Final Evaluation Report

Your Details	
Full Name	Camila Arnés Urgellés
Project Title	Climate variability effects on the feeding behaviour of the endangered scalloped hammerhead at the Galapagos Islands.
Application ID	27052-1
Grant Amount	£5000
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Date of this Report	6th February 2020

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
(1) Obtain tissue biopsies from juvenile and adult hammerhead sharks during the predicted 2019 El Niño event at the Galapagos Marine Reserve; this will be carried out between the months of January to March, the warmest seasons.			■	This year predicted El Niño event occurred around March 2019, not during January 2019 as predicted in 2018 (NOAA). We obtained the hammerhead shark biopsies from Darwin and Wolf islands.
(2) Conduct stable isotope analyses on the samples collected in 2019 and samples previously collected by Galapagos National Park rangers and other researchers between 2016-2018 (unpublished data); the analysis will be conducted after taking the samples around the months of April, May, and June.			■	The analysis was carried out in June 2019 in the laboratory facilities of the Galapagos Science Center, Universidad San Francisco de Quito.
(3) Conduct field surveys to document hammerhead abundance at aggregation and nursery sites during 2019 and compare results with data collected during non-El-Niño years; this will also be carried out between the months of January to March, the warmest seasons.			■	This occurred during at the beginning of June 2019, a little later that predicted, but we conducted three different field trips to nursery sites, Venecia and Caleta Tortuga Negra.
(4) Generate a technical report with management recommendations for the Galapagos National Park Directorate (GNPD); this will occur at the end of our study between the months of August- September.			■	This technical report was sent to the Galapagos National Park Directorate and to the Project leaders at the Charles Darwin Foundation and the Galapagos Science Center.
(5) Publish study results on a peer-review journal: this will	■			Not yet achieved. This is still in working progress.

also occur at the end of our study between the months of August-September 2020.				

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

The only unforeseen events during this project was the delayed of some activities, such as the laboratory part of the project (the stable isotope analysis) and the collection of biopsy samples from the hammerhead nurseries that also occurred later than expected. However, apart from those delays all activities were carried out as planned.

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

Some of the highlights of this project were:

1. Being able to interact so closely with sharks in their natural environment while studying hammerheads at the place with the largest shark biomass in the world, Darwin and Wolf islands. Also, visiting baby hammerhead shark nursery areas and being able to meet highly experienced scientists and authentic local people.

2. Learning relevant laboratory techniques widely used in ecological studies while analysing over 200 shark biopsy samples, from 2016 to 2019, and creating a master database that will serve as a baseline for future hammerhead ecology studies.

3. Presenting a technical report to the Galapagos National Park Directorate with preliminary results from this project and evidence-based recommendations to improve conservation measures. Also, presenting this project in a local International symposium to create awareness amongst international scientists and the local community.

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

Local park rangers and volunteers form the Charles Darwin Foundation and the Galapagos National Park Directorate were able to participate in the field helping with the study design and data collection process. They were also able to experience areas of the Galapagos archipelago that are restricted to tourists. Moreover, students from local schools that attended the 60-year symposium held in the Puerto Ayora town, were able to see shark photos from the field and learn about their diet and behaviour. Also, they were able to see the importance of the shark nurseries in the Galapagos Islands.

5. Are there any plans to continue this work?

There is an ongoing shark project that monitors and studies the biology of these species in the Galapagos Marine Reserve, so similar projects involving the foraging ecology of sharks will continue after this project.

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

Preliminary results, charismatic wild photos, and field experiences were shared amongst the local community in San Cristobal Island and Santa Cruz Island during informal presentations and The International Symposium: 60 Years of Conservation and Science in Galapagos. Also, popular blog articles were shared with the public audience and are currently posted in the Charles Darwin Foundation website in both, English and Spanish (https://www.darwinfoundation.org/en/blog-articles/463-what-s-on-a-hammerhead-shark-menu-at-the-galapagos-islands).

Furthermore, the methodology and results of this project will be submitted to a peer-reviewed scientific journal for ecology field studies.

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

The small grant was mostly used from February to June 2019 to carry out field sampling and laboratory analyses. This grant was mainly used to cover field logistics and expensive laboratory materials and tests. Overall, the timescale of the project developed as previously intended.

8. Budget: 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. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Boat time during field trips to different sampling sites.	£1000	£837	-£163	This include three separate field trips to sampling sites and car rides to the Itabaca channel to board the boat.
Laboratory costs/materials and tests: Stable isotope analyses	£2000	£1771	-£229	I used the Galapagos Science center laboratories for the sample analyses, not only did I analysed the samples collected from this 2019, but also samples from the years 2016, 2017 and

				2018. After I prepared the shark biopsies in the lab, the samples were taken to the stable isotope facility at UC Davis. Some of this money was also used to pay for printing photos and banner for my poster presentation, as well as some outreach material.
Living expenses in Santa Cruz for 4 months	£2000	£1943	-£57	This covered lodging and personal living expenses in Santa Cruz Island during the duration of the project, as well as working hours and life insurance from the Charles Darwin Foundation.
Living expenses in San Cristobal and Santa Cruz for 1 month		£458	+£458	Since we experienced some delays, I stayed one more month in Galapagos in order to complete the analyses and also present my preliminary results to the local community and scientific community at an international symposium. *this change in the budget was pre-approved by the Rufford Foundation's grant manager via email.
Total	£5000	£5000		***Notes to Budget** We assume an exchange rate of 1.3 pounds sterling into U.S dollars.

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

After achieving the short-term goals of this project, we believe that the next steps will be to analyse and publish the results obtained from the stable isotope analyses to answer basic shark ecological questions, such as what do these top predators eat?, what role they occupy within the Galapagos archipelago ecosystem?, and how do climate variations affect these populations? Also, to continue the data collection process and keep providing sound scientific evidence to the Galapagos National Park to help in their decision-making process, thus, ensuring the preservation of the enchanted islands' marine ecosystems.

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

The Rufford foundation was mentioned in all my outreach articles, such as the Charles Darwin Foundation blog posts, in which the logo and a hyperlink to the Rufford Foundation website are available. Also, The Rufford Foundation is mentioned

in the acknowledgement section of my presentations, posters and technical reports. Additionally, the logo and a link to the Rufford projects appear on my LinkedIn profile. Furthermore, the Rufford Foundation will be mentioned in all future articles and publications regarding this project.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Dr. Pelayo Salinas de León: the supervisor of this project at the Charles Darwin Foundation. The official photographer and a co-author of all the produced documents.

Dr. Diego Páez-Rosas: from the Galapagos Science Center, Universidad San Francisco de Quito, Galápagos, Ecuador: local collaborator and expert in stable isotope analysis, he was my laboratory supervisor. Also, a co-author of all the produced documents.

Jenifer Suarez- Moncada: from the Galapagos National Park: local collaborator and park ranger. She was key in the field trip to the scalloped hammerheads nursery areas.

Alberto Proaño: also, a local collaborator and park ranger. He has the local knowledge on where to find nursery areas.

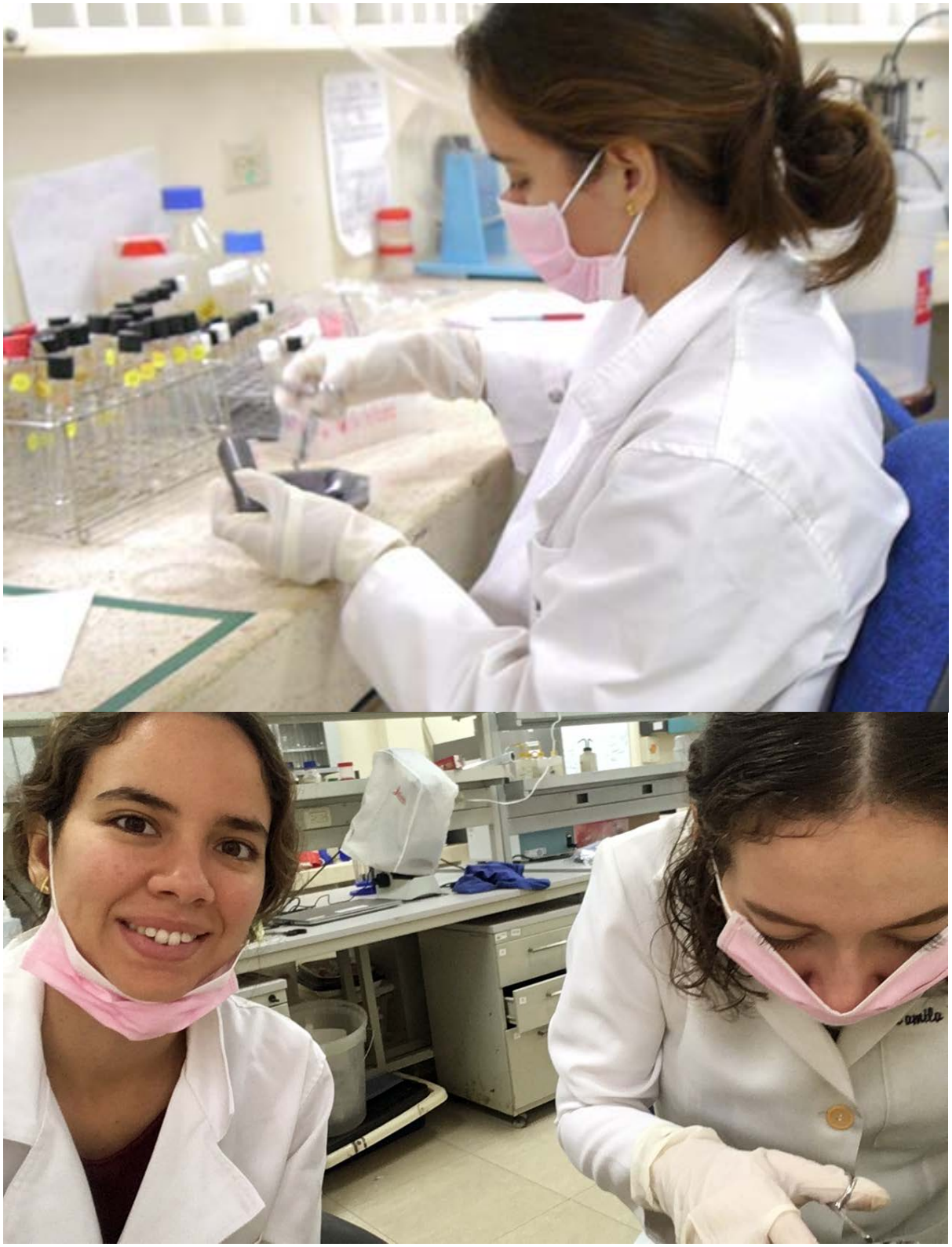
Magdalena Mossbrucker: volunteer from the Charles Darwin Foundation that help on the field trip to the scalloped hammerheads nursery areas. This was her first time working with baby hammerhead sharks.

Megan Cundy: volunteer from the Charles Darwin Foundation that help on both field trips to Darwin and Wolf and to the nursery areas. She was also key in the data collection process.

Renata Leemhuis: laboratory volunteer. She learned how to do the stable isotope analyses sample preparations and also participated in the lab part of this project.

12. Any other comments?

I really enjoyed conducting this project and I am extremely grateful to the Rufford Foundation. This has been great opportunity for me. This project has really helped me further develop my leadership aptitudes and to gain more skills on the field, as well as on laboratory techniques. Overall, this project helped me grow as a scientist and science communicator, and with this, I have also expanded my network of other professionals working in the field of biology, which could result in future project collaborations.



Top: Using the agate mortar and pestle to grind shark biopsy samples at the lab. © Renata Leemhuis. Bottom: Lab Selfie during shark sample preparations for the stable isotope analysis with volunteer Renata Leemhuis. © Camila Arnés.