



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

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|----------------------------|---|
| Your name | Dr. Simon Pierce |
| Project title | Population ecology of whale sharks in Mozambique: the largest population of the largest fish? |
| RSG reference | 23.12.08 |
| Reporting period | 2011 |
| Amount of grant | £5,200 |
| Your email address | simon@marinemegafauna.org |
| Date of this report | 2nd December 2011 |

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 |
|---|--------------|--------------------|----------------|---|
| Count the number of whale sharks in Mozambique | | | X | We have now identified over 620 whale sharks from Mozambique, and the specific study site appears to be the largest year-round whale shark hotspot in the world. |
| Estimate total population size | | X | | Conventional population modelling techniques have proven difficult to apply to this population, as many sharks move quickly through the area and do not return. Note: while this objective proved to be impossible to complete within the duration on the study, we should be able to re-run our models in early 2012 with more data to hopefully achieve this objective. |
| Assess residency of whale sharks to the main study area | | | X | Most sharks are not resident to the study site: only 29% of sharks have been seen in more than one year. Most sharks are in the area for less than one week at a time. |
| Enhance protection for whale sharks in Mozambique | | X | | The provincial (Inhambane) government has drafted protection legislation for whale sharks, which is presently being considered for national application. |

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

The main area of difficulty on this project has been the time taken to achieve conservation goals. The length of time taken to have protective legislation enacted at government level has far outweighed our expectations. Meetings with all the relevant provincial departments have all been positive, and the provincial tourism department has actually drafted full protective legislation. The process has now paused until government activity resumes in January 2012. The next step will be a meeting between provincial and national government representatives in Jan/Feb 2012.

One of the challenges in this process has been the realisation by legal advisors that all fish species in Mozambique are specifically managed under Fisheries Law, which only has the power to enforce a fishing ban. Breaches of this fishery law has a very low penalty (for instance, if whale sharks were listed, killing a whale shark would result in a <\$50 fine). Government legal advisors are working through the relevant legislation to suggest a way to enact more effective protection and keeping us apprised of their findings.

A practical area of unexpected difficulty was estimating abundance or population size. Due to the short residency time of sharks within the study area it has proven impossible to apply conventional

models to this population within the duration of the study. We anticipate better results following re-analysis after end of the current field season in February 2012.

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

1. This project has demonstrated that the study area, Tofo Beach, is the largest permanent aggregation site for whale sharks known in the world. At this stage we have identified 621 individual whale sharks from this location, representing almost 20% of the known global population of the species. This area is an important foraging site for the species, with sharks regularly moving through the area to feed.

All the whale shark ID photos we have obtained over the course of this project are being managed through the ECOCEAN Global Whale Shark Database (www.whaleshark.org), which has facilitated broader collaboration between different countries in the region. 'Mozambican' sharks have been re-sighted in South Africa (and vice versa), and we compared our photo library with researchers working in the Seychelles, Tanzania and Djibouti for the first-ever migration study of a shark species using photo-matching (published in Brooks *et al.* 2010, below). No interchange was found between whale sharks sighted in these countries, suggesting that the species may actually be less migratory than previously suspected and emphasising the importance of local protection efforts, such as those underway in Mozambique.

2. Our scientific work has created a strong platform on which to engage with the Mozambican Government, raise their awareness with regard to marine threatened species conservation and advocate specifically for legal protection of whale sharks. This work has led to the crucial backing of the provincial government who are in the process of drafting legislation to fully protect whale sharks from exploitation in the country. Also, on the national agenda, our work has informed discussion of creating a Marine Protected Area along this stretch of coastline. In consultation with Government, WWF and community stakeholders we are working towards submitting a final research report with the comprehensive data required to support the implementation of a Marine Protected Area. This data will also provide a useful baseline for future monitoring of the coastline.

3. Through your support for this project we have also been able to develop a technique to accurately measure free-swimming whale sharks with parallel-mounted lasers on our camera (published in Rohner *et al.* 2011, below). This system is now also in use in the Maldives, the Galapagos Islands, the Seychelles and Oman. Prior efforts to obtain growth and age data on whale sharks were restricted to extremely rare whale shark strandings, whereas this new technique enables us to gather data routinely from live sharks. This work was widely featured in media outlets including the BBC and the Daily Mail.

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

To facilitate community outreach, we work in partnership with the Mozambican association Bitonga Divers which is also located in Tofo. Bitonga Divers is a community-based organisation which focuses on encouraging local Mozambicans to train in the dive industry and to raise awareness of marine conservation issues. We work closely with Bitonga Divers to provide information and support for their community engagement programme and work to build their

capacity to develop their conservation approach, with one of their staff members working directly with us full-time. In 2012 we will also start working directly with MSc students at Eduardo Mondlane University in Maputo, Mozambique, and will be supervising an MSc project on whale shark conservation.

We also worked in association with local film makers Moz Images and Bitonga Divers to develop a shark finning documentary called “Shiver” which highlights the issue of shark camps in Mozambique and creates awareness of the issues around shark finning. The film was shown on Mozambican network television and is shown regularly in communities by Bitonga Divers. As well as creating general awareness, following the film the team revisited the shark camps and found that the communities there were no longer consuming shark meat as they had learnt from the documentary that the levels of mercury it contains can be particularly harmful to pregnant mothers and children. The full documentary is available online at <http://vimeo.com/28539793>

This project has also helped to inform sustainable development of the whale shark tourism industry. Through our work we partner with the national association of Mozambican dive operators, AMAR. Most dive operators in Mozambique are members of AMAR, and we have worked successfully to utilise this network as a means to disseminate information to dive businesses and their clients. We were able to effectively galvanise support for our Code of Conduct for whale shark tourism by working with AMAR (see short introductory video at <http://vimeo.com/23795174>) and in future plan to further expand this relationship in developing a mitigation strategy against human threats to whale sharks.

5. Are there any plans to continue this work?

Yes. This work has helped to highlight the importance of this site for whale shark conservation, but as yet Tofo Beach is the only major whale shark hotspot in the world with no formal protection in place. Studies from 2005 to 2010 (incorporating the results of this project) have shown an overall 62% decline in whale shark sightings over this period. Continuation of this work will include studies of (a) local threats to whale sharks, such as gill nets and boat strikes culminating in a mitigation strategy, and (b) further developing the data-driven argument for habitat-level protection and submitting a final report to Government at the end of 2012.

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

Two scientific papers have already published from this project acknowledging RSG support:

- Rohner CA, AJ Richardson, AD Marshall, SJ Weeks & **SJ Pierce** (2011) How large is the world’s largest fish? Measuring whale sharks with laser photogrammetry. *Journal of Fish Biology* 78: 378-385.
- Brooks K, D Rowat, **SJ Pierce**, D Jouannet & M Vely (2010) Seeing spots: Photo-identification as a regional tool for whale shark identification. *Western Indian Ocean Journal of Marine Science* 9: 185-194.

Several more scientific publications will be published in the next few months from data gathered in this project. More broadly, I have conducted 100+ public talks annually over the course of this project in Mozambique, Kenya, South Africa, Honduras, New Zealand, Australia and the United Kingdom including presentations at Shark's International (one of the first ever dedicated shark conferences), Southern African Shark and Ray Conference and the Indian Ocean Whale shark Workshop. Locally, the information gathered is shared with fishing communities in monthly presentations in different villages along the coast. We also regularly present new and ongoing results to Mozambican government officials. We have also produced a Code of Conduct for whale shark tourism in Mozambique and a documentary on shark conservation in Mozambique (including whale sharks). Our work is also featured regularly in international media outlets such as BBC (http://news.bbc.co.uk/earth/hi/earth_news/newsid_9370000/9370031.stm), the Daily Mail (<http://www.dailymail.co.uk/sciencetech/article-1354627/Worlds-biggest-fish-The-whale-shark-bigger-say-scientists.html>) and National Geographic Traveller (see attached articles),

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

We were able to extend the duration of our RSG through in-kind support from commercial whale shark tourism operators in Tofo Beach, who offered us space on their vessels to conduct our research. This enabled our RSG field costs to cover a longer time period than originally anticipated, through to 2011.

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 |
|----------------------|-----------------|---------------|------------|----------|
| Field costs (petrol) | 5000 | 5000 | 0 | |
| Posters | 200 | 200 | 0 | |
| TOTAL | 5200 | 5200 | | |

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

Scientifically, we have established that the Tofo area is a world hotspot for whale sharks. However, this population is dominated by male sharks (72%), and the majority are 5-8 m juveniles. We are only seeing a small piece of the puzzle. To ensure the species is effectively protected it is important to investigate where whale sharks are breeding, and which habitats are preferred by the female sharks. This aspect could be addressed by encouraging submission of photos from around African coastline and more broadly through the Western Indian Ocean to establish population linkages. At this stage we must also focus our attention on facilitating the collection of data from other international sites where limited information is currently known about the size and composition of the whale shark populations.

Whale shark sightings in Mozambique are declining. Concurrent studies on the ecological sustainability of the tourism industry have shown that no significant impact on the sharks is



apparent from this source. Therefore, we are concerned that the sharks are being more directly affected by local net fisheries and boat traffic. Our current satellite-tracking studies are showing that whale sharks use a coastal movement corridor in shallow (< 50 m) water where they are subject to a range of human pressures. Studies on the relative risk to whale sharks and potential mitigation strategies are important to the long-term viability of this population.

Long-term, to effectively safeguard the whale shark population in Mozambique we must achieve legal protection for whale sharks and their preferred coastal habitat. The government has asked us to provide more scientific data on the threats faced by whale sharks, to map the spatial extent of the coastline they are utilising within Mozambique, and to establish their linkages with surrounding countries. This is now a key scientific priority to help achieve an exceptional and essential conservation goal.

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?

The RSGF logo has been shown prominently on the posters we produced for dive centres, and 100+ public talks over the course of the project.

11. Any other comments?

Support from Rufford Small Grants Foundation was fundamental to the success of this project. This grant has directly led to a major growth in understanding of whale sharks and particularly the population in Tofo, Mozambique, one of the world's leading hotspots. Key outcomes of this grant have been the initiation of significant new conservation measures for Mozambican whale sharks in the form of a Code of Conduct for tourism, draft protection legislation and vitally increased support for community involvement in their local marine environment. We are extremely grateful for the funding you have granted and for the support you have shown for our work, and look forward to working with you in the future.