

Maldivian
Manta Ray Project

LAAMU ATOLL | ANNUAL REPORT 2020

*Conservation through
research, education, and collaboration*

- The Manta Trust





WHO ARE THE MANTA TRUST?

The Manta Trust is a UK and US-registered charity, formed in 2011 to co-ordinate global research and conservation efforts around manta rays. Our vision is a world where manta rays and their relatives thrive within a globally healthy marine ecosystem.

The Manta Trust takes a multidisciplinary approach to conservation. We focus on conducting robust research to inform important marine management decisions. With a network of over 20 projects worldwide, we specialise in collaborating with multiple parties to drive conservation as a collective; from NGOs and governments, to businesses and local communities. Finally, we place considerable effort into raising awareness of the threats facing mantas, and educating people about the solutions needed to conserve these animals and the wider underwater world.

Conservation through research, education and collaboration; an approach that will allow the Manta Trust to deliver a globally sustainable future for manta rays, their relatives, and the wider marine environment.



MALDIVIAN MANTA RAY PROJECT

Formed in 2005, the Maldivian Manta Ray Project (MMRP) is the founding project of the Manta Trust. It consists of a country-wide network of dive instructors, biologists, communities and tourism operators, with roughly a dozen MMRP staff based across a handful of atolls.

The MMRP collects data around the country's manta population, its movements, and how the environment and tourism / human interactions affect them. Since its inception, the MMRP has identified over 4,942 different individual reef manta rays, from more than 70,000 photo-ID sightings. This makes the Maldivian manta population the largest, and one of the most intensively studied populations in the world. The MMRP has also identified over 710 different individual oceanic manta rays.

The long-term and nationwide data collected by the MMRP has allowed researchers to record and identify key patterns within this population over time. Not only does this invaluable information improve our understanding of these animals, but it informs their ongoing management and protection both in the Maldives, and around the world.



OUR PARTNERSHIP WITH SIX SENSES LAAMU

For years, Six Senses Laamu has contributed to the research efforts of the Manta Trust and the MMRP, through external submissions of manta ray ID photos. In 2014, a closer partnership began to blossom, with the Manta Trust launching an exciting five-month pilot project in Laamu Atoll. The project focused on investigating the nearby manta aggregation site at Hithadhoo Corner. The pilot phase was so successful that the Manta Trust team were invited back in 2015, this time for an extended period of nine months.

In 2016, a full 12-month partnership between both parties was born, and since then the project has gone from strength to strength. The Manta Trust's MMRP now has a permanent presence on the island, working closely with the resorts' resident marine biologists and sustainability manager, to raise awareness surrounding the unique, yet vulnerable marine environment of Laamu Atoll.



Cover photo by Leanna Crowley
Photo by Marteyne van Well

EXECUTIVE SUMMARY

This report is the seventh of its kind in a series that presents data collected by the Maldivian Manta Ray Project (MMRP) on Laamu Atoll's manta ray (*Mobula alfredi* and *M. birostris*) populations from January until the end of March, and then August through to December 2020, due to the global pandemic prompting a resort closure in-between. The MMRP has been collecting data on manta rays in the Maldives consistently since 2005; however, data for Laamu Atoll only dates to 2012, a short time after Six Senses Laamu opened in 2011. The Manta Trust team are incredibly proud and grateful to continue to have Six Senses Laamu as one of the MMRP's Key Regional Partners. Despite a large gap in data collection from April to August, the Manta Trust were immensely thankful to the resort for the opportunity to continue research in the surrounding months, given the logistical challenges of the global pandemic.

Laamu Atoll supports year-round manta ray sightings with the highest numbers of sightings historically recorded between the months of May to June and October to November each year. Two primary aggregation sites have been identified, Hithadhoo Corner in the south of the atoll, and Fushi Kanduu in the Northeast, with a third potential aggregation site (Maabaidhoo Kanduu) being increasingly monitored by the MMRP team. Following increased manta ray sightings reports at this site in 2019, efforts were made in 2020 to combine surveys at nearby Fushi Kanduu with this location on dive trips. Both Hithadhoo Corner and Fushi Kanduu are characterised by large cleaning stations, which support frequent cleaning behaviour and seasonal courtship activities. At Maabaidhoo Kanduu, cleaning has

been observed over an area of high coral cover at the reef drop-off. However, there have also been anecdotal reports of manta rays utilising a well-defined cleaning station within the channel.

In 2020, surveys ($n=610$) were conducted on a total of 194 days by either the MMRP, Six Senses Laamu staff or citizen scientists from outside the resort. Despite being the lowest number of days surveyed since the start of research in the atoll, this was an exceptional number of surveys carried out. Key findings in 2020 include a total of 118 confirmed sightings of 53 individual reef manta rays, recorded over six sites. Overall confirmed sightings in 2020 decreased, due to limited research opportunities at the usual research locations. Hithadhoo Corner continued to support the highest number of confirmed sightings throughout the region ($n=75$), followed by the Northeastern channel of Fushi Kanduu ($n=13$). The number of sightings recorded at secondary sites in 2020 ($n=30$) was lower than the average recorded in previous study years.

Of the 53 individuals recorded, each manta ray was observed on average 2.23 times. The mean number of confirmed manta ray sightings per survey was especially low ($n=0.19$) in 2020, due to lower research activity than previous years. However, there was a peak in sightings per survey noted during October ($n=0.51$). As with previous years, a Residency Index (RI) was calculated to gauge the extent of movement amongst those frequenting Laamu Atoll. The RI for 2020 (1.05) was at its lowest to date (1.87 in 2019).

As of 2020, the population demographics of Laamu Atoll constitute 59% female ($n=79$), 40% male ($n=54$), and 1% ($n=1$) for which sex cannot be determined. Overall, 56% ($n=76$) comprise adult individuals, 39% ($n=53$) juveniles, 3% ($n=4$) are considered sub-adult and 1% ($n=1$) for which maturity cannot be determined. Of the population known to Laamu Atoll ($n=134$), 91% ($n=122$) have been re-sighted and only 13% ($n=7$) have been seen in another geographical atoll of the Maldives.

In 2020, two individuals were identified as new to both the Maldives database and Laamu Atoll. This number was lower than the new individuals observed in Laamu Atoll in 2019 ($n=7$). In 2020, there were no pregnancies recorded, which has continuously dropped from previous years ($n=7$ in

2019 and $n=11$ in 2018). Of the 12 individuals recorded as pregnant in 2019, none were re-sighted in 2020. Courtship behaviour was extremely low, with only 2 sightings seen in December 2020 ($n=15$ for 2019).

Research projects in 2020 included photo-ID surveys, stereo video photogrammetry, remote underwater video cameras, and “eyes on the reef” long life time-lapse camera deployments. Outreach led to increased citizen science submissions, education sessions within the community, and an increased online presence within the community in response to COVID-19 restrictions concerning inter-island movement.

MONSOONS & LAAMU ATOLL

The South Asian Monsoon heavily influences weather patterns in the Maldives. There are two defined monsoons (seasons) in the Maldives, characterised by wind speed and direction. The Northeast Monsoon (*Iruvai*) runs from December to March, while the Southwest Monsoon (*Hulhangu*) runs from May to October. April and November are classified as transition months; here, wind speed and direction can be highly variable.

As the winds change with each monsoon, so do ocean currents. The islands and atolls within the Maldives act as barriers to these currents, creating regions of deep-water upwelling, which drives nutrient-rich water to the surface. This increases the production of phytoplankton and drives subsequent blooms of zooplankton - the primary food source of manta rays.

The central and northern atolls of the Maldives are “double-chained”, with numerous channels dividing the fringing reefs. These characteristics cause plankton to accumulate on either the western or eastern sides of atolls depending on the monsoon, and manta rays migrate accordingly to take advantage of the varying abundances of their zooplanktonic food. Between periods of feeding, manta rays often utilise cleaning stations to clean and engage in other social interactions.

Located at the southernmost tip of the south-central Maldives, the topography of Laamu Atoll differs from that of the more northern atolls (Fig. 1). Laamu Atoll does not form part of a double chain, and few (seven) channels break the outer reef. While Laamu Atoll experiences strong oceanic currents, water movement through the atoll is restricted,

and no clear seasonal manta ray migration pattern has been documented.

Hithadhoo Corner, located near the southern edge of Laamu Atoll, has historically supported year-round manta sightings, with peaks at the start and end of the Southwest Monsoon. Fushi Kanduu, located on the northeastern edge of the atoll, appears to be used primarily during the Southwest Monsoon (Fig. 1). Both sites have well-defined cleaning stations and support cleaning and courtship behaviours.



Laamu Atoll

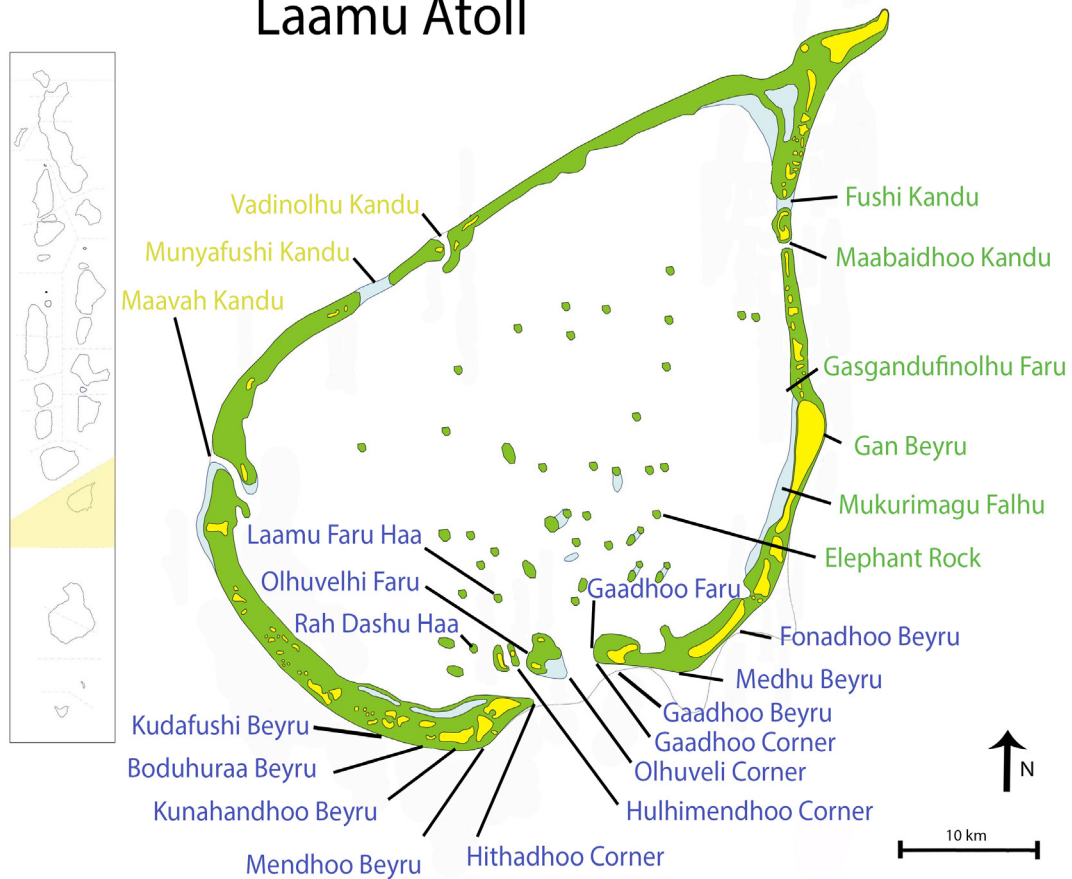


Figure 1: Map of Laamu Atoll showing the twenty-four locations in the atoll where reef manta rays (*Mobula alfredi*) have been observed (2014-2020).

STUDY PERIOD & SAMPLING METHODOLOGY

Throughout the Maldives, the MMRP records sightings of manta rays through photographs of the unique ventral spot patterns of individuals. Since 2013, most sightings data on the local manta population in Laamu Atoll has been collected by the MMRP researchers ($n=3,964$). However, sightings have also been submitted by resort partners and guides ($n=235$), and outside contributors including guests ($n=93$). For this report, a sighting is defined as a confirmed photo identification (photo-ID) of an individual manta ray on a given day at a specific location (survey site).

For each survey, information was collected on the location, manta ray numbers, behaviour (e.g., cleaning, courtship, feeding, cruising), duration of encounters, environmental variables (including wind direction, current direction, and plankton density), and anthropogenic factors (including the number of divers/snorkellers and the number of boats). Most data were collected while scuba diving due to the depth of aggregation sites. In 2020, the overall survey time was increased using remote underwater video and time-

lapse photo cameras (RUV and RUP respectively), primarily at Hithadhoo Corner.

Two-thousand and fourteen marked the first year that a dedicated research boat was provided by the resort to the Manta Trust team to conduct survey dives, with every month of the year being surveyed from 2016 onwards. In 2020, the research boat was used for surveys until March 12th, before vessels were sent back to local islands at the start of a national pandemic lockdown. Following the resort re-opening, no research boat was available for the remainder of the year, resulting in survey dives and locations visited differing greatly to those at the start of 2020. Due to limited dive staff at the resort, MMRP staff filled in as dive guides for Deep Blue Divers daily, allowing them to continue to conduct survey dives but without the use of cameras or research equipment. Before March 12th, research dives were conducted at manta aggregation sites daily (primarily Hithadhoo Corner), but after the resort re-opened visits to manta aggregation sites were sporadic and

occurred only upon optimal conditions, such as full or new moon, or upon guest request. Therefore, visits to manta hotspots and the ability to record manta sightings through photo ID, decreased significantly in the second half of the year, which must be recognised when assessing the 2020 data. Photo-ID submissions that were provided by resort guests during this time made a fundamental impact to the amount of data the team were able to collect.

For this report, a survey is defined by the start and end time of an activity (such as diving and snorkelling) spent at a single location. Remote underwater sensing is included in the survey effort, and a remote survey is also defined by the start and end time of recording within one day at a single location. A survey day refers to the number of days when surveys were conducted in the atoll irrespective of location. There were additional reports of manta ray sightings received in 2020, such as surface observations during guest excursions.

In all reports prior to 2020, surveys were defined by time spent at a single location each day. This meant that if two

dives were conducted at one location, collectively the two dives plus the surface interval would be considered as one survey. If there was a long break in-between the morning and afternoon survey effort, the second visit to the location would be considered as a separate survey. Additionally, remote underwater sensing was previously included within the dive or snorkel surveys, but in this report remote underwater sensing is considered as a separate entity. Whilst data numbers may vary from previous year's reports, the comparison between years will not vary, as all the historical data was re-formatted for the purpose of this report.

Before April 2015, MMRP researchers were not based in Laamu Atoll during all 12 months of the year, and therefore, data was not recorded on all dives to the manta aggregation sites. For this reason, averages where survey effort could be accounted for only include data between 2016 through 2020. Where possible, data has been standardised for survey effort to provide comparable results by both months and years.

Table 1: Twenty-four sites in Laamu Atoll where reef manta rays (*Mobula alfredi*) have been observed; grouped by their geographical location within the atoll. * Indicates primary study site. Locations in bold indicate locations where manta rays were seen in 2020.

Group	Site Name	Reef Type	Location
1	Boduhuraa Beyru	Outer Reef	Southwest
	Kunahandhoo Beyru	Outer Reef	Southwest
	Kudafushi Beyru	Outer Reef	Southwest
	Mendhoo Beyru	Outer Reef	Southwest
	Hithadhoo Corner*	Channel	South
	Olhuveli Corner	Outer Reef	South
	Hulhimendhoo Corner	Inner Reef	South
	Olhuveli Faru	Inner Reef	South
	Gadhoo Faru	Inner Reef	South
	Gadhoo Corner	Channel	South
	Rah Dashu Haa	Inner Reef	South
	Laama Faru Haa	Inner Reef	South
	Gadhoo Beyru	Outer Reef	Southeast
	Medhu Beyru	Outer Reef	Southeast
Fonadhoo Beyru	Outer Reef	Southeast	
2	Mukurimagu Falhu	Lagoon	East
	Elephant Rock	Inner Reef	East Central
	Gan Beyru	Outer Reef	East
	Gasgandufinolhu Faru	Inner Reef	East
	Maabaidhoo Kandu	Channel	Northeast
	Fushi Kandu*	Channel	Northeast
3	Vadinolhu Kandu	Channel	Northwest
	Munyawushi Kandu	Channel	Northwest
	Maavah Kandu	Channel	West

2020 Study Period

In 2020, all surveys conducted by Manta Trust, Maldives Underwater Initiative, and Deep Blue Divers at the primary aggregation sites of Hithadhoo Corner and Fushi Kandu were recorded regardless of whether manta rays were observed during the dive or snorkel. Following reported manta ray sightings at Maabaidhoo Kandu in early January 2019, the MMRP began joining guest dives to this location, and in 2020 this site continued to be surveyed regularly for manta activity. Reports were also received from Emperor Divers Laamu on dives conducted at Fushi Kandu and Maabaidhoo Kandu, irrespective of if manta rays were recorded. However, due to national dive centre closures, submissions from Emperor Divers were limited in 2020.

For all other locations, surveys were only recorded if manta rays were present, or if MMRP staff participated in the dive.

In 2020, surveys were undertaken ($n=610$) on as many days ($n=194$) as conditions and logistical operations allowed (Fig. 2). Data was collected on the manta ray population through a combination of dedicated MMRP research dives ($n=78$) and snorkels ($n=3$), Six Senses Laamu (SSLM) activities with guests ($n=414$ dives, $n=42$ snorkels and $n=3$ excursion boats), remote underwater camera deployments ($n=67$), and survey data collected from contributors outside the resort ($n=3$).

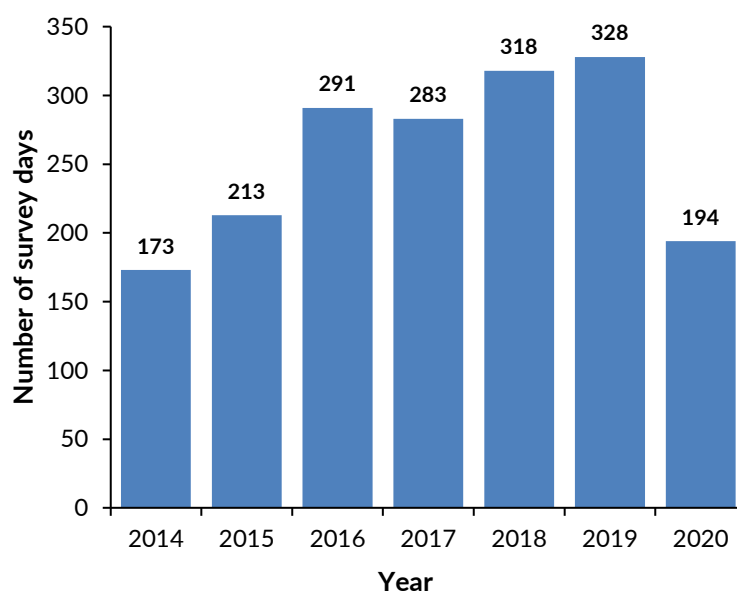


Figure 2: Number of days that surveys were undertaken in Laamu Atoll annually.

Hithadhoo Corner and Fushi Kandu continued to be the two primary survey sites, with data collected from Hithadhoo Corner on 142 days, and Fushi Kandu on 39 days in 2020 (Fig. 3). In 2019, with increased reporting from outside contributors and visits by Deep Blue Divers, survey efforts at Maabaidhoo Kandu increased to 28 days (from just one day in both 2017 and 2018). It was the first year the site had been considered a potential aggregation site. Despite significant resort closures and limited dive opportunities, MMRP and Deep Blue Divers staff were still able to survey the site over 19 days in 2020. Given the proximity and location of Maabaidhoo Kandu to Fushi Kandu (approximately two kilometres), these two sites have been grouped as the Northeastern Channels for further discussion of environmental trends and sightings patterns.

The MMRP has now collected reports of manta ray sightings from 24 sites in the atoll, and confirmed photo-ID sightings from 15 locations (Fig. 1 and Table 1). Regular monitoring of

these sites in future is necessary to determine the reliability of these locations for supporting manta ray sightings.

Overall, manta rays were encountered on 23% ($n=113$) of all dives ($n=488$), and identification photographs were recorded during 42% ($n=48$) of dives with manta rays. This is significantly less than in 2019 (80%) due to MMRP researchers being allocated to mainly guiding dives instead of joining as researchers. Manta rays were observed on 34% ($n=23$) of the remote underwater camera deployments. Snorkelling surveys were recorded from any resort or MMRP led snorkel trips carried out at the two main aggregation sites (Hithadhoo Corner and Fushi Kandu), or any other snorkel sites where manta rays were identified. Manta rays were observed on 24% ($n=12$) of the snorkel surveys ($n=50$), with confirmed identification photos collected for 8% ($n=4$) of the surveys. These figures are not reflective of snorkelling conducted across Laamu Atoll, as it remains rare to see manta rays while snorkelling in the atoll.

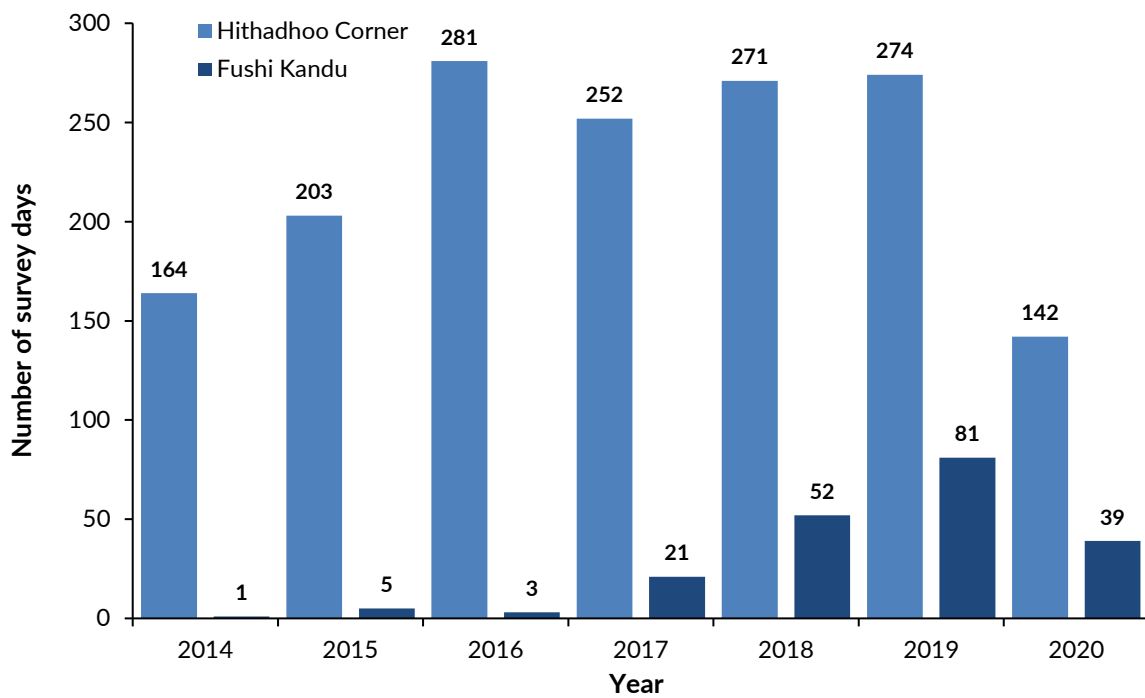


Figure 3: Number of days where surveys were conducted at Hithadhoo Corner and Fushi Kandu in Laamu Atoll annually.

REMOTE UNDERWATER SURVEYS

Remote underwater photo and video surveys (RUP and RUVs) are commonly used in research to monitor specific areas and their use by different marine life whilst humans are absent. In 2019, RUP and RUVs became a regular surveillance tool at the manta aggregation sites in Laamu Atoll, deployed by MMRP researchers, and left to record between dives to increase the opportunity of collecting manta identification and behavioural data. With improvements in the Manta Trust’s remote underwater equipment, 2020 saw the introduction of extended life remote surveys. RUVs were able to record for up to 24 hours whilst “eyes on the reef” (EOTR) time-lapse cameras were able to record for up to 4 days, capturing images every 1 minute.

Of the total 610 surveys conducted, 67 were undertaken using RUV/RUPs (11%). A total of 128 hours of survey time was recorded over 25 RUV surveys, whilst 343 hours of survey time was recorded over 42 RUP surveys. A total of 35 sightings were recorded over the surveys, which makes

up 30% of the total 2020 sightings ($n=118$). This was a noteworthy increase from 16% in 2019 (79 out of 490 sightings), which proves the benefits of remote sensing techniques to our research.

Twenty-five individuals were sighted during RUV and RUP surveys, which was a significant increase from 2019 ($n=9$), due to increased remote sensing effort. The highest number of monthly sightings recorded by RUP/RUVs was 14 (in January), and the lowest was three (in March). After cancellation of the MMRP research boat in mid-March, remote survey effort was rarely possible to co-ordinate. Therefore, no significant analysis can be made due to inconsistent deployments throughout the year. We will be receiving newer RUP models in 2021, which will allow us to make more deployments over multiple cleaning stations, and capture images of higher quality. We aim to expand our understanding of site use by reef manta rays in the Maldives through further use and analysis of this non-invasive research method in the coming years.

SIGHTING TRENDS

Oceanic Manta Rays

Oceanic manta ray (*Mobula birostris*) sightings in Laamu Atoll remain rare. Twelve oceanic manta rays have been identified in Laamu Atoll since 2014, at five different sites. Despite three sightings in 2019, there was zero in 2020, which is likely due to limited research activity. The MMRP is working to increase our understanding of this species through research conducted in Fuvahmulah and Addu

Atolls, where oceanic manta rays are sighted seasonally in much larger numbers than in other regions of the Maldives. The team in Laamu Atoll will continue to monitor for this species throughout 2021. The remainder of this report refers solely to reef manta rays (*Mobula alfredi*); any subsequent reference to manta rays refers only to this species.

Reef Manta Rays

Since 2012, a total of 4,297 sightings of reef manta rays have been recorded in Laamu by full-time MMRP researchers, citizen scientists, and remote underwater cameras. Between 2015 and 2018, numbers of confirmed sightings remained consistent, ranging between 727 and 780 sightings per year (Fig. 4). In 2019 there was a significant decline in the number of manta ray encounters, with only 490 confirmed sightings (Fig. 4) followed by 118 in 2020, which was the lowest recorded figure since the establishment of a

permanent research base in Laamu Atoll. The mean number of sightings per survey in 2020 further decreased from 2019, with an average of just 0.57 (Fig. 4). Tourism levels remain low in the atoll, therefore the decrease in sightings is not likely linked to an increased presence of divers and possible human disturbance. Instead, the significant drop in both total and average sightings in 2020 is attributed to inconsistent survey effort.

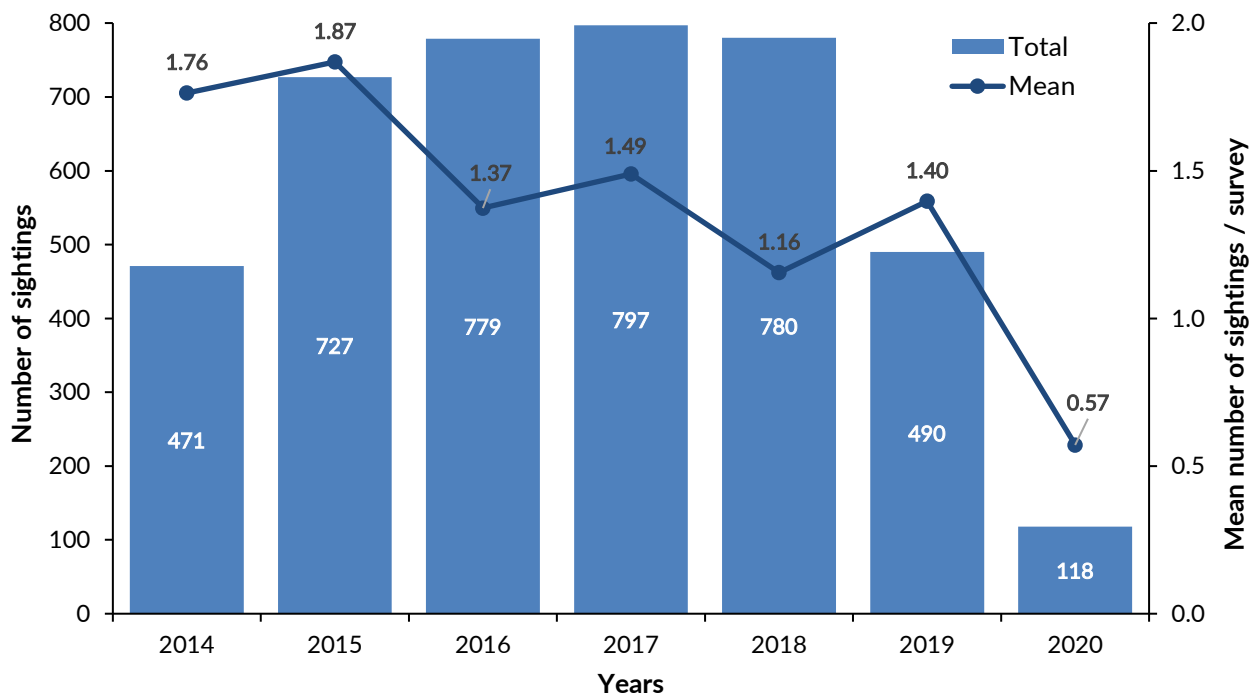


Figure 4: Annual sightings of reef manta rays (*Mobula alfredi*) in Laamu Atoll, and the mean number of sightings per survey for each year (2014-2020).

Sightings trends in Laamu Atoll were relatively consistent between 2014 through 2018, with peaks in sightings typically recorded at the start and end of the Southwest Monsoon (May to June and October to November each year) (Fig. 5).

In 2020, not only were the typical sightings trends not consistent overall, but also the total number of sightings per month was significantly below average compared to 2014 – 2018 (Fig. 6). Relatively high sightings numbers were recorded in January and February ($n=25$ and $n=23$, respectively), when the MMRP team still had access to a dedicated research boat. Despite low survey effort, October still presented the highest sightings numbers ($n=28$), which follows the peak trends of 2014 – 2018. However, November (which typically presents high sightings) presented extremely low numbers, followed by a considerable increase in sightings in December. It must be noted that once the resort reopened, the only opportunity to conduct surveys was on guest diving boats, so surveys were generally conducted by MMRP or Deep Blue Divers staff, guiding guests without cameras to record ID photographs, and manta ray aggregation sites were visited sporadically. The occupancy of the resort was at its highest in December, with more diving guests in house visiting the

aggregation sites more regularly, which could be the reason for higher sightings in December. Therefore, inconsistent survey effort and lack of standard MMRP survey protocols are the likely cause of high inconsistencies in sightings trends compared to 2014 – 2018, and no conclusive results can be drawn from the sightings recorded in 2020. Two-thousand and nineteen was not included in this comparative analysis because it was not representative of the consistent trends noted over previous years. However, it is worth noting a potential new trend developing in recent years, with peak sightings occurring earlier in the year (January in 2019 and January – February in 2020). Two-thousand and twenty was not a typical research year, so no conclusions can be drawn from this trend. However, the higher number of sightings at the start of the Northeast Monsoon in recent years is worth noting. This will need to be further monitored and continuously evaluated in upcoming years to decipher whether this is a new trend in sightings and seasonal presence of manta rays in the atoll, which could be the result of changing environmental conditions.

In 2020, the majority of sightings were recorded at Hithadhoo Corner (64%, $n=75$), and at the Northeastern Channels (11%, $n=13$).

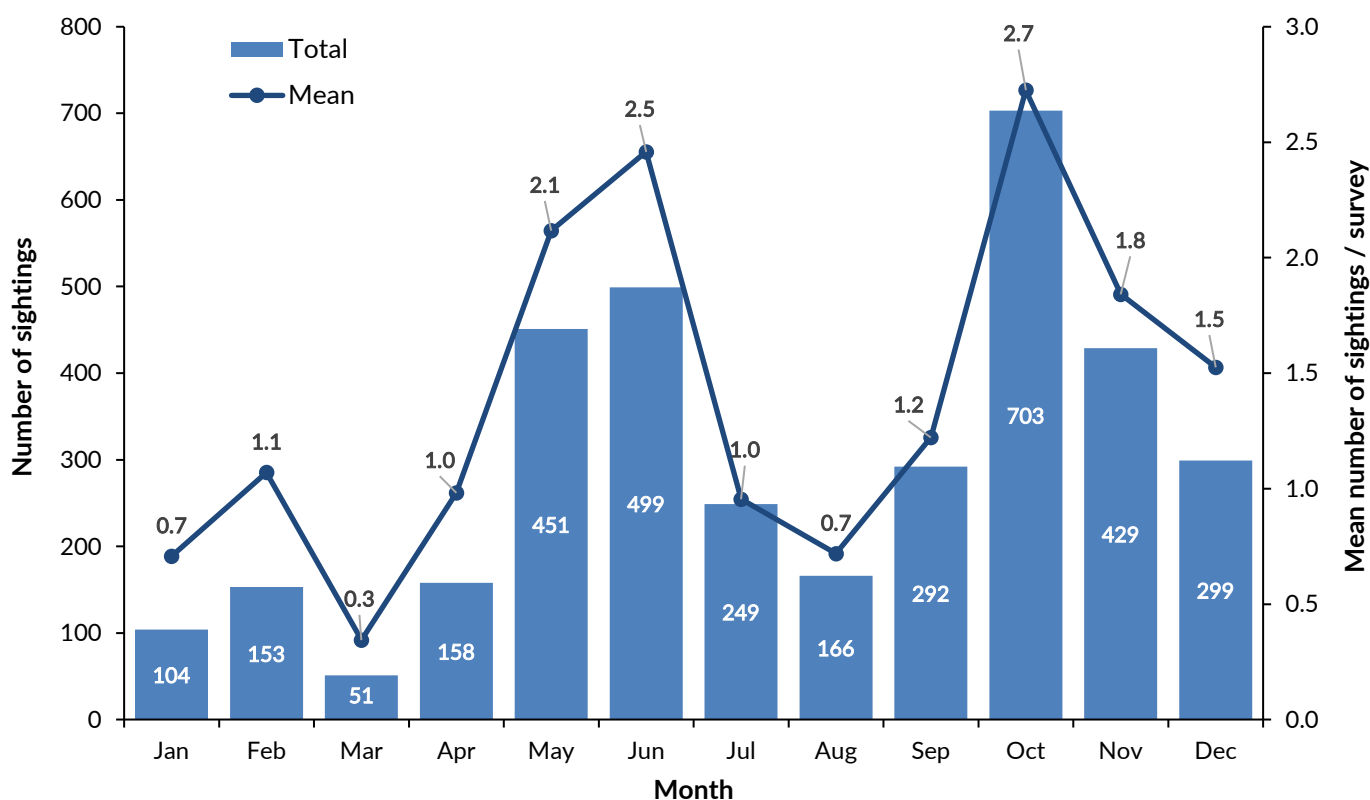


Figure 5: Monthly sightings of reef manta ray (*Mobula alfredi*) in Laamu Atoll (2014-2018) and the mean number of sightings per survey.

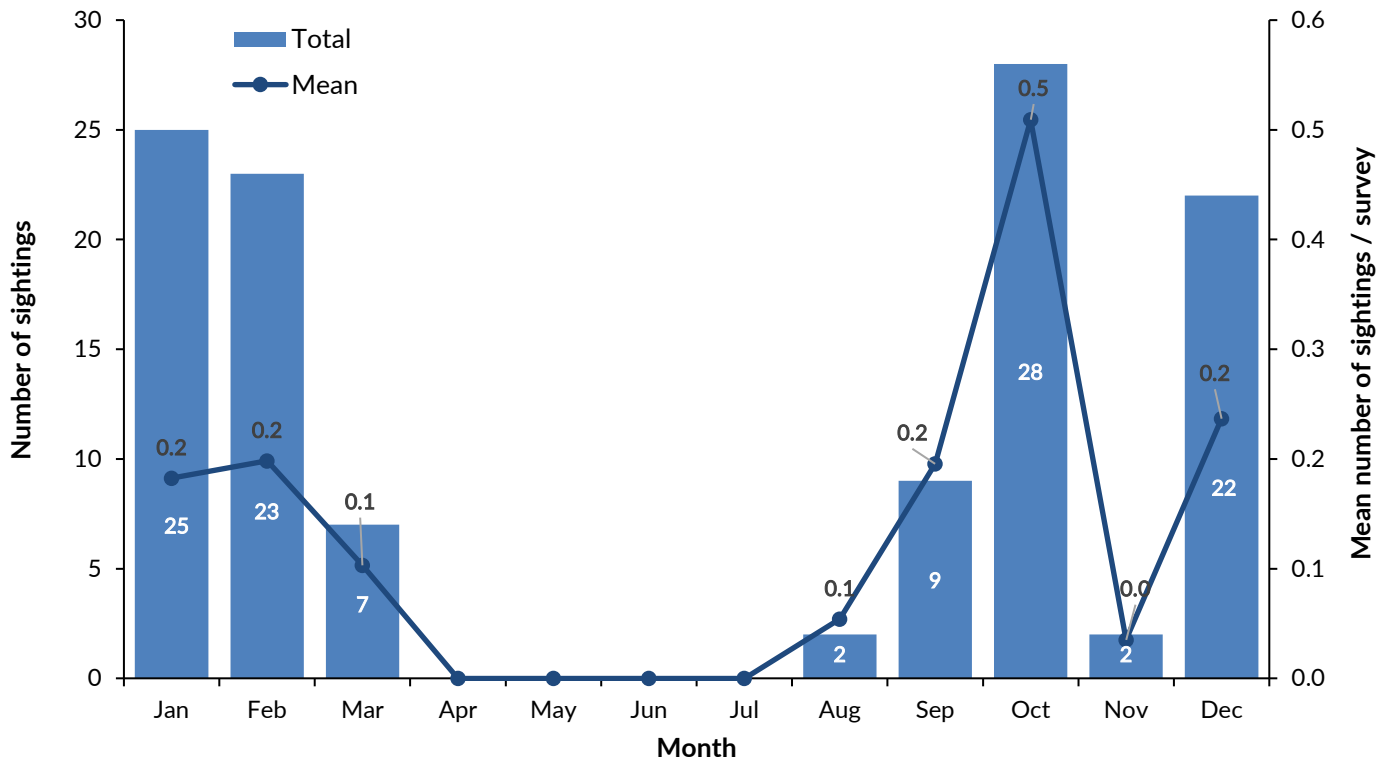


Figure 6: Monthly sightings of reef manta rays (*Mobula alfredi*) in Laamu Atoll (2020) and the mean number of sightings per survey.

Hithadhoo Corner

In 2020, sightings at Hithadhoo Corner were at their lowest since 2014 ($n=75$), following a steep decline from 2019 ($n=396$). When accounting for survey effort, a drop in the mean number of sightings per survey day was also apparent ($n=1.45$ and $n=0.53$, in 2019 and 2020 respectively) (Fig.

7). Peaks in sightings were recorded at Hithadhoo Corner in January, October, and December 2020, with the highest numbers of individuals also recorded during these months (Fig. 8).

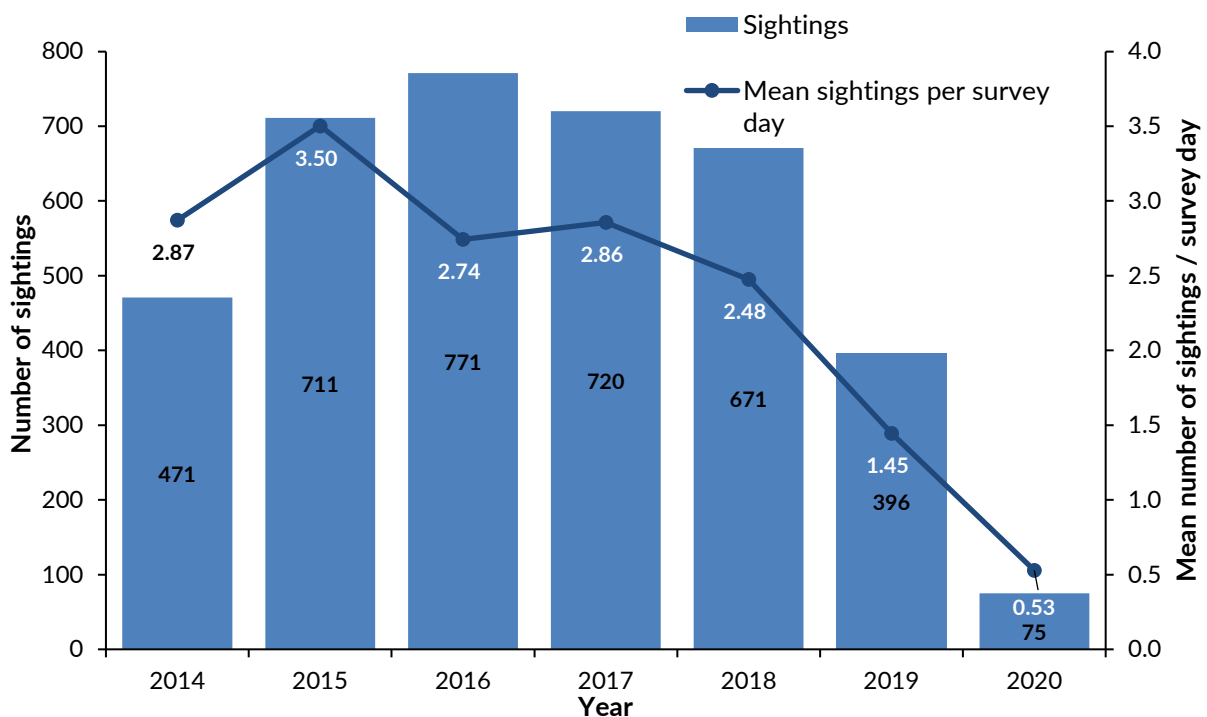


Figure 7: Annual sightings of reef manta rays (*Mobula alfredi*) at Hithadhoo Corner in Laamu Atoll and the mean number of sightings per survey day.

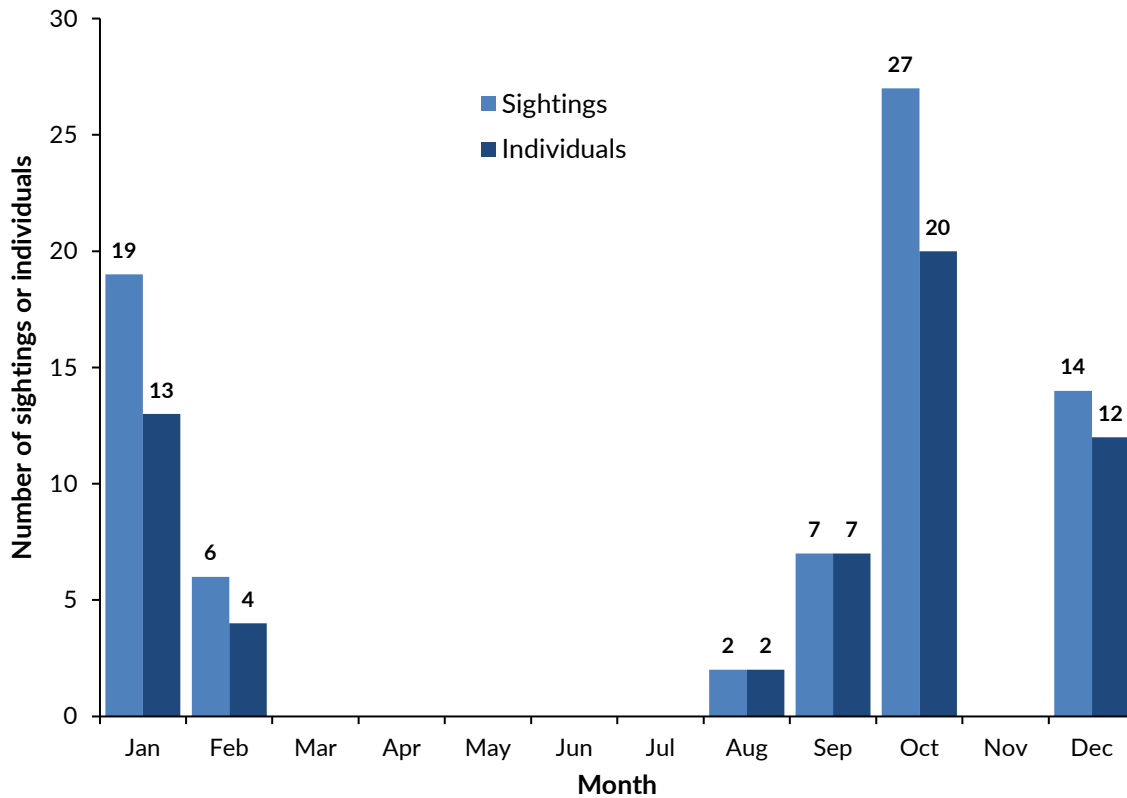


Figure 8: Monthly sightings and the number of individual reef manta rays (*Mobula alfredi*) recorded at Hithadhoo Corner in Laamu Atoll (2020).

Eighty-three percent ($n=62$) of sightings recorded at Hithadhoo Corner in 2020 were associated with cleaning behaviour, an increase from 2019 (Fig. 9). Cruising behaviour made up 11% of observations ($n=8$), which was a decrease from 2019. The average encounter duration ($n=10$ minutes) was significantly shorter than the average encounter time of 2014 – 2020 ($n=19.6$ minutes) and was the lowest time since the project began (Fig. 10). These observations may indicate that individuals were cleaning elsewhere, possibly at sites that presented better feeding opportunities nearby. These observations may also indicate that the manta rays passing through the site were less likely to stop at these social aggregation sites because of a lack of reproductive opportunities in 2020. Changes in environmental conditions may offer more favourable conditions elsewhere or reduce drivers of cleaning station use.

Sixty nine percent ($n=24$) of all RUV/RUP sightings in 2020 were captured at Hithadhoo Corner. Of these sightings, 58% ($n=14$) were recorded in January, when the MMRP still had access to a dedicated research boat. Due to logistical issues with deploying and recovering the systems during sporadic guest dives to the locations, RUV/RUP survey effort declined once the MMRP team could no longer survey the sites regularly. Interestingly, 29% of the individuals recorded by RUV/RUP at Hithadhoo Corner ($n=7$) were not seen at any other time during the year by MMRP researchers or divers. This signifies the importance

of deploying the systems on a regular basis to develop further insight into manta ray site utilisation and population dynamics.

The shorter average encounter duration, the significant proportion of sightings captured only on an RUV/RUP, and lack of regular monitoring, suggest that some photo-IDs were likely missed, particularly of individuals that visited the site infrequently.



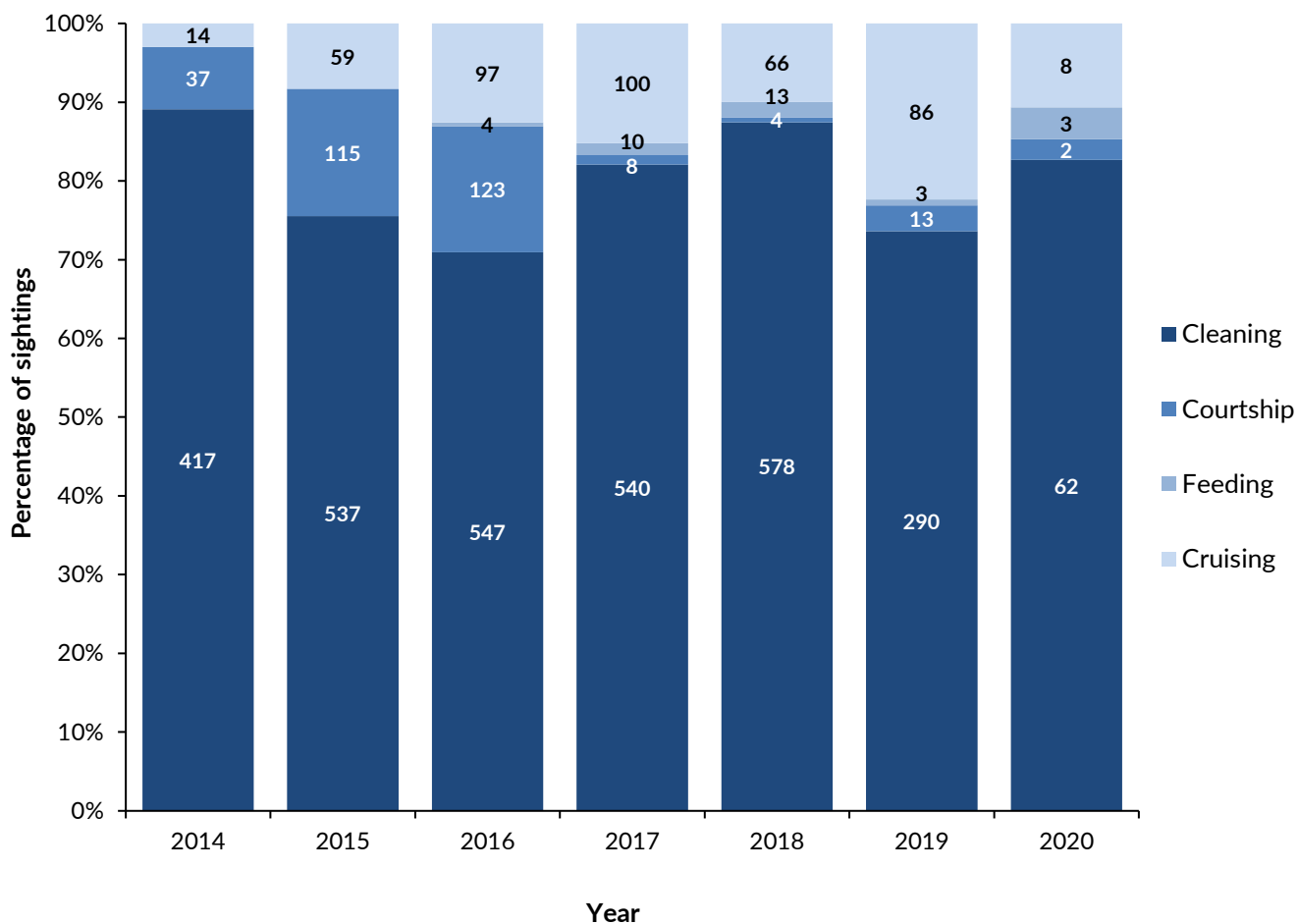


Figure 9: Predominant behaviour recorded during each reef manta ray (*Mobula alfredi*) sighting at Hithadhoo Corner in Laamu Atoll annually. Actual number of sightings above bars.

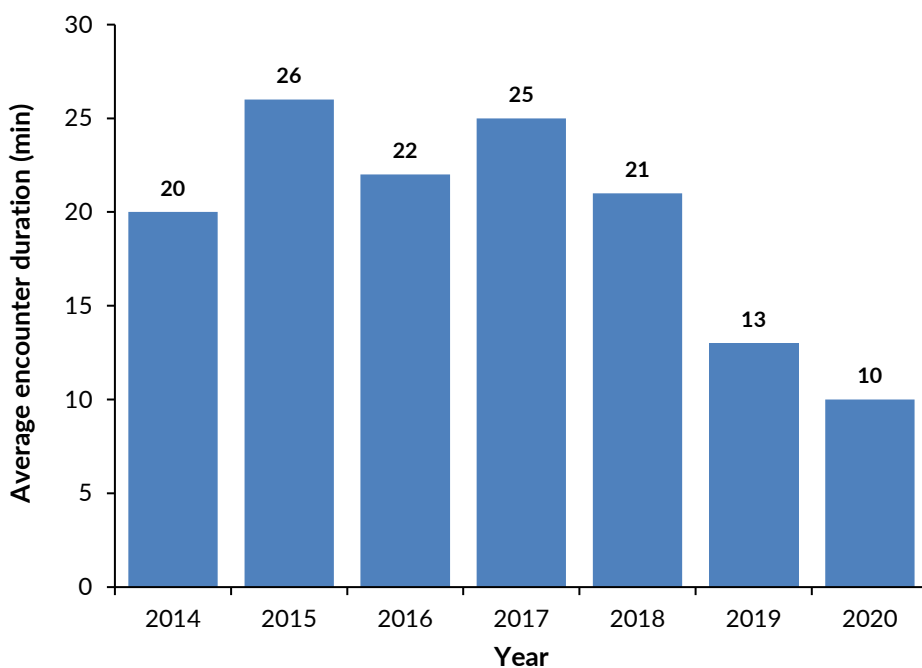


Figure 10: Average duration (min) of reef manta ray (*Mobula alfredi*) encounters recorded by divers at Hithadhoo Corner in Laamu Atoll annually.

Northeastern Channels

In 2018, Fushi Kandu was identified as a second key aggregation site based on preliminary surveys conducted in previous years, and surveys at this site increased in 2019 ($n=81$ survey days). In 2020, survey effort at this site dropped due to restrictions ($n=39$ survey days), yet despite decreased surveys, average sightings per survey day increased between 2019 - 2020 (from $n=0.6$ in 2019 to $n=1.3$ in 2020) (Fig. 11). Most of these surveys were conducted by Deep Blue Divers staff, without cameras

to take photo-IDs, so unfortunately average confirmed sightings per survey day was the lowest since 2014 ($n=0.33$). At nearby Maabaidhoo Kandu there were only ($n=9$) unconfirmed sightings, and ($n=0$) confirmed sightings. To calculate sightings per survey day at these sites, the approximate number of manta rays observed was used when there were no confirmed sightings, as data for these sites remains limited.

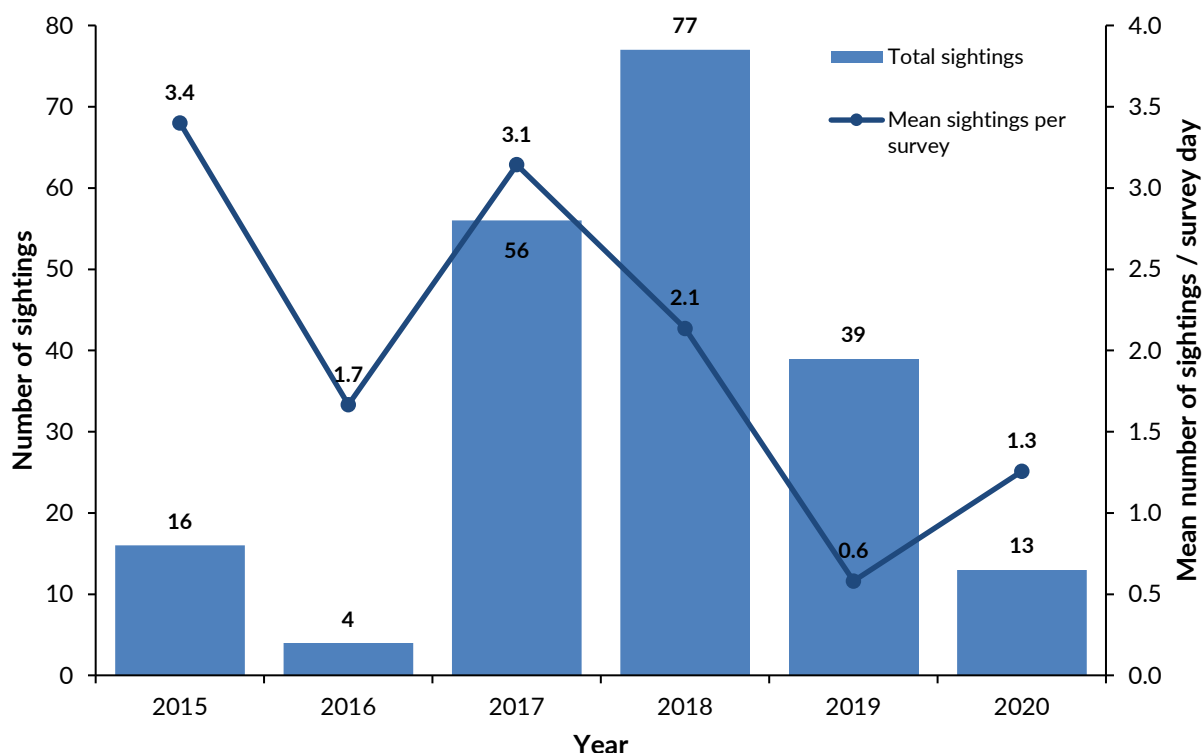


Figure 11: Annual sightings of reef manta rays (*Mobula alfredi*) at Fushi Kandu in Laamu Atoll, and the mean number of sightings per survey.

In 2020, ($n=8$) individuals were collectively recorded from ($n=13$) confirmed sightings from the Northeastern channels (Fig. 12). Most confirmed sightings ($n=8$), and the highest average number of sightings per survey day, were observed ($n=0.7$) in December due to a large photography group visiting the resort and frequently diving at Fushi Kandu during this month. However, this did coincide with the rise in sightings ($n=14$) and high average number of sightings per survey day ($n=0.7$) at Hithadhoo Corner during this month. Zero sightings were observed at both Hithadhoo Corner and the Northeastern Channels in November, which historically is when sightings numbers were still high (Fig. 13). However, survey days were limited ($n=13$, $n=0$ and $n=2$ at Hithadhoo Corner, Fushi Kandu and Maabaidhoo Kandu respectively) which compromises the chances of recording sightings.

Of the 134 individuals known to Laamu Atoll, 94% ($n=126$) have been sighted at Hithadhoo Corner, and 48% ($n=65$) at the Northeastern Channels. There are only 5 individuals

that have been sighted at either Fushi Kandu or Maabaidhoo Kandu, and not at Hithadhoo Corner; one of which was new to the atoll this year. One of these individuals (MV-MA-4342) showed unusually high site fidelity for Fushi Kandu ($n=11$ sightings). However, since the majority of the individuals sighted at the Northeastern Channels have also been sighted at Hithadhoo Corner, the most plausible theory remains that Fushi Kandu and Hithadhoo Corner represent key aggregation sites of a single manta ray population within Laamu Atoll. Individuals likely move along the outer atoll reef (including Maabaidhoo Kandu) to travel between these sites.

Total sightings since 2014 remain low from the Northeastern Channels ($n=220$). Wind direction data was recorded during 63% of these sighting occasions. Of these sightings, the highest proportion was recorded during the Southwest Monsoon (27%, $n=38$), whilst very few sightings ($n=15$) were recorded during the Northeast Monsoon. Interestingly, in 2020 as many sightings were

recorded in the Northeast Monsoon as in the Southwest Monsoon ($n=5$), and the highest proportion of sightings were recorded during North-westerly winds (45%, $n=10$). However, the resort closure spanned over the majority of the Southwest Monsoon, impacting research efforts during this period, and ultimately influencing overall findings. This would explain why sightings in 2020 did not follow historical wind patterns.

The overall seasonality at Fushi Kandu and Maabaidhoo Kandu is consistent with observations from the MMRP's study sites in the central atolls, whereby eastern sites experience higher numbers of sightings during the Southwest Monsoon and western sites during the Northeast Monsoon. This indicates that there may be a more significant correlation between monsoons and sightings than was previously thought.

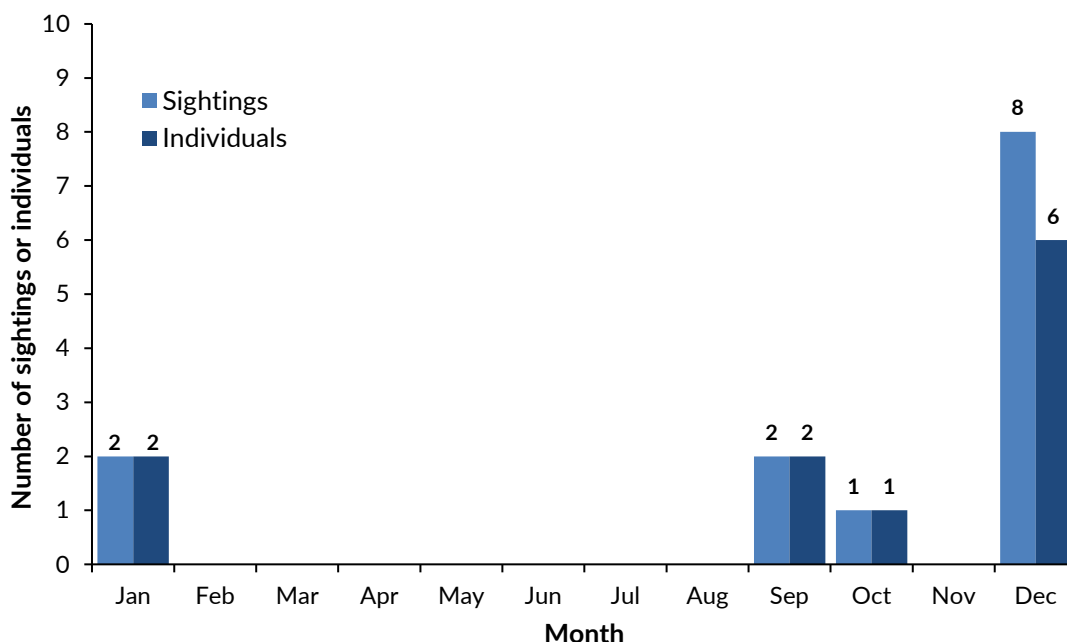


Figure 12: Monthly sightings and the number of individual reef manta rays (*Mobula alfredi*) recorded at Fushi Kandu and Maabaidhoo Kandu in Laamu Atoll (2020).

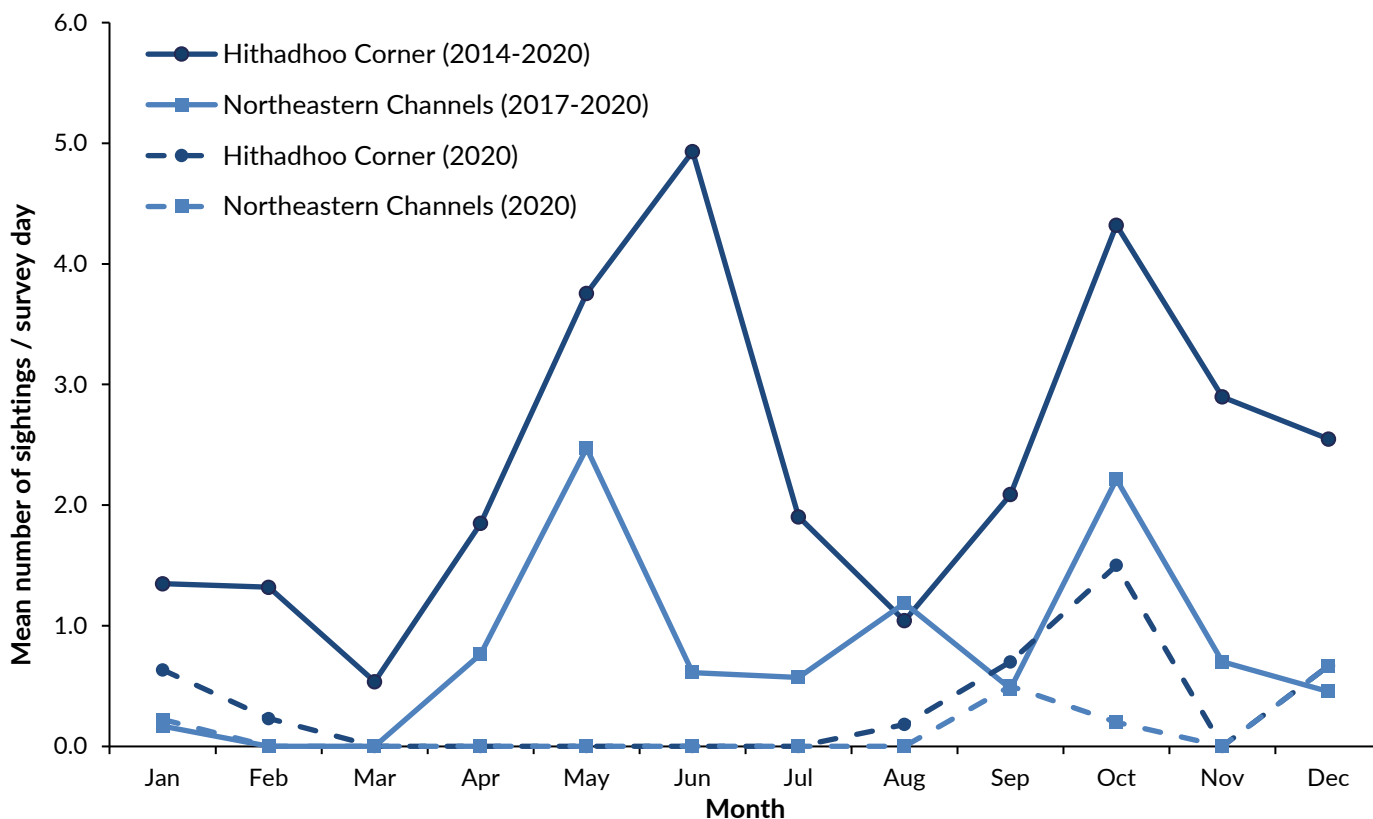


Figure 13: Mean number of reef manta ray (*Mobula alfredi*) sightings per survey day at Hithadhoo Corner and the Northeastern Channels in Laamu Atoll.

Secondary Sites

Fifty-one reef manta ray encounters were reported at an additional ten survey sites in 2020, with an additional two encountered at unknown sites. Of these, 30 sightings (24 individuals) were confirmed through photo-IDs. These sightings ($n=30$) constituted 25% of the total sightings in 2020, which is a significant increase from the proportion of total sightings recorded at secondary sites between 2014 – 2020 (3%, $n=127$ out of $n=4,160$ sightings). The sightings in 2020 also made up 24% of all sightings recorded at secondary sites in Laamu since 2014. This could be due to surveys being conducted at a wider variety of sites, or because of a lack of monitoring at the main aggregation sites. In 2020, 55% ($n=70$) of sightings from secondary locations were of feeding activity, 21% ($n=27$) of cruising behaviour, 20% ($n=25$) of cleaning, 2% ($n=2$) of courtship, and 2% ($n=1$) of unknown behaviour. Most feeding sightings were at Mendhoo Beyru ($n=27$), which is close to the aggregation site Hithadhoo Corner; so further monitoring of feeding activity at this site should be established in 2021.

Of the confirmed sightings recorded at secondary locations between 2014 and 2020, 92% ($n=117$) were along outer reefs on the southern edge of the atoll, and 8% ($n=10$) were recorded at inner reef sites. It appears there may be some seasonality to the sightings on the southern edge of the atoll, with these increasing during the Northeast Monsoon. Data remains limited and additional research is needed to determine if sightings in these areas are linked to environmental conditions.

Of the 30 confirmed sightings recorded at secondary locations in 2020, 23 of these were recorded at Boduhuraa Beyru (also known as Kurethi) in February and March, of which a significant number were recorded using the RUV system. Increased survey effort and extended life remote underwater cameras will be deployed at this site in 2021 to develop further insight into manta ray sightings trends and frequency of visitations to Boduhuraa Beyru. This site has a lot of potential to provide further insight into manta habitat use in the atoll, if closer monitoring is established.

Environmental Influence

Throughout the Maldives, site usage by manta rays has been linked to wind direction, which changes with the South Asian Monsoon. Research in Laamu Atoll has been on-going since 2014, but the wind has never been considered as a key variable in determining site use, as Hithadhoo Corner was the only aggregation site identified until 2018, and the site supports year-round encounters.

A preliminary analysis of the data since 2014 on the approximate number of manta rays observed at a site in relation to wind direction revealed that sightings at Hithadhoo Corner have generally been recorded under all wind conditions, but typically peak when winds are blowing from the southwest and west (Fig. 14). At the Northeastern Channels of Fushi Kandu and Maabaidhoo Kandu, sightings also peak when winds are from the southwest (Fig. 14). Very few sightings have been recorded at Fushi Kandu or

Maabaidhoo Kandu during the Northeast Monsoon, which suggests these sites may be used more seasonally, but surveys remain limited for these locations. In other areas of the atoll, there may be correlations, particularly on the southern outer edges of the atoll where sightings peaked when winds were from the northeast (Fig. 14). While topography may be somewhat different in Laamu Atoll to the more northern atolls, manta ray site usage in the atoll appears to still be heavily influenced by wind direction. Understanding the influence of wind in the atoll is important as it allows the MMRP to prioritise survey areas depending on the prevailing wind direction and monsoon. Data on sites away from Hithadhoo Corner remains limited and further research is needed during both monsoons to determine the environmental influence on sightings trends at these locations.



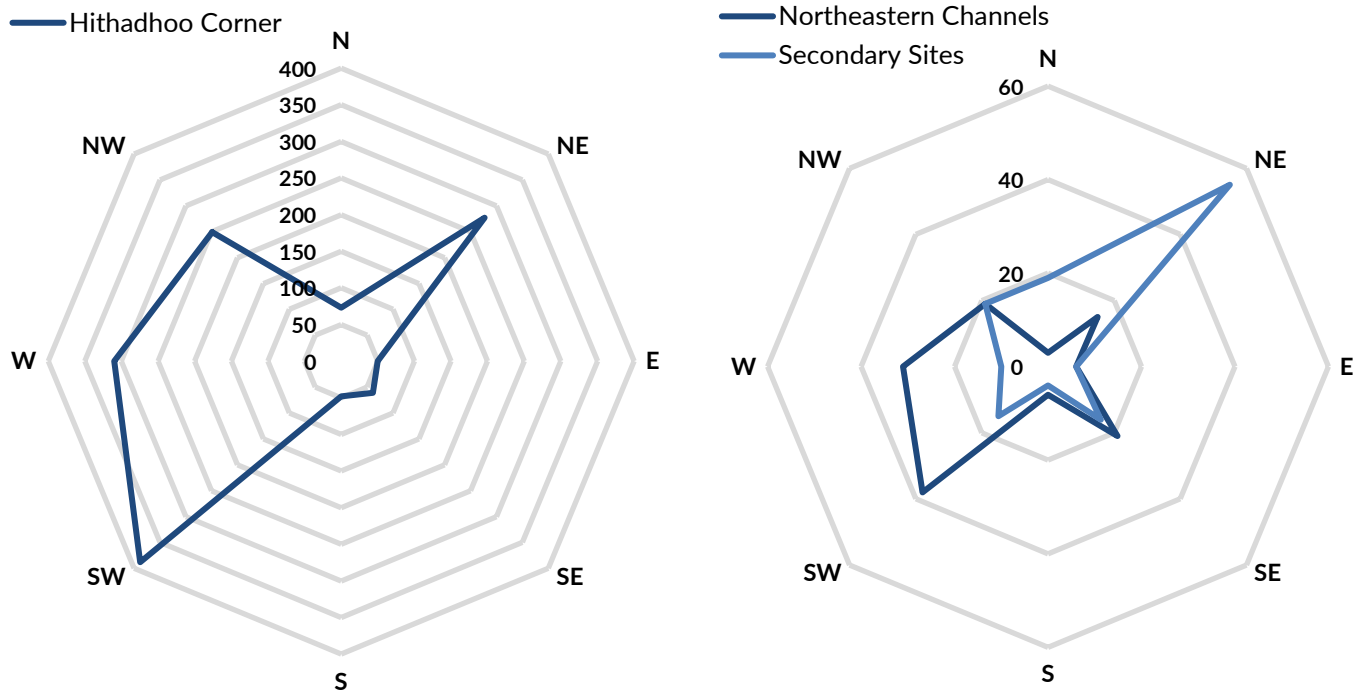


Figure 14: Number of reef manta ray (*Mobula alfredi*) sighting records in relation to the prevailing wind direction at Hithadhoo Corner, the Northeastern Channels, and at all the combined secondary sites in Laamu Atoll (2014-2020).

POPULATION DEMOGRAPHICS

As of 31st December 2020, 134 individual manta rays (79 females, 54 males, and 1 individual of unknown gender) have been identified in Laamu Atoll, comprising 2.7% of the known Maldives population. At study locations further north, the ratio of female to male manta rays observed is roughly 50:50. By contrast, Laamu Atoll supports a female dominated and predominantly adult population (Fig. 15). This is to be expected as most sightings in Laamu Atoll occur around cleaning stations, which are commonly visited by adult manta rays, and are typically dominated by females, who invest more time in cleaning than male individuals. If more feeding sites and juvenile aggregation areas are identified within Laamu Atoll, the population demographics are likely to more closely reflect the national average.

Of the 134 known individuals, 53 (39%) were photographed in 2020, a major decrease from records in previous years ($n=80$ in 2019) (Fig. 16). Two new individuals were recorded in Laamu Atoll, both of which were new to the Maldives. One of the individuals was identified as a juvenile female, whilst the sex and maturity of the other individual could not be determined from the submitted photo-ID.

Between 2015 and 2018, the percentage of males sighted has remained consistent at 40 – 41% per year. In 2020,

49% ($n=26$) of individuals sighted were male, and 47% ($n=25$) were female. This shift in the ratio was due in part to the new males identified in 2019 but may have also been the result of below-average sightings of female manta rays.

Maturation status in manta rays can be determined by the presence of mating scars or visible pregnancies in females, or by the enlargement and calcification of claspers in males. If visual features are not apparent, the size and historical sightings records of individuals can also be considered to estimate maturation. If an individual was estimated or measured to be at, or larger than, 320 centimetres (cm) disc width in females, or 270 cm disc width for males, they were considered as adults. Research on measuring manta rays is currently being conducted in Laamu Atoll as part of a PhD study. More information about measuring manta rays is also available in the project activities report.

Maturation demographics in 2020 remained similar to previous years. Sixty-six percent of individuals sighted in 2020 were adult manta rays ($n=35$) (Fig. 17), with demographics of the overall population appearing relatively consistent. From 2016 – 2019, there was a steady increase in the proportion of juveniles sighted in Laamu Atoll, and a steady decrease in the proportion of adults sighted (Fig. 18).

This may be the result of young recruits utilising the study sites after a period of population fecundity. However, it could also indicate that the study sites in Laamu Atoll are utilised more by adults when conditions are favourable for courtship. Another possibility is that research effort in recent years has diversified focus to collect data from more varied manta ray aggregation sites, opportunistically

capturing younger individuals in the process, which are less likely (less often) to frequent the adult cleaning stations at sites like Hithadhoo Corner. Interestingly, this pattern was not followed in 2020, with an increase in adults and decrease in juveniles sighted. Survey effort drastically reduced in 2020 and a lower variety of sites were visited, reducing the opportunity to encounter new juveniles.

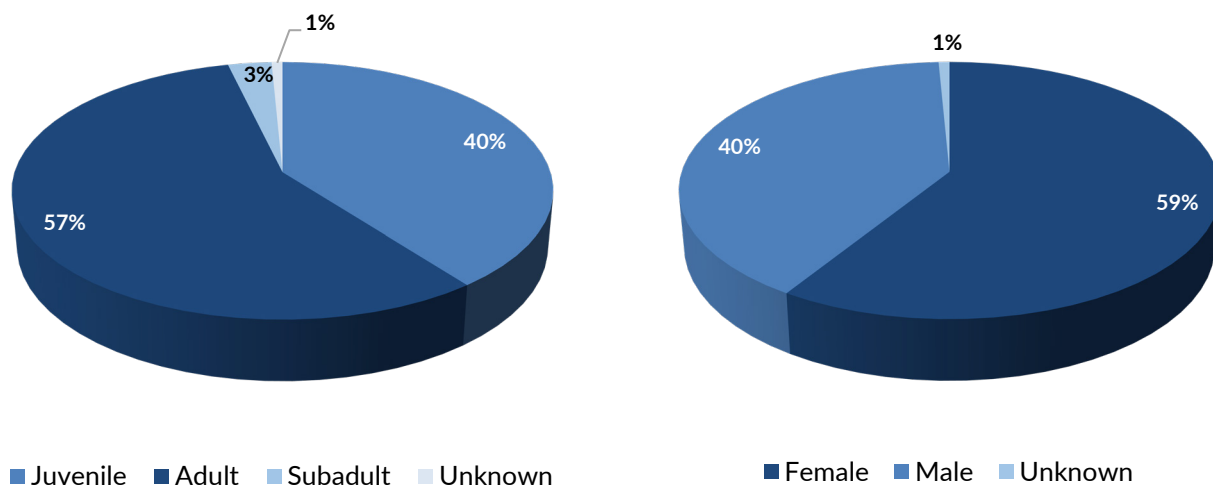


Figure 15: Demographics of the Laamu Atoll reef manta ray (*Mobula alfredi*) population (n=134).

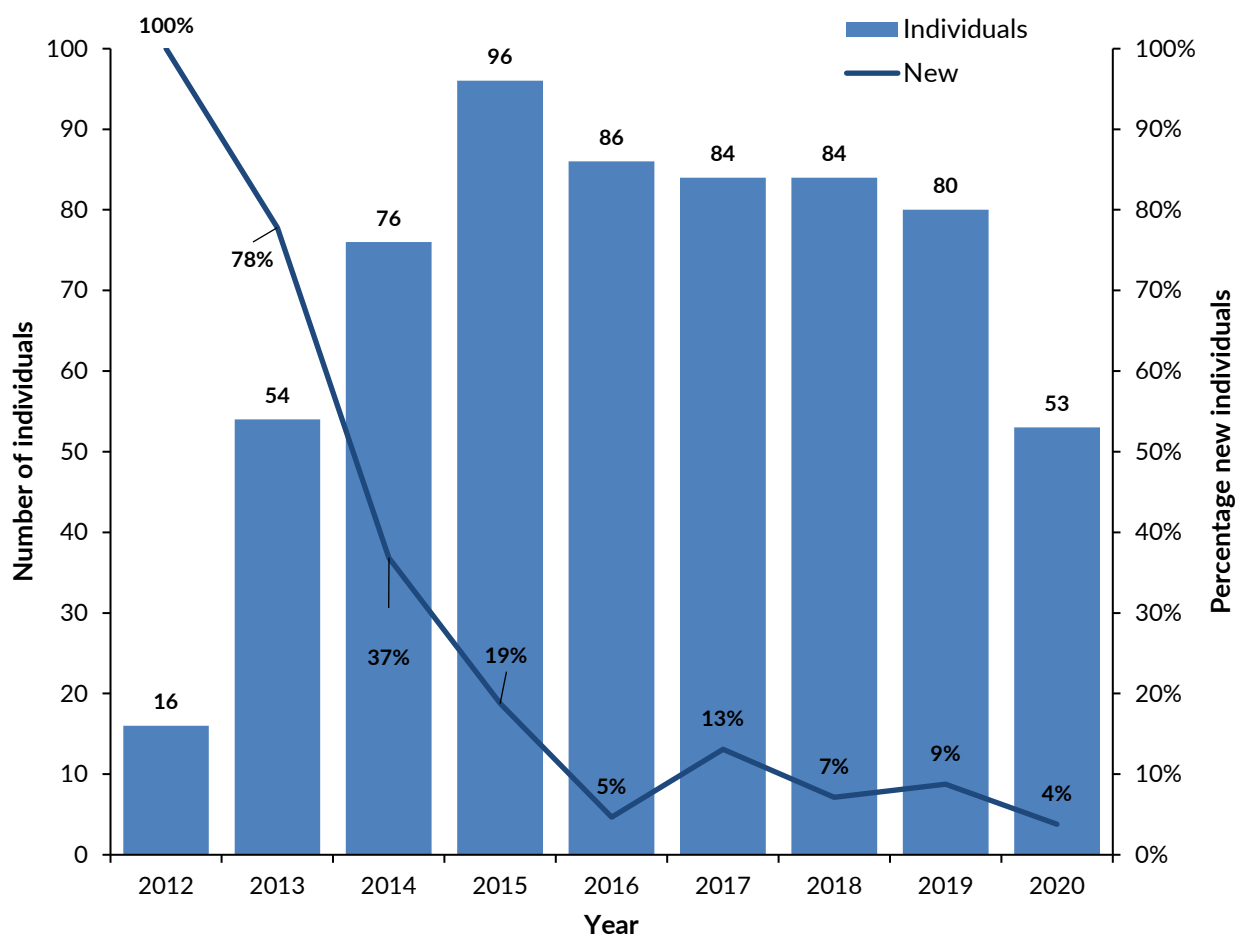


Figure 16: Number of reef manta rays (*Mobula alfredi*) sighted annually in Laamu Atoll and the percentage of those individuals that were newly recorded.

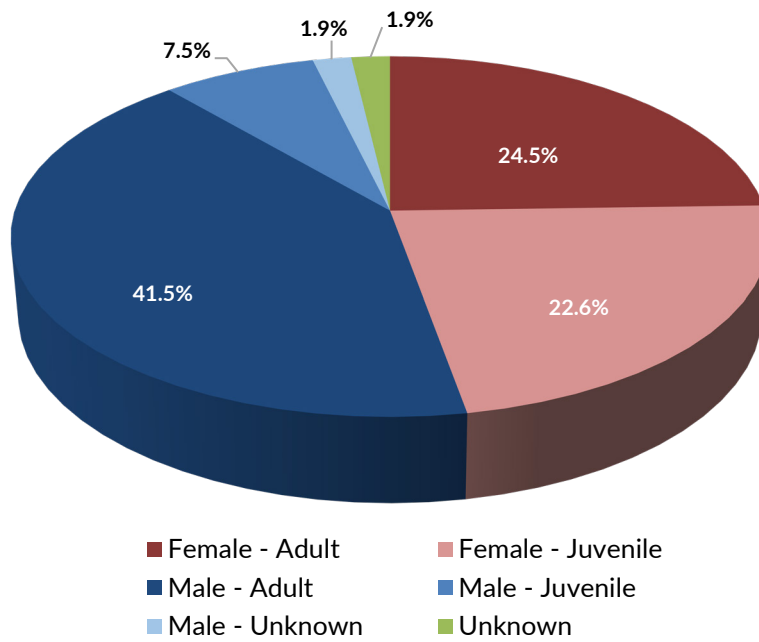


Figure 17: Demographics of the Laamu Atoll population of reef manta rays (*Mobula alfredi*) sighted in 2020.

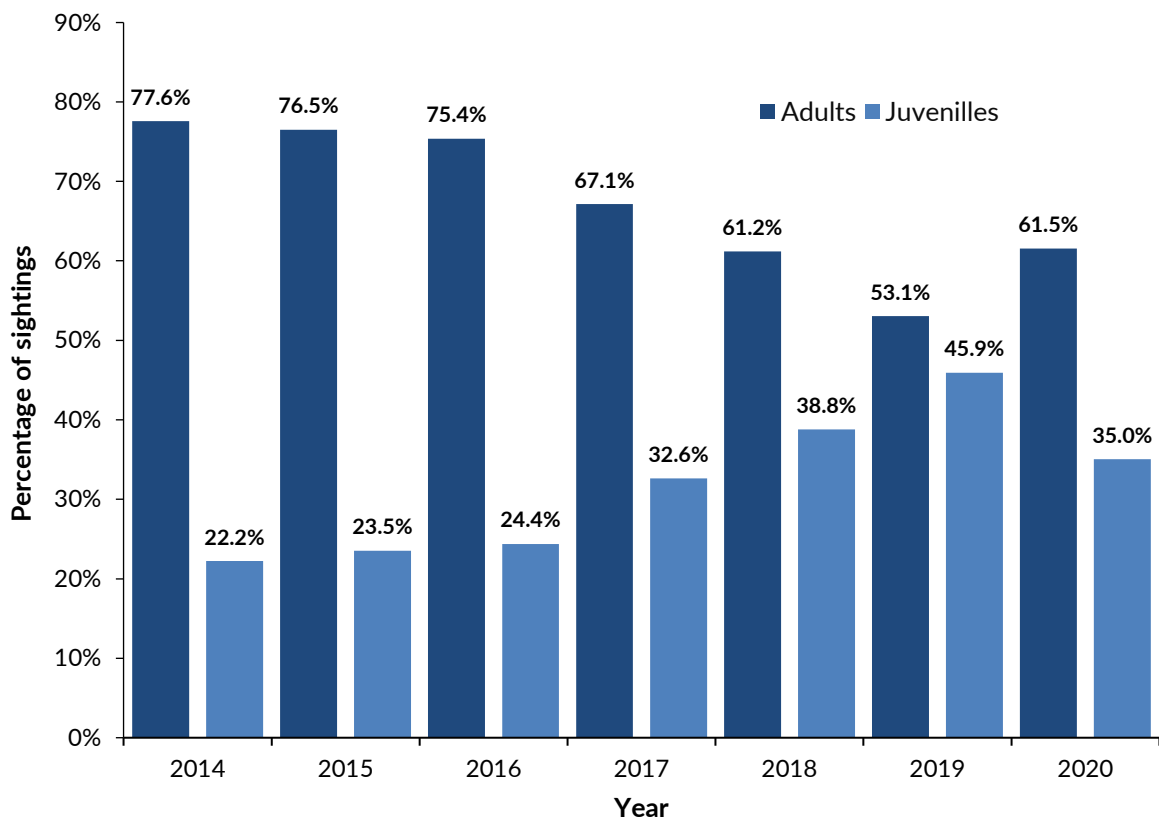


Figure 18: Percentage of confirmed sightings of juveniles and adult reef manta rays (*Mobula alfredi*) in Laamu Atoll between 2014 and 2020.

MIGRATION & RESIDENCY

The population of reef manta rays in Laamu Atoll is small yet highly resident. Individuals show high site fidelity and are rarely sighted elsewhere in the Maldives. Given the decrease in both sightings and number of individuals sighted (Fig. 16), the number of sightings per individual was lower in 2020 than in previous years (an average of 2.23 sightings per individual in 2020, compared to an average

of 6.13 sightings per individual in 2019). The proportion of manta rays observed on more than one occasion (72%) was the lowest recorded between 2014 – 2020 (Fig. 19). This suggests that the manta rays of Laamu Atoll were spending more time away from the identified study sites, utilising habitats unknown to the Manta Trust, most likely still within the atoll.

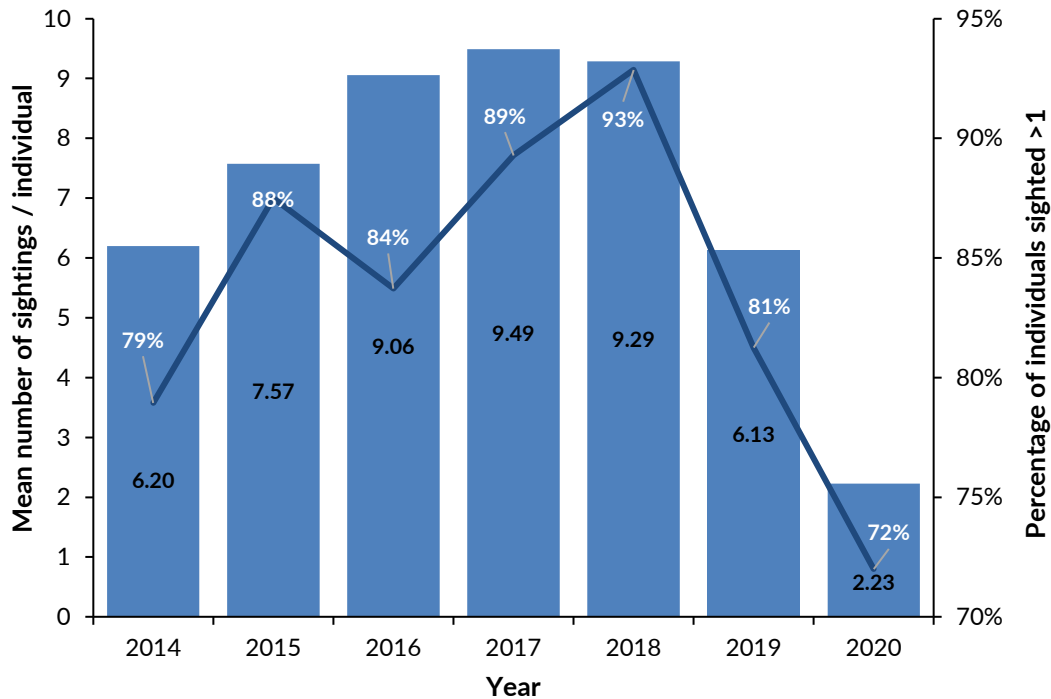


Figure 19: The mean number of sightings per individual reef manta ray (*Mobula alfredi*) annually in Laamu Atoll and the percentage of those individuals sighted more than once.

To account for variations in survey effort, an average Residency Index (RI) was calculated for each year based on the ratio between the number of times each individual was sighted and the total number of surveyed days (e.g., an RI of 3% means that, on average, each individual was sighted on 3% of the total surveyed days). The average RI in Laamu Atoll has been steadily decreasing each year, from 3.6% in 2014 to 1.87% in 2019 (Fig. 20). Changes in RI can be linked to environmental fluctuations or changes in survey effort in a given year; as survey effort was consistent between 2016 – 2019, the decrease in residency is likely due to environmental or behavioural changes. Two-thousand and twenty presented the lowest RI on record at 1.15% (Fig. 20). However, the number of survey days in 2020 was significantly lower than previous years.

While we cannot determine the exact movements of individual manta rays, it appears that the population

exhibited more transient behaviour between 2019 – 2020, perhaps searching for more favourable conditions elsewhere. To date, 17 individuals (13% of Laamu Atoll's population) have been recorded elsewhere. Some individuals have been sighted in more than one atoll outside Laamu Atoll, resulting in a total of 27 recordings of these 17 individuals across other atolls in the Maldives (Fig. 21).

To determine if manta rays are utilising additional sites, it is necessary to increase survey effort in unexplored areas of Laamu Atoll. Increasing numbers of exploratory dives presents logistical challenges and this would mean a decrease in dives at Hithadhoo Corner. However, decreased sightings at crucial aggregation sites provide significant justification. This should be accompanied by increased outreach to liveaboard operators and dive centres in Laamu Atoll in the hope of obtaining additional sightings updates from study sites.

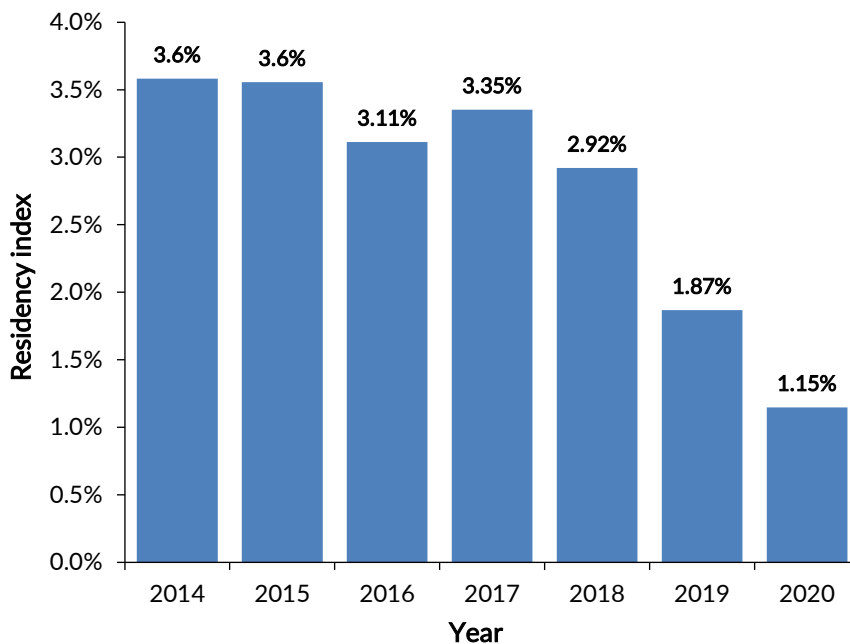


Figure 20: Annual Residency Index (RI) of the reef manta rays (*Mobula alfredi*) sighted annually within Laamu Atoll. RI was calculated as the average of each individual's residency score (equal to the number of times sighted annually divided by the number of surveyed days in the atoll).

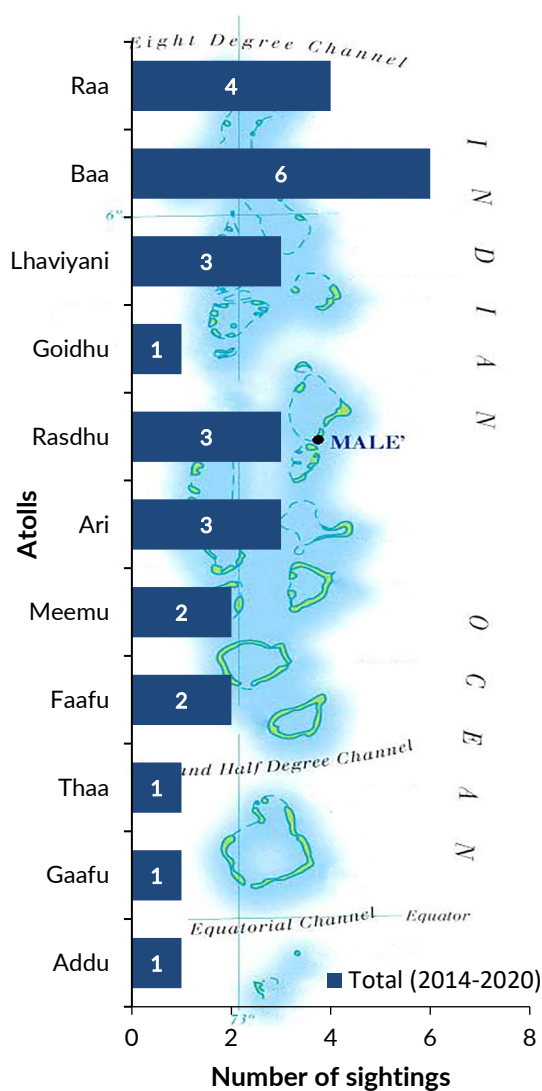


Figure 21: Number of reef manta rays (*Mobula alfredi*) (n=17) from the Laamu Atoll population which have been sighted in other atolls throughout the Maldives. Note - some individuals have been sighted in more than one atoll throughout the Maldives Archipelago.

PREGNANCIES & COURTSHIP

Prior to 2018, Laamu Atoll was considered to support a bi-annual courtship season (May – June and October – November). Following minimal courtship behaviour in 2018 (four sightings) but high pregnancy records (73 sightings of 16 individuals), 2019 saw a very slight increase in courtship behaviour (15 sightings of 14 individuals) with pregnancy records greatly reduced (Fig. 22). This could be due to a combination of lower sightings in 2019 and individuals recorded pregnant in 2018 having given birth and in a period of recovery between gestations. In 2020, courtship behaviour was extremely low, with only 2 sightings recorded in December (Fig. 22), and no period of the year offering particularly high sightings of the behaviour as had been observed in 2016 and 2017. It must be noted however that no surveys were conducted in the first courtship season, and minimal surveys in the second, which reduced potential courtship sightings significantly. As a result, no seasonality to the courtship behaviour could be determined in 2020.

2017. Of these individuals sighted since, 58% (n=15) were recorded as pregnant in 2018 – 2019. Given the low instances of courtship activity recorded in 2019, the high number of pregnancies documented in recent years, the recovery time between pregnancies, and reduced overall survey effort; the absence of pregnancies seen in 2020 can be easily understood.

In 2019, Six Senses Laamu, the Manta Trust, IMV Imaging, and the University of Cambridge released the first images of pregnant and non-pregnant reef manta rays using the world’s first contactless underwater ultrasound scanner. Unfortunately, no scans were obtained in 2020 due to logistical restraints. However, the Manta Trust team hope to increase scanning effort in 2021 once research boat surveys begin again. For additional information about the ultrasound scanner, please see the press release or project activities report.

Of the 32 mature females known to Laamu Atoll, 81% (n=26) have been recorded on at least one occasion since

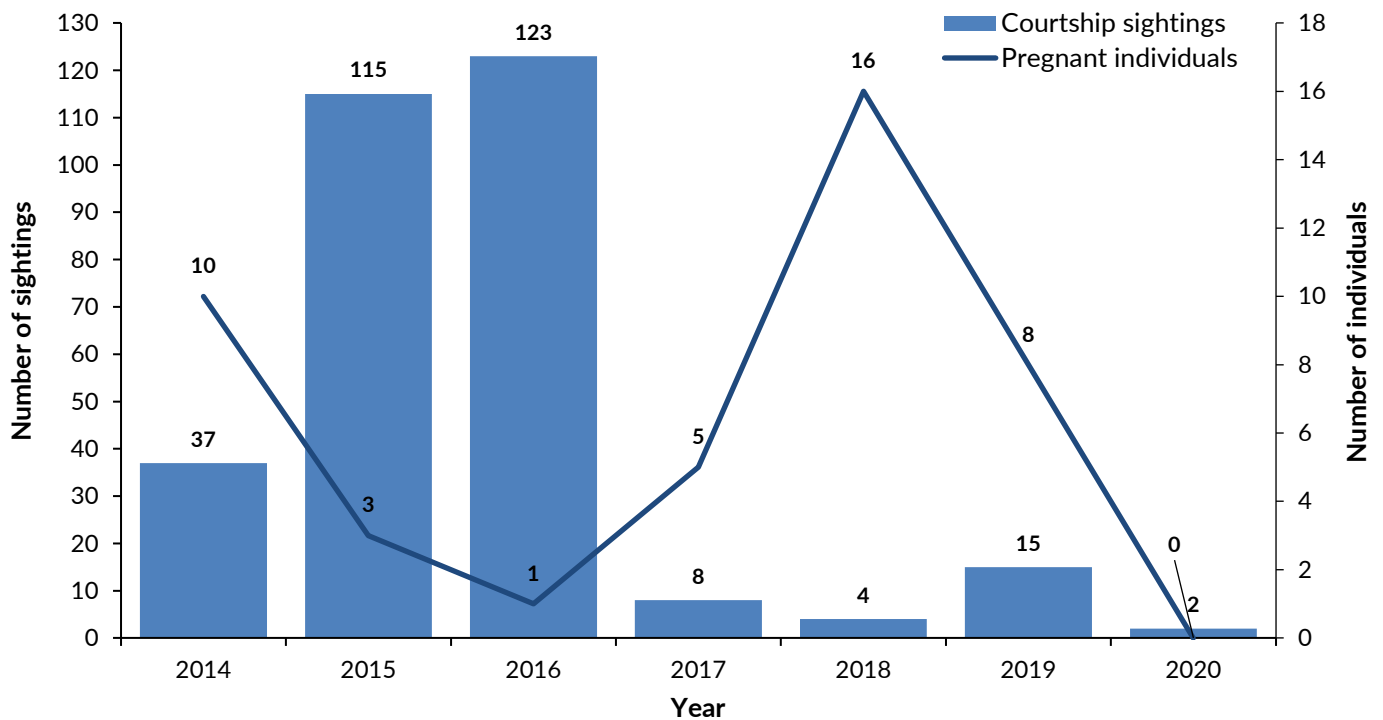


Figure 22: Number of sightings annually during which courtship was the primary behaviour, and the number of individual reef manta rays (*Mobula alfredi*) which were recorded pregnant annually.

SUB-LETHAL INJURIES

Of the 134 identified individuals in Laamu Atoll, 23% (n=31) have been recorded with at least one sub-lethal injury. Thirty-nine injuries have now been documented in Laamu Atoll, and 90% (n=28) of injured individuals have one sub-lethal injury, while 10% (n=3) have two sub-lethal injuries. Of the 31 injured individuals, 45% (n=14) displayed injuries of natural origin, 26% (n=8) of anthropogenic origin, and

29% (n=9) of unknown origin (Fig. 23). Of the 33 records denoting where the injury took place on the body (injury location), 46% (n=15) were to the pectoral fins, 15% (n=5) to their cephalic fins, 18% (n=6) to their head, tail, or dorsal regions, 6% (n=2) to the pelvic fins or claspers, 6% (n=2) to the gill slits, and 9% (n=3) were unknown (Fig. 24).

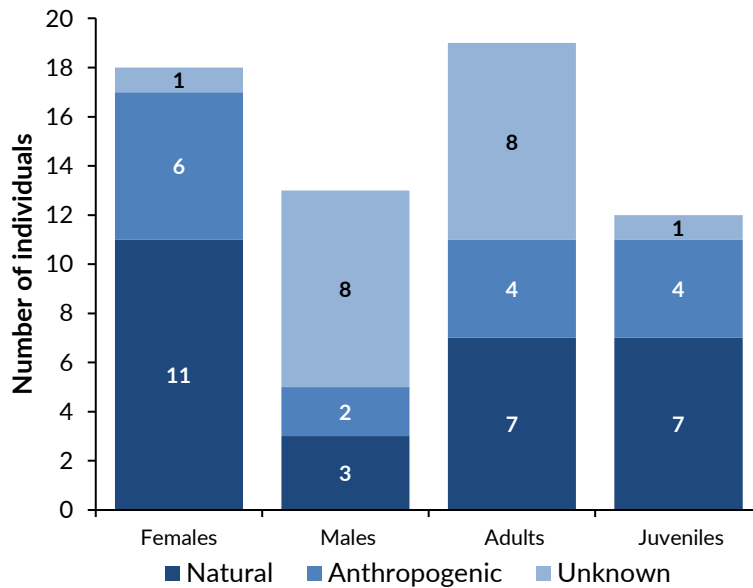


Figure 23: Demographic variation in the likely origin (natural, anthropogenic, or unknown) of sub-lethal injuries (n=39) within the injured reef manta ray (*Mobula alfredi*) population of Laamu Atoll (n=31).

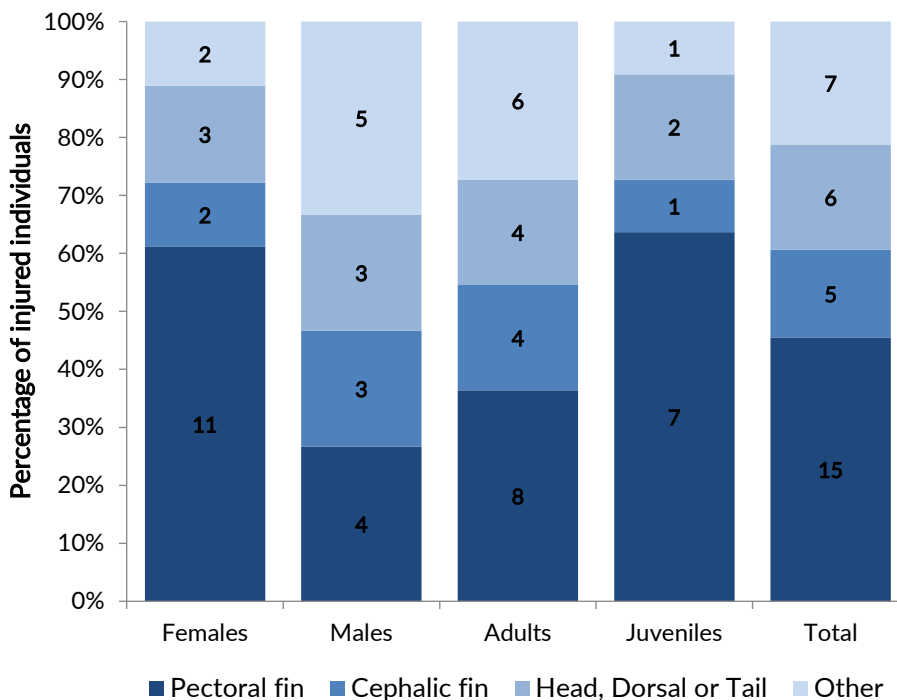


Figure 24: Variations in the location of sub-lethal injuries (n=39) within the injured reef manta ray (*Mobula alfredi*) population of Laamu Atoll (n=31). Actual number of individuals on bars.

Fifteen percent ($n=6$) of the recorded injuries have resulted from entanglement in fishing line (Fig. 25). Most fishing line entanglements has caused injury to the pectoral fins of individuals ($n=4$), but there have also been injuries of concern to the cephalic fins or eye regions ($n=3$). Despite Six Senses Laamu actively discouraging fishing at Hithadhoo Corner, and the Maldives Underwater Initiative team working hard to protect the area, fishing continues at this

site. Active fishing is rarely observed. However, the MMRP removed fishing line from the reef and cleaning stations on multiple occasions. This fishing line likely originates from reef fisheries as tuna fishing takes place further offshore. Without observing individuals becoming entangled, it is impossible to determine whether fishing at Hithadhoo Corner constitutes the cause of injuries observed or whether these injuries are sustained elsewhere.

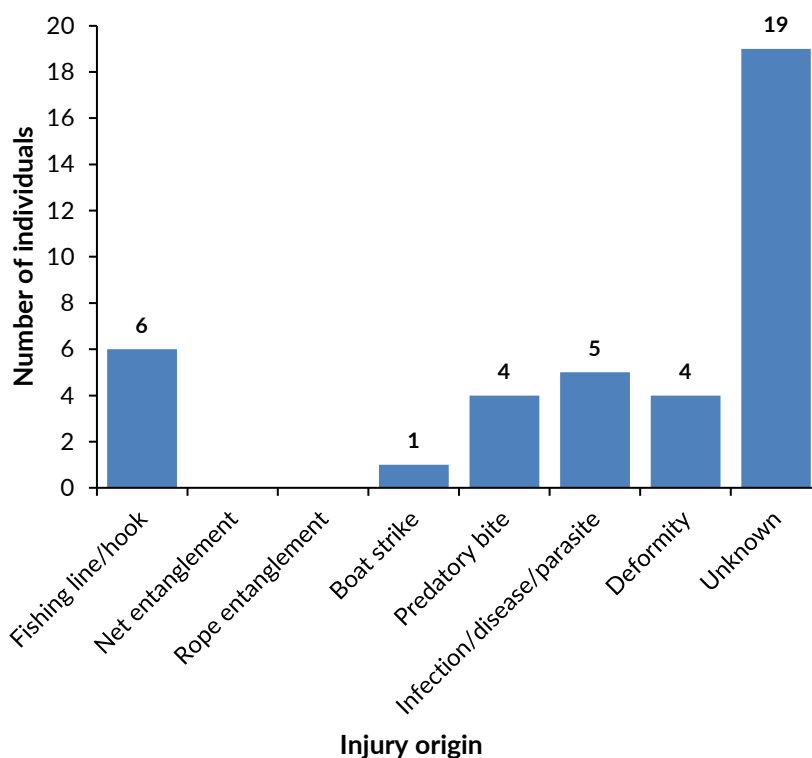


Figure 25: Variations in the origin of sub-lethal injuries ($n=39$) within the injured reef manta ray (*Mobula alfredi*) population of Laamu Atoll ($n=31$).

Only one injury consistent with a boat strike has been recorded in Laamu Atoll. The low prevalence of this injury type in the atoll is likely due to the low level of tourism and boat traffic. As tourism and boat traffic increases, particularly near the aggregation sites, operators need to be vigilant in looking for marine megafauna on the surface. Predatory bites were inflicted upon 13% ($n=4$) individuals originating from natural causes. Interestingly, 100% of these manta rays were female. This may be coincidental but could also suggest that predatory attacks occur near cleaning stations where female manta rays spend more of

their time cleaning. Cleaning stations are typically located in channels and are therefore more exposed to large predators. Infection/disease/parasite made up the highest proportion of natural injuries (38%, $n=5$), however without enough data available on the state of their habitat health, no assessment on this finding can be deduced.

In 2020, there were four individuals (MV-MA-0801, MV-MA-3221, MV-MA-3727 and MV-MA-3878) recorded with new minor injuries to their cephalic fins, pelvic fins, or claspers, all of which had unknown causes.

FISHERMAN INTERVIEWS

Since the MMRP's partnership with Six Senses Laamu in 2014, our work has primarily focused on in-water surveys. In 2019, the Manta Trust's Laamu Atoll team broadened its reach and conducted fishermen interviews to gather information from the local community.

Throughout the Maldives, fishermen spend a vast amount of time on the water and therefore are likely to encounter manta rays on their fishing trips. The Laamu Atoll team conducted preliminary fishermen interviews to gain a greater understanding of current and historic manta sightings in the region and to determine whether night light trials may be more successful at different sites within the atoll. These interviews also provided a fantastic opportunity to gain knowledge about fishermen's perceptions of manta rays and manta ray conservation.

Thirty-one preliminary interviews were conducted in 2019, on six local islands (Hithadhoo, Kunahandhoo, Maamendhoo, Gan, Maabaidhoo and Isdhoo). Ninety percent of fishermen ($n=28$) reported that they had encountered manta rays during fishing trips. Of the 28 fishermen that reported manta sightings, 75% ($n=21$) reported encounters within the atoll, whereas 61%

($n=17$) reported encounters farther offshore (between 1-70 miles). Seven fishermen reported either catching a manta ray, or a manta ray becoming entangled in fishing line. Most fishermen understood that manta rays were a protected species in the Maldives. However, 51% ($n=16$) were unaware of the rules and regulations surrounding the species. Ninety-four percent ($n=29$) of fishermen agreed that manta rays should be protected and 6% ($n=2$) did not answer the question.

In 2020, the team planned to conduct more formalised interviews on each of the inhabited islands in Laamu Atoll. However, with a national lockdown and bans on inter-island movement, this was not possible. We aim to still conduct these interviews in 2021 and ideally hire an intern who can assist with the process and use this data as part of their master's thesis. We are hopeful that through collaboration and information sharing, the MMRP team in Laamu Atoll can learn more about habitat usage and migration of manta rays in the atoll.

To learn more about our education and outreach programs with schools, liveboards, and community members in Laamu Atoll, please see the 2020 project activities report.



CONCLUSION

In 2020, the Manta Trust researchers recorded shifts in many trends including encounter locations, residency, and seasonality of manta ray sightings. Whilst these changes could be a result of inter-annual fluctuations in the ecological needs of the population, most likely resulting from changes in environmental conditions, it is not possible to determine an exact cause due to survey effort and techniques changing drastically from previous years in response to the global pandemic. We hope that in 2021 consistent survey effort will enable robust scientific analysis on the manta ray population once again.

The manta ray population in Laamu Atoll remains highly resident, with few individuals known to visit other atolls. Despite lower-than-average sightings, Hithadhoo Corner continues to support year-round manta sightings - a crucial habitat for the species in this region. While it is a key aggregation site, it is likely that other sites in the atoll also support the local manta population. Comparatively little is known about manta ray sightings closer to Isdhoo, and at the western channels of the atoll. Further research should be conducted in these areas, during both monsoons, as sightings here may provide information about site usage and potential migrations within Laamu Atoll. Further study is needed, and we hope that in conjunction with community outreach and exploratory dives, we can gain additional insight into migration patterns and habitat use in the atoll.

Advances in technology and survey methodology have increased data collection, and these tools will enable us to expand our research across Laamu Atoll. Remote underwater video cameras proved their value this year, recording 30% of confirmed sightings. The team plan to increase remote sensing survey effort in 2021, with the

aim of deploying more systems over a bigger variety of locations. While drone surveys have only been trialled in Laamu Atoll to date, they have enabled teams in the northern atolls to identify shallow water manta ray cleaning stations and feeding aggregations. Aerial studies will be conducted regularly in 2021 to search for new sites across Laamu Atoll.

Unfortunately, community engagement opportunities were limited after the first quarter of the year. However, a transition to a stronger online presence allowed the Manta Trust team to continue outreach efforts. The team hopes to focus on engagement opportunities in 2021 through additional fisherman interviews, community sessions, and liveboard vessel outreach as soon as it is safe to do so.

Given the small size of Laamu Atoll's reef manta ray population, and the high site fidelity observed in the atoll, key aggregation habitats in Laamu Atoll are of utmost importance to the local manta ray population. As development and tourism continues to increase in the Maldives, we need to be mindful of all potential impacts to habitats and recognise the stressors already altering the environment in the Maldives.

We remain incredibly grateful to Six Senses Laamu for supporting our research, education, and outreach initiatives. Through collaboration with the Maldives Underwater Initiative team, local stakeholders, and government agencies, it is our hope that significant areas of manta ray habitat in Laamu Atoll can be protected to safeguard this species, and to conserve the wider biodiversity and marine resources in the atoll.

Photo by Marteyne van Well



This report was made possible thanks to



MALDIVIAN MANTA RAY PROJECT (MMRP)

The MMRP is highly regarded within the scientific community. It is the largest and one of the longest running manta ray research programmes in the world. We would welcome the opportunity to continue to work with the Maldives government and our other partners 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 is unique and has many implications on a global scale for manta ray conservation.

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



SIX SENSES

LAAMU

SIX SENSES RESORT LAAMU

The MMRP expresses its sincere appreciation for the ongoing partnership between Six Senses Laamu Resort and the Manta Trust. Without their support, this important work would not have been possible. The Manta Trust and the MMRP are looking forward to a continued and successful partnership with Six Senses Laamu.



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