continuous and ongoing research of manta rays in Baa Atoll and throughout the Maldives must remain a priority if Baa Atoll's UNESCO World Biosphere Reserve is to be successful.

Maldivian Manta Ray Project (MMRP)

The MMRP is highly regarded within the scientific community. It is one of the longest running manta ray research programmes in the world. We would welcome the opportunity to continue to work with the Maldivian government for the long term management and conservation of these species in Maldivian waters. The opportunity we have to learn about manta rays in the Maldives

Manta TRUST

This report was compiled on behalf of the MMRP and the Manta Trust by:

Niv Froman - BSc (Hons), MSc (Hons)
Project Leader - Maldivian Manta Ray Project.

Guy Stevens - BSc (Hons), PhD Candidate:
Chief Executive / Founder - The Manta Trust.

The MMRP and the Manta Trust are happy to share any data collected as a part of this study.

For further information please email:

guy@mantatrust.org or niv@mantatrust.org