The Rufford Small Grants Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole

Grants Director

Grant Recipient Details

Your name	Andrea Marshall
Project title	Ray of Hope: Monitoring and Protecting the World's Largest Gathering of Giant Mantas
RSG reference	15805-2
Reporting period	October, 2014 – October, 2015
Amount of grant	£5000 ($8000 USD, rate October 2014 = 1 GBP to 1.60005 USD)
Your email address	andrea@marinemegafauna.org
Date of this report	22/10/2015

1. Please 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
To provide information on critical habitats and migratory corridors		X		Critical habitats are areas of particular importance to a population or species. In recent years concern over the state of species-specific critical habitats and the high anthropogenic pressures they face has been on the rise. While we have gathered a lot of information on the habitat use of two major critical aggregate sites for the giant manta ray within Ecuador we have not managed to further or understanding beyond these two sites. Collecting information on migratory corridors has also proved more challenging with equipment loss or theft hampering our abilities to expand our acoustic array as originally hoped. We have been successful in collecting information on the habitat use and migratory behaviour between two major critical habitats Isla de la Plata and the Cope Seamount this year adding to our understanding of the season dynamics of this migratory population of manta rays.
Supplement photo identification records with presence and absence data from individually tagged manta rays			X	The detection of acoustic tags on individual manta rays was compared and contrasted with photo identification records for the same individuals. As in previous years, acoustic telemetry provided us with crucial presence absence information at times when divers were not in the water, such as surface intervals, early morning and night-time use of critical areas.
Learn more about the drivers of aggregative behaviour for this poorly understood species		X		Through a wide variety of techniques and employing different technologies, our team has learned a lot about the behaviour of manta rays at the two monitored critical areas. Cleaning appears to be the most important driver causing individual rays to aggregate inshore at both of these monitored sites. Acoustic telemetry has helped us quantify and explore the importance of this interaction and document the most

				important sites within the region for cleaning. Still, many questions remain. Cleaning behaviour is more complex than previously thought and very little research has been done on the benefits of this behaviour for manta rays. We have also continued to document feeding and courtship events at the island/seamount. While neither seems to be driving their aggregations at the inshore sites specifically, they may still be responsible for driving their overall movement to the region seasonally as the sourcing of food and mates often is the underlying driver of strong seasonal migrations for any species.
Help develop a national management action plan for this species and to increase effectiveness of patrols		X		One of the primary objectives of our project in Ecuador is to use the information from our research to better inform relevant authorities on sustainable conservation practices for manta rays. This year we continued to reach important milestones. Meetings with the Machalilla National Park authorities to discuss tourism protocols and codes of conduct for manta rays within the park is leading to the establishment of long-term regulations. Many of the laws being legislated will protect manta rays from unsustainable tourism practices in the coming years and allow for increased education and outreach to local communities. This year we also used drone technology to monitor the illegal fishing efforts within the park and managed to effectively pass this information on to the park's authorities to demonstrate the weak points in their patrol programme. A proof of concept study was also conducted with the drone to deal with entangled mantas that we verified could be identified from the air, allowing teams to respond immediately in order to save animals. A short video about these successes was created and given to National Park authorities, a copy can be provided on request. Despite these wonderful localised successes we have still yet to apply these regulations nationally, something that we will continue to work on in the coming year.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

It was anticipated that with additional acoustic receivers, our team would be able to get increased coverage around Isla de la Plata in order to look at habitat use over a broader scale. Unfortunately, when we returned to the study site this season we discovered that two of our moored stations had been tampered with and receivers stolen - we suspect by illegal fishermen who operate within the boundaries of the national park. After reporting the thefts to relevant authorities great care was taken to secure the new stations with a wide range of hardware which now makes them much more difficult to remove without the use of specific tools. Unfortunately this meant that while we maintained coverage of the study sites this season we were not able to expand our view around the island.

3. Briefly describe the three most important outcomes of your project this year.

i. A total of 14 tags were deployed this season, the most we have ever put out in a single study year to date. As a result we got wonderful information back from a wide variety of different individuals which will help us to interpret the habitat use of these giant rays around the island. In addition, we will give the national park updated information on manta ray movements and residency in the park-information that is sorely needed for management. Most notably this year we were able to tag some of the largest females ever encountered in the population. These potentially reproductively active, female manta rays were seen residing at the island for much longer periods of time in comparison to male manta rays and smaller females.

> -Two of the largest females (~6.8m wide) were found to reside at the island for just over 2 weeks. They appeared to be using the habitat on almost an uninterrupted basis during the day and the night-time hours, the first time that significant day and night use of the sites have been documented by our team. In comparison, individual males were on average only found to reside at the island for 2 days.
> -This finding suggests that cleaning stations at Isla de la Plata are incredibly important for large females who may have higher parasite loads, and certainly higher remora loads, in comparison to smaller conspecifics. Additionally, since some of the large females were seen to be engaging in courtship displays, it is possible their high residency times at the island can be explained by their desire to make themselves available at a heavily trafficked site to males for reproduction purposes.

ii. The El Nino year allowed our research team to document the manta ray season for the first time during this influential weather phenomenon. The abnormal weather conditions, which were reflected in increased water temperatures, seemed to have resulted in much higher residency times compared to neutral weather years.

> - Our research season this year coincided with an extreme El Nino event that looks set to rival that of 1997/1998 where both local and industrial fisheries in the region neared complete collapse. While there was a great deal of individual variation between tagged manta rays, average residency times at Isla de la Plata this year were significantly higher to those in 2013 and 2014. El Nino is well known to affect the amount of nutrient availability in the Eastern Pacific and therefore amount of plankton in the water. Plankton is the main food

source of manta rays and it is possible that with such a strong event currently taking place, individuals may be restricting their movements and effectively conserving more energy this year as less food is available.

iii. Manta rays spend the majority of their time at Isla de la Plata within a small area of the island.

-Giant manta rays from this sub-population in the eastern Pacific Ocean are known to cross multiple international borders. These animals undertake extensive migrations and cover thousands of kilometres each year. Isla de la Plata is a relatively small island located close to the mainland of Ecuador and has been known to host a seasonal aggregation of manta rays for a number of years. However, reasons behind such large numbers of individual manta rays using this habitat have so far been hard to elucidate. The area where tags are most frequently detected around the island has a large number of cleaning stations that are visited by manta rays and other megafauna alike. Cleaning behaviour is ubiquitous among marine organisms and as we gather more information, it has become increasingly clear that this behaviour could be an important driving force behind aggregations of large and threatened marine species. This information is very important to officials at the national park, who are busy refining plans for patrols at the island during the manta season. Knowing that the majority of rays heavily traffic a specific side of the island and very specific locations will allow them to develop more effective patrols helping to reduce or even eliminate the detrimental impacts of seasonal illegal fishing around the island.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

Throughout our study season, weekly research talks were given at no charge to interested groups visiting the area. Audiences for these talks ranged from national park and government employees to tourist and local university students undertaking marine biology degrees. A large public talk was also given by our project manager Michel Guerrero and Dr. Andrea Marshall at ESPOL's University campus in Guayaquil in September - over 200 people attending including government officials, university students, dive club members, scientists and staff of other local NGOs.

This year, through a collaboration with the Marine Megafauna Foundation and the IAMWATER Foundation, a week's worth of education activities for local youth and school groups were run in Puerto Lopez. Over 50 children within the local community received lectures, got swim and free-diving training from world-record holding athletes, visited a local turtle rehabilitation centre, participated in beach clean-ups, went on whale watching trips and had their first ever in-water snorkels within the Machalilla National Park. With such a disconnect between the ocean and local coastal communities this carefully tailored education programme which we hope to carry on in future years was designed to get youth interested in the marine environment and conservation since most adults in these communities are involved directly in artisanal or industrial fishing activities.

Lastly, each year our findings are disseminated to the Machalilla National Park and The Ministry of Environment in Ecuador. This means we provide real time research findings from our work around Isla de la Plata to relevant authorities that are in a position to stop or limit harmful anthropogenic activities that affect manta rays and other threatened marine species in the region. The park then goes on to pass this information on to the public through their various public campaigns meaning

that our work reaches thousands within the local communities surrounding the Machalilla National Park

5. Are there any plans to continue this work?

The Marine Megafauna Foundation has now been operating in collaboration with a local NGO in coastal Ecuador for 6 years. This is an on going project and each year goes from strength to strength. With regards to the acoustic telemetry portion of the overall project it is envisaged that this aspect of the program will also continue on and expand in future years allowing us to look in more detail and on broader scales along the Ecuadorian coastline. Even more importantly through strategic collaborations with other researchers and NGOs, our small array of acoustic stations is now part of a wider regional network of acoustic stations throughout Costa Rica, Panama, Colombia and the Galapagos Islands. Our new collaboration with research groups working further afield from Isla de la Plata gives us the opportunity to investigate habitat use patterns at a number of other international marine protected areas and will give us a better idea of migratory behaviour of giant manta rays in the Eastern Pacific.

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

- Results from this acoustic telemetry study will comprise a chapter of a PhD thesis at the University of Queensland, Australia.
- Open access peer reviewed journal articles, several which are being prepared now.
- Public and private presentations at the University of Queensland, San Francisco University, and University of ESPOL in Ecuador.
- Oral and poster presentations at international scientific conferences in 2016.
- Documentaries set to film and/or premier in 2016

7. Timescale: Over what period was the RSG used? How does this compare to the anticipated or actual length of the project?

This second Rufford grant was used within the 2015 field season in Ecuador (August-October). At present, acoustic stations are still moored and able to detect tagged animals at three different sites around Isla de la Plata and also a heavily fished seamount located 60 km from the national park boundaries. All tags were deployed within 2 weeks at the beginning of August to maximise the amount of detection time for each tag throughout the time researchers were present in Ecuador.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
13 x Acoustic tags	£2,988.63	£2,988.63	NA	$4,615.00 USD 1 GBP = 1.544183 USD*
1x Reference Tag	£229.90	£229.90	NA	$355 USD 1 GBP = 1.544183 USD*
2x Coded Acoustic Receiver	£1,606.03	£1,606.03	NA	$2,780 USD 1 GBP = 1.544183 USD*

Delivery of equipment	£175.24	£126.28	£48.96	Initially, equipment was to be delivered to the United states. The items were instead delivered to Australia so they could be directly transported with a member of our team to the field site. $195 USD 1 GBP = 1.544183 USD*
TOTAL	**£5,000**	**£4,950.84**	£48.96	

* Average exchange rate taken from www.x-rates.com for May 2015, when equipment was purchased from Vemco, Canada.

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

Giant manta rays are a long-lived species and in order to enhance our ecological understanding of this animal long-term observations and data are needed. Our team will always look to expand on the acoustic telemetry study started in 2013 with:

- The addition of more stations and tagged animals. Studies that use acoustic telemetry are only as good as their coverage. While this technology can be used in in very small areas, expansion of coverage is incredibly important for gaining a more comprehensive understanding of wide-ranging marine species. Furthermore, it is also really important to tag animals that differ in sex and size to look for differences between these demographics.
- Disseminate the findings from the last 3 years to the broader scientific community. While this will be an ongoing project, we now have enough results from this study for a peer reviewed scientific publication. This process will allow our work to be critiqued by expert researchers in the field of acoustic telemetry and will provide us will valuable feedback on how we can better improve our study in the future.
- Using the information gleaned from this study to help not only with the development of localised management plans but national ones so that the species becomes more comprehensively protected in the country even in the areas that our team does not directly monitor. These results can be used to generalise behaviour about giant manta rays and develop more effective ways to protect them at critical habitats within the country.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

- For all 6 public public talks given in Ecuador this season Rufford was featured as a sponsor of the program (see example photo attached). Audience numbers ranged from 10 to 200.
- The Rufford logo was also used on promotional materials during the youth education week in Puerto Lopez.
- The RSGF logo was also present on an oral presentation slide as a programme sponsor at the Oceania Chondrithyan society Conference in Auckland, New Zealand (June, 2015).

- More generally speaking the Rufford logo appeared on several posts and blogs on social media that went our during the 2015 season.

Future events

- December 2015. Blog for the Marine Megafauna Foundation website, Newsletter circulation= 1500 people) and Facebook page (+14,000 likes) not to mention the annual MMF report.
- November 2015: International postgraduate symposium at the University of Queensland, Australia (Katherine Burgess oral presentation).
- Results and an acknowledgment of Rufford funding will be featured in a major documentary on the research being conducted by our team in Ecuador set to premier in 2016.

11. Any other comments?

We are once again incredibly grateful for the second grant from the Rufford Foundation. Giant manta rays are a challenging species to work on and mainland Ecuador is one of (if not the most) accessible places in the world to conduct research on this vulnerable species. Support from RF has made the inception and continuity of this acoustic telemetry project possible and we are certain results from this project will contribute to effective and much needed conservation strategies for manta rays in the Eastern Pacific Ocean.