

Final Evaluation Report

We ask all grant recipients to complete a project evaluation that helps us to gauge the success of your project. This must be sent in **MS Word and not PDF format**. 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 – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please DO NOT fill in and submit this form until the project has been completed.

Complete the form in English. Note that the information may be edited before posting on our website.

Please email this report to jane@rufford.org.

Your Details	
Full Name	JENNIFER KEEPING
Project Title	Novel techniques to study the critically endangered marine wildlife in Mozambique
Application ID	37616-2
Date of this Report	7 th September 2023 (Version 2: 5 th December 2025) (Version 3: 26 th January 2026)

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
Successful deployments of camera equipment to rocky reefs of Tofo, Mozambique		X		574 hours of the 4,380 hours of remote camera footage from over 100 recording days between 2021 and 2024 were taken (see appendix I), due to flooding issues – see section 3. Two additional HongKong Cameras (3 in total) and 3 additional GoPro cameras (6 in total) were deployed for the project.
Attaining footage of the listed target species			X	Of 574 hours of camera footage, 824 elasmobranch sightings representing 17 identified species were recorded (see appendix II). Mostly cleaning and cruising were seen in the footage, and key insights into multi-species habitat use have been published (and are pending publication) from these data. Mostly, intimate information on manta ray symbiosis with cleaner fish and the quantification of disturbance by divers, as well as the documentation of species rarely sighted whilst on SCUBA; inc. hammerhead sharks and eagle rays.
Produce publishable works to present to government			X	One MSc Thesis, one chapter of a PhD thesis, one published and 2 pending publications have been produced exploring the cleaning station function and relationship with the marine megafauna passing through. All publications are made with association of the Maputo Natural History Museum and Eduardo Mondlane University, which are governmental organisations.
Public engagement workshops			X	The 2 World Ocean Festival exhibits have been done, and also in 2025. We also plan to participate in the 2026 festival. 5 School visits following the Ocean festivals were done with similar activities, engaging the students in recognising the species seen in the footage.

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

- a). The successful deployments of novel remote camera technology in Mozambique
- b). High yield of rare and endangered wildlife in the remote camera footage
- c). Engagement of the Mozambican public in the footage of rare and endangered wildlife on the reefs of Mozambique

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

There was an issue with camera flooding in the units sent from Robotics Ltd in Hong Kong (Open Ocean Cameras, AKA; OOCAM) during 2021 and again late in 2022. This meant that the units had to be returned to Hong Kong for repairs and replacements, delaying deployment schedules. Luckily, with the additional GoPro units, we still could make some deployments (although for notably shorter times, as GoPro batteries last a maximum of 40 minutes, not 10-12 hours per day for 10-12 days as with the OOCAMs). The OOCAM cameras were returned to Mozambique from Hong in 2023 and were functioning, with sporadic and minor technical setbacks with software updates. We added Nauticam™ vacuum additions to the seals of the Hong Kong cameras to avoid future flooding issues in 2021, and added further sealants in 2023. There was an issue in developing the machine-learning program to recognise marine megafauna species within the hours of remote camera footage. Despite our efforts, the program developed in Python and a program called 'Biigle', in association with students and staff at the university of Gibraltar, we were unable to differentiate reliably between usually reef fish schools and megafauna species. We have since advertised for computer science students to develop new AI technology to train with our many hours of megafauna footage. This meant additional staff were required to help in the analysis of the remote camera footage than originally planned, as we did not have the ML/AI technology to automate the process.

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

The local community have been engaged in the remote camera footage at the World Oceans Day event of 2023, 2024 and 2025, as well as during local fishing union meetings where results from the cameras were presented. From school children to fishing elders in the community have appreciate having this insight in to the life on the reefs of their region, and our project has encouraged an appreciation of the biodiversity and complexity of behaviours shown by some of the rarest marine animals in the oceans.

5. Are there any plans to continue this work?

Absolutely! We are in the 3rd year of the project and we plan even further expansions and still the development of the Machine-learning AI software to automate the process of analysing the hours of footage. We hope to capture more unique and important behaviours of some of the rarest marine animals in the oceans. We know we have a high biodiversity in this region, and this information has already helped in

securing a Mission Blue Hopespot and IUCN Important Shark and Ray Area. These in combination with more footage from around the diving region we hope will increase our chances to see more cleaning and courtship, even mating events to strengthen our ultimate goal to have this region under national park status. Moreover, we hope to implement these same cameras for observations in Queensland Australia, creating a complimentary and comparative project there.

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

Through student dissertation publications and peer-reviewed journals. We will continue to share clips of the remote camera footage on social medias and articles, as well as through community festival events. We will continue to engage with the local fishing union, both in Mozambique and overseas.

Some social media posts can be seen below;

<https://www.instagram.com/reel/CxKrSAuN7U1/?igsh=cnhnMzZ0bHo4OGlh>

<https://www.instagram.com/reel/C2julGPtOPA/?igsh=MWZqMjJ4dnM0ajE4dA>

==

<https://www.instagram.com/reel/C4IESnJNJz/?igsh=MTQ2b2d0ZW9kN3F1bw>

==

<https://www.facebook.com/share/p/1C49XzuFwk/>

<https://www.facebook.com/share/v/1CGBQLhXrF/>

<https://www.facebook.com/share/v/1R7oxXqWVQ/>

<https://www.facebook.com/share/p/14VHq5apPiV/>

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

We must simultaneously scale-up the number of cameras and locations to increase the chances of seeing unique behaviours and species. With this, we increasingly have the need for automating the process of analysing the hours of footage. We will be continuing our mission to develop a ML software for species recognition.

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?

The Rufford foundation logo has been featured within presentations given at conferences (e.g., the Southern Africa Shark and Ray Symposium 2025), in multiple social media posts from All Out Africa Marine Research centre and in each of the 3 publications (1 published, 2 pending) in the acknowledgements section.

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

Jennifer Keeping – conceived of the project, attained funding, deployed cameras, analysed the data, created and edited publications and subsequent outputs of these data.

Jule Buschmann – deployed cameras, analysed the data, created and edited publications and subsequent outputs of these data.

10. Any other comments?

It has been such a great pleasure to be able to explore the possibilities of new technologies, observe the undisturbed behaviours of some of the rarest ocean creatures, and now implement these findings into tangible evidence for preservation of these animals and this reef habitat. We cannot thank Rufford enough for their support in this project and this is certainly not the end!

Final statement:

This project has demonstrated the transformative potential of long-term remote underwater video technology for studying rare, threatened, and otherwise inaccessible marine wildlife in Mozambique. Despite unforeseen technical setbacks—such as camera flooding and delays in machine-learning development—the project delivered exceptionally high-quality ecological data, revealing frequent appearances and previously undocumented behaviours of endangered megafauna. Through community events, school outreach, and engagement with local fishing associations, the project has also strengthened public appreciation for the extraordinary biodiversity of the Tofo region and highlighted the importance of safeguarding its reefs. The work has already contributed to major conservation designations, including the Mission Blue Hope Spot and the IUCN Important Shark and Ray Area, and continues to provide essential evidence for future protection initiatives such as the push for national park status. Building on the success of these deployments, our next steps involve scaling up camera coverage, advancing automated species-recognition tools, and expanding the programme internationally to establish comparative studies in Queensland, Australia. We are deeply grateful to The Rufford Foundation for enabling this innovative research and for supporting a project that is already shaping marine conservation outcomes in Mozambique and beyond.

**ANNEX – Financial Report
[Intentionally removed]**

APPENDIX I: Remote camera deployment record as a results of The Rufford Foundation funding Camera

Camera	Count of Days				Total Count of Days	Total Duration				Total Duration
	2021	2022	2023	2024		2021	2022	2023	2024	
GoPro™		4	47	6	57	13:53:3	3	60:43:48	3	82:11:44
OOCAM™	7		40	9	56	64:00:0	0	380:00:0	47:30:0	491:30:0
Grand Total	7	4	87	15	*113	64:00:0	13:53:3	440:43:4	55:04:2	573:41:4

*100 different days, 13 days of simultaneous GoPro™ and OOCAM™ recordings

APPENDIX II: Species sightings from remote cameras as a consequence of the Rufford Foundation funding in Praia do Tofo, Mozambique

	Common name	Scientific name	n	IUCN RedList status*
Elasmobranchs				
1	Giant Manta	<i>Mobula birostris</i>	207	Endangered
2	Smalleye Stingray	<i>Megatrygon microps</i>	157	Data deficient
3	Reef Manta	<i>Mobula alfredi</i>	129	Vulnerable
4	Bowmouth Guitarfish	<i>Rhina ancylostomus</i>	115	Critically endangered
5	Blotched Fantail Stingray	<i>Taeniurops meyeri</i>	38	Vulnerable
6	Spotted Eagle Ray	<i>Aetobatus narinari</i>	23	Endangered
7	Blacktip Shark	<i>Carcharhinus limbatus</i>	22	Vulnerable
8	Shortfin Devil Ray	<i>Mobula kuhlii</i>	11	Endangered
9	Jenkins Stingray	<i>Pateobatis jenkinsii</i>	3	Vulnerable
10	Dusky Shark	<i>Carcharhinus obscurus</i>	2	Endangered
11	Smoothnose Wedgefish	<i>Rhynchobatus laevis</i>	1	Critically endangered
12	Great White Shark	<i>Carcharodon carcharias</i>	1	Vulnerable
13	Grey Reef Shark	<i>Carcharhinus amblyrhynchos</i>	1	Endangered
14	Indo-Pacific Leopard Shark	<i>Stegostoma tigrinum</i>	1	Endangered
15	Scalloped Hammerhead	<i>Sphyrna lewini</i>	3	Critically endangered
16	Whale Shark	<i>Rhincodon typus</i>	1	Endangered
17	White Tip Reef Shark	<i>Triaenodon obesus</i>	4	Vulnerable
	Unknown Guitarfish	–	1	
	Unknown Manta	–	61	
	Unknown Stingray	–	9	
	Unknown Shark	–	34	
Cetaceans				
18	Humpback Whale	<i>Megaptera novaeangliae</i>	12	Least concern
19	Bottlenose Dolphins	<i>Tursiops aduncus</i>	2	Not Threatened
20	Loggerhead Turtle	<i>Caretta caretta</i>	24	Vulnerable
21	Green Turtle	<i>Chelonia mydas</i>	2	Least concern
22	Hawksbill Turtle	<i>Eretmochelys imbricata</i>	1	Critically endangered
	Unknown Turtle	–	5	
Osteichthyes				
23	Potato Grouper	<i>Epinephelus tukula</i>	14	Least concern
Human				
24	Divers	<i>Homo sapien</i>	53	Least concern