

## Final Evaluation Report

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Your Details	
<b>Full Name</b>	Janis Khansa Putri Argeswara
<b>Project Title</b>	Conservation of threatened manta rays in a key reproductive habitat – Nusa Penida MPA, Indonesia
<b>Application ID</b>	35872-1
<b>Date of this Report</b>	23 December 2022

**1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.**

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Provide complete local population demographics and size classes				From March 2021 to November 2022, we have conducted 148 dives, 94 of them were at Manta Point, the identified manta ray cleaning station, and 54 at Manta Bay, the identified manta ray feeding ground. During those encounters, we saw 390 manta rays. Within all those dives, we collected 204 measurements from 188 manta rays.
Establish baselines for monitoring growth rates of immature life stages				We were able to measure manta rays in Manta Bay, the potential manta ray nursery ground, and see the sizes of the smaller rays.
Establish local populations reproductive cycles and rates,				We were able to see the seasonality of pregnancies based on the data we have collected for the past 10 years. Our data shows the top 15 most sighted female manta rays in Manta Point. All of them has been sighted pregnant at least twice.
Evaluate the influence of the local environment (deduced by sea surface temperature (SST) and chlorophyll-a conditions, both indicators of ocean productivity) on reproduction				We are planning to approach the local university in Bali to help with local environment satellite data for processing and analyses.
Systematically evaluate tourism practices with manta ray watching trip goers				We were able to interview and survey tourists who went out to see manta rays and share our results to several local stakeholders and tourism operators.

## **2. Describe the three most important outcomes of your project.**

### **a). Tourists' input and perspective on snorkelling activities within the MPA:**

Through our tourism interviews and surveys, we could understand what was good and what was lacking in the snorkelling activities within the MPA. Tourists provided valuable information in response to our survey, and we shared those results with the local tour operators we could connect with.

### **b). Comparison of Lasers vs. Stereo measurement results:**

By using laser and stereo photogrammetry to measure manta rays, we could see the results from both methods. Both methods provided accurate estimates of manta ray measurements and we recommended them for use for another marine megafauna. However, I personally prefer measuring manta rays using stereo-photogrammetry rather than laser-photogrammetry. Although the post-processing steps of stereo-photogrammetry is more complicated than laser-photogrammetry, the results are much more accurate (up to the mm), and since the data are processed using 'R studio', processing is slightly more automated than laser-photogrammetry, where data are processed using 'Adobe Photoshop'. This makes data processing much more efficient, and results can be analysed sooner.

### **c). Increased knowledge of reproductive trends and demographics for manta ray population in Nusa Penida:**

From March 2021 to November 2022, we have conducted 148 dives, 94 of them were at Manta Point, the identified manta ray cleaning station and 54 at Manta Bay, the identified manta ray feeding ground. During those encounters, we saw 390 manta rays. Within all those dives, we collected 204 measurements from 188 manta rays. Through our measurements, we were able to confirm the maturity of 41 female manta rays as adults where their maturity was previously unknown.

We analysed results from our measurements to confirm our hypothesis: Manta Bay, the potential nursery ground, has smaller manta rays than Manta Point. Currently, the average size (disc width) of manta rays found in Manta Bay is 2.53 m, much smaller than those found in Manta Point, with an average disc width of 3.70 m. However, we still need to gather more data of the same individual to establish a clear growth rate. Previous studies have seen yearling and juvenile manta rays within the area based on visual sexual maturity indicators, but accurate measurement of individuals was lacking. With more measurements of smaller manta rays encountered at Manta Bay, we could test the hypothesis of Manta Bay being a nursery ground for reef manta rays.

In addition, we also see the pregnancy seasonality of manta rays. We were able to see the seasonality of pregnancies based on the manta ray data we have collected for the past 10 years. Our data shows the top 15 most sighted female manta rays in Manta Point, where all of them has been sighted pregnant at least twice in the past 10 years.

**3. Explain any unforeseen difficulties that arose during the project and how these were tackled.**

We had several equipment malfunctions and losses during this grant. The equipment that wasn't working properly was the underwater shuttle, which was used to collect temperature data from our underwater temperature loggers. Due to the malfunction, we had to wait a couple of weeks for the new shuttle to arrive before the equipment could be deployed. One temperature logger was lost due to unknown causes (i.e., natural: logger was not tied strong enough that strong swell and current pushed it away; unnatural: a diver took it). In that case, we did not have a temperature logger measuring in-water temperature in one of the sites for a couple of months, as purchasing the new logger took some time.

Other than logistical issues, we received a lack of support from the government to conduct sustainable tourism practices outreach. Although we did eventually socialise with local stakeholders and tourism operators individually, we expected the local government to be more involved in gathering the audience to attend the event, and as a result we altered our strategy to include one on one information sessions.

**4. Describe the involvement of local communities and how they have benefited from the project.**

**Sustainable tourism practices outreach to local communities:** We had outreach activities with the local community regarding sustainable tourism practices. During the outreach, they were keen on learning about the tourism survey results we did and were open to suggestions on how to conduct better tourism practices. They were also sharing their thoughts and concerns about the sustainability of the tourism practices that most snorkel operators practice. Through this outreach, not only did we get insights from the local snorkel operators, but they also received valuable knowledge and feedback from our tourism survey on how to improve their snorkelling tour practices better.

**Posters distribution and one-on-one discussion regarding sustainable tourism practices with local snorkel guides and captains:** To emphasise the importance of sustainable tourism practices, we reached out to local captains and snorkel operators to discuss what tourists experienced and what could be improved in their snorkelling services, including limiting the disturbances to manta rays and other reef life. We also gave the captains and operators posters of manta ray code of conduct in Indonesian and in English and informed them on what they should brief tourists at the beginning of every snorkelling trip.

**Ocean literacy outreach to schools by interns:** Our interns provided presentations to two schools (primary and junior high school) within the MPA. Their presentations were focused on the importance of marine life, in the surrounding waters of their home (the MPA), why it is important to protect marine life, and what they could do to contribute to protecting the marine environment. The students receiving the

presentation learned more about their home and the marine life they're surrounded by, which they might not currently learn in school and have little knowledge about.

**Scientific capacity building for two entry-level scientists (the interns):** Our interns during this period were two recent graduates who were looking for more marine conservation experiences. Prior to joining this internship, one mainly worked with sea turtles, and the other on coral reefs and shark conservation. This internship helped them experience fieldwork with manta rays, and the challenging work of obtaining data from free swimming animals. It also helped them with their public speaking in English, as they needed to give short briefings on marine megafauna interaction code of conduct before going on dive trips.

#### **5. Are there any plans to continue this work?**

**On-going manta ray measurements:** We are going to continue measuring manta rays in 2023 and 2024 for a long-term data set, and hopefully, the results will be enough gain insight into the growth rates of manta rays.

**Environmental data collection:** We have placed one temperature logger securely at one site, and we're planning on placing more in another site.

**Capacity building:** For our next intense fieldwork season, we're planning on recruiting two Indonesian interns.

**Reporting tourism study findings to local management authorities:** We report our findings and recommendations to the local government when we submit our bi-annual report. However, we are also planning on reporting our findings outside of our bi-annual reports, hopefully through an in-person presentation and meeting.

#### **6. How do you plan to share the results of your work with others?**

**Send survey results and report to local ministry office (DKP Denpasar):** We will report our findings and recommendations to the local ministry office through our bi-annual report.

**Social media posts:** We will share our activities and findings through the Marine Megafauna Foundation and annual report of Yayasan Megafauna Laut.

**Online and in-person presentations:** We share the results of our project during manta ray presentations with the public (usually tourists and guests). However, we have also been doing more online presentations recently, and we mention our project and the results during our online presentations.

**Scientific conferences:** We participate in scientific conferences and create a poster and/or presentation about the topic results and recommendations.

**7. Looking ahead, what do you feel are the important next steps?**

We feel our last approach to the local government during our one-on-one discussions with the local tourism operators could be done better by collaborating with larger and more established conservation organisations. Therefore, we think more collaboration with the government or more prominent conservation organisations are important to implement sustainable tourism practices. To do this, we would all have to put sustainable tourism practices as a priority, which can be challenging as other organisations and/or the government might have other agendas. However, we are keen on continuing highlighting the importance of sustainable tourism to local stakeholders, tourism operators, and conservation organizations.

**8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?**

Yes, we did use the Rufford Foundation logo in some of our work. The foundation was mentioned and received publicity during the in-person and online presentations that we did.

**9. Provide a full list of all the members of your team and their role in the project.**

**Janis Argeswara:** Project leader (data collection, grant writing, report writing, data processing, data analyses, permit administration, documentation, outreach)

**Elitza Germanov:** Team leader / project advisor (data collection, writing advisor, processing and analyses advisor, documentation)

**Aulia Zeintrinanda:** Intern (manta ray and tourism data collection, documentation)

**Maulana M Priadhi:** Intern (manta ray and tourism data collection, documentation)

**Fajrin Ramadhon:** Intern (manta ray data collection, outreach, documentation)

**Gabriela Nathania H:** Intern (manta ray data collection, outreach, documentation)

**10. Any other comments?**

This project would like to thank the regency governance for the research permits which allowed the study to be commenced. We would also like to give our gratitude for the support of the local tourism operators for accepting our inputs of better tourism practices and for sharing their views during the discussions, one particular local snorkelling operators, Made G, for helping us reach out and get in touch with the local snorkel operators and local governance, and our amazing volunteers who have come to help with data collection.



Photo 1: The team (L-R: Nathania, Rama, Janis, Elitza)



Photo 2: Putting our underwater temperature loggers



Photo 3: Presenting our tourism survey results to local snorkelling operators



Photo 4: Giving a presentation to the local students.

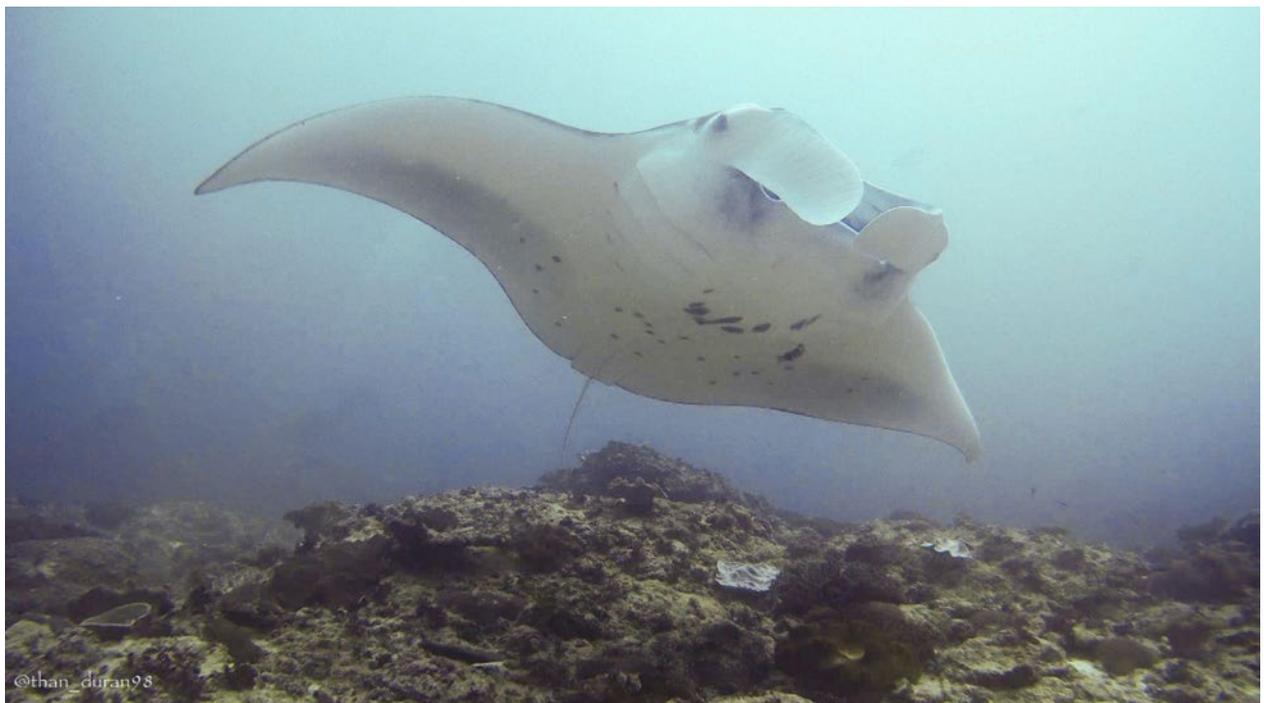


Photo 5: One of our local residents, INNLP0577A or also known as Sarabi, over at Manta Point.

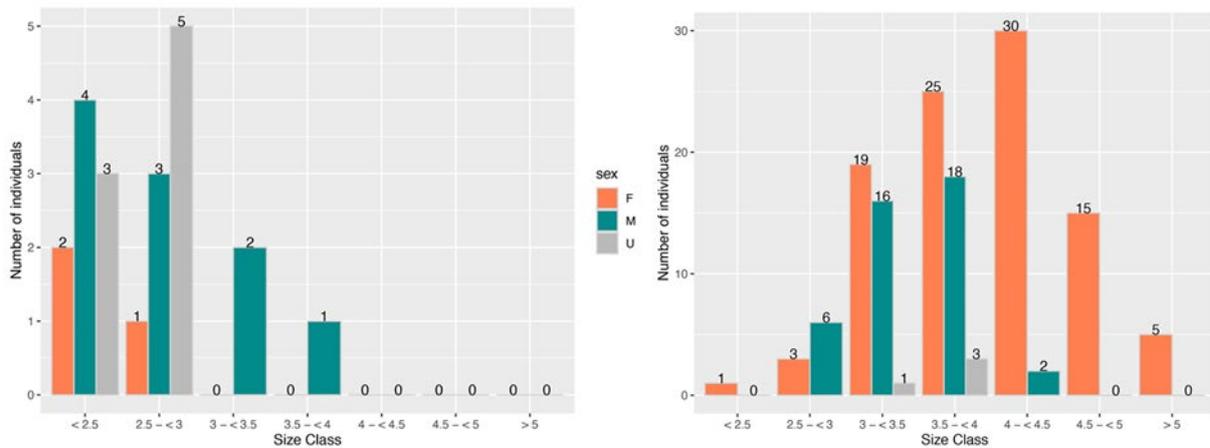


Photo 6: Results of manta rays measured in Manta Bay (left) and Manta Point (right) according to their size classes.

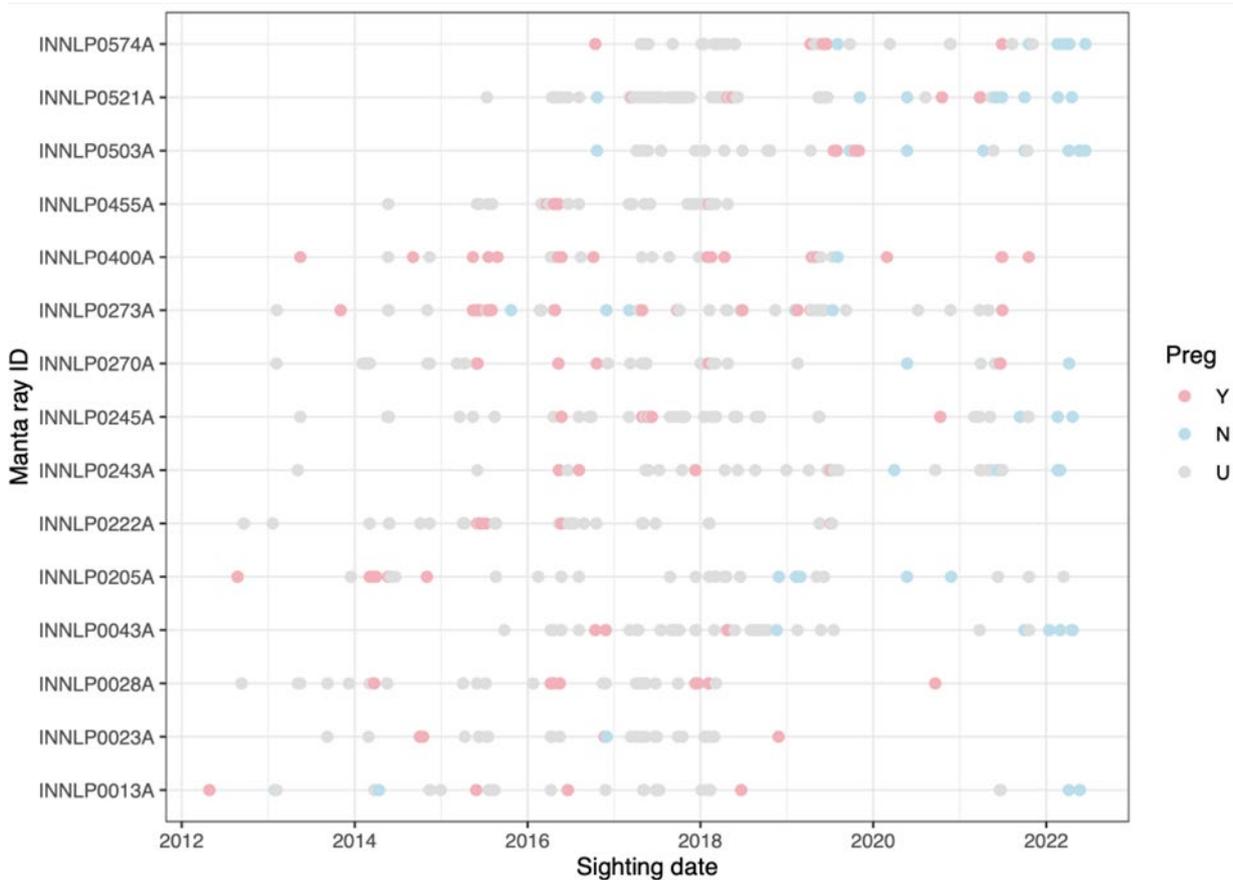


Photo 7: An abacus plot of our pregnancy seasonality data of the top 15 female manta rays encountered in Manta Point