

The Rufford Foundation Final Report

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

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other 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. 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. Please note that the information may be edited for clarity. 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	Elpis Joan Chávez Calderón
Project title	Movements and habitat use of bull sharks (<i>Carcharhinus leucas</i>) in a Costa Rican tropical river
RSG reference	18030-1
Reporting period	Nov 2015 – Nov 2016
Amount of grant	£ 4,940
Your email address	elpis_joan@hotmail.com
Date of this report	Feb 2017

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 determine the movement and activity patterns of juvenile bull sharks				Four individual sharks were passively monitored over 8 months, and two other sharks were actively tracked between December 2015 and February 2016. With all the data collected, I estimated the residency index, site attachment, rate of movement, daily activity and the influence of tides, lunar phases and diel cycle on shark's movements.
To analyse habitat use and home ranges of juvenile bull sharks				Based on the data collected during active tracking of juvenile bull sharks, I investigated the use of depth, temperature and salinity by the tagged individuals. I also estimated the home range of two bull sharks within the Coyote estuary.
To provide evidence to characterise the area as a nursery site for bull sharks				I found evidence of high residency and strong site attachment that suggests the Coyote estuary could be an important area for juvenile bull sharks. However, due to the short time of this research this couldn't be confirmed. A longer research period could provide evidence to substantiate this hypothesis.
Give talks to local communities and involve students in the project				I gave talks to local communities and high school students about my project and the importance of sharks for marine ecosystems. Throughout the research, many students and volunteers have participated actively.
To communicate the results and management suggestions				The results of this research along with the main suggestions were presented to the academia, federal authorities and local communities.

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

Due to the nature of fieldwork in tropical estuaries, many of the difficulties were related with the environmental and weather conditions (heavy rains or winds). In some cases the capture of the sharks was suspended because bad weather or lack of bait. Due to remoteness of the site the bait used for capture sharks was obtained from the local fishermen but sometimes there was a lack of bait due bad fishing or bad weather, so I decided to buy bait and freeze it for its future use.

The active tracking of bull sharks was also difficult, especially for a single person, and consumed a lot of time and fuel. Despite the small size of the estuary, the strong summer winds made it dangerous to sail because of the potential of trees falling. Besides, the telemetry equipment used for tracking (VR100 acoustic receiver) broke up and had to be repaired. All these unforeseen factors caused a delay in the fieldwork and shorter shark tracking periods.

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

- I. We determined that the Coyote estuary was an important site for juvenile bull sharks, at least during the time of this study. All sharks showed high levels of residency and a continuous presence in the study area. The juvenile bull sharks used depths of 0, 6 - 13, 3 m, temperatures of 27, 2 - 32, 3°C and salinity of 5-34ppt. However, the movement patterns and habitat use of juveniles were not strongly related with the environmental drivers we evaluated (temperature, depth, salinity, lunar phases or tidal cycles). Therefore, the behaviour of bull sharks in this site might be related with the presence, distribution and movement of their prey and not too much with other environmental factors.
- II. The space used by juvenile bull sharks was estimated using a Kernel Density Estimator (KDE). The two sharks used similar areas (164 200-39 000 m²), which corresponded to ~70% of the extension of the estuary. Their activity was restricted to the upper areas where major mangrove vegetation was present. Evidence of connectivity between coastal and estuary habitats. Juvenile bull sharks were detected inside the estuary throughout the day. In contrast, these sharks were detected in coastal areas only at night. This activity pattern could be evidence of transition between estuary habitats used by juvenile sharks as a nursery site and coastal habitats used by bigger and adult bull sharks.
- III. During the present study many volunteers participated in the fieldwork. Through talks given at local fishermen communities and high schools, people

gained awareness about the importance of this kind of projects and the importance of sharks for marine and coastal environments.

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

Through the talks given at the local communities and schools people increased their knowledge and interest about sharks and understood how sharks contribute to maintaining healthy fisheries and ecosystems. The volunteers that participated in the research also gained valuable experience about the use of telemetry equipment and other aspects of this project, like the capture, tagging and tracking of sharks.

5. Are there any plans to continue this work?

Throughout this project public universities, local organisations and local fishermen expressed their interest in continuing to collaborate with this project as well as extend the investigation to other near-coastal areas. In spite of our work, there are important questions that could not be responded by this investigation mainly because of time limitations. There is a lack of information about the ecology and population status of several shark species inhabiting in the estuaries and coastal zones in this region. The successful participation of local institutions and communities provides an important opportunity to continue working in this area and to educate the public and the people who depend on marine resources for their livelihoods.

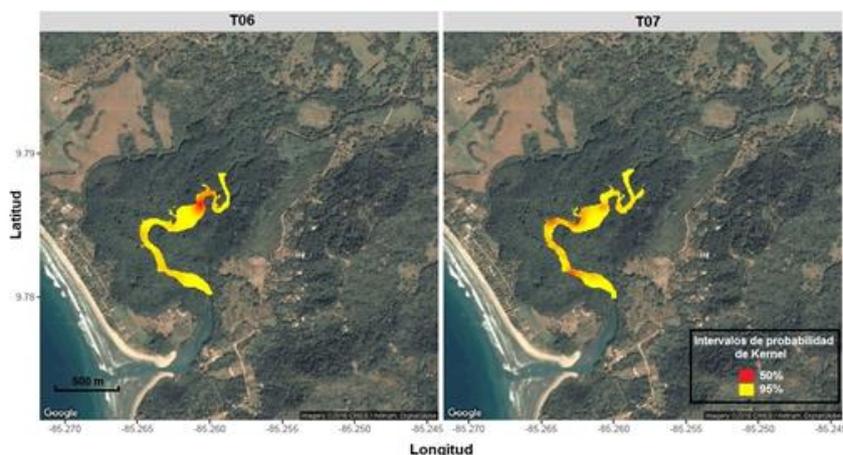


Fig. 1. Map showing the home ranges of juveniles of bull sharks in the Coyote estuary, Guanacaste, Costa Rica. The red zones reveal the core areas used by juvenile bull sharks, while the yellow area reflect the total area use by these sharks.

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

Our results will be orally presented to the scientific community at the two most important universities of Costa Rica: National University (UNA) and University of Costa Rica (UCR). The final report will be presented to the government authorities and a copy will be available for public access at the library of the National University. Furthermore, I am working on a poster to share the results of this research with the local students and fishermen communities, and with other people at international workshops and symposiums. A scientific paper is also expected to come out of this research.

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

The RSG was used over the second half of the study period. Originally the fieldwork was planned to last for one year, but due to several difficulties (i.e., research permits, equipment, logistics and weather conditions) the fieldwork was restricted to eight months. Nevertheless, the remaining four months were used to give talks and analyse the data collected.

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
Transportation	520	520	0	
Accommodation	780	820	+40	Due to bad weather the fieldwork took longer than expected.
Food	2340	1500	-840	The cost of food was reduced by purchasing in the local supermarket.
Acoustic tags	1300	1390	+90	Difference due to an increase in the cost of acoustic tags.
Consumables	0	500	+500	Mainly fuel for the boat used for active tracking, and bait used for capturing sharks
Field equipment (fishing)	0	200	+200	Extra costs of materials due to

line, hooks and gloves)				equipment repair and maintenance.
Repair to VR100	0	800	-800	The repair of the equipment was paid by the NGO PRETOMA
TOTAL	4940		+10	The majority of the logistic expenses (boat, fuel, research assistant, etc.) were covered by PRETOMA

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

The next step is to extend the study area and to tag more bull sharks including bigger individuals. This will provide evidence of the importance of the local coastal habitats to the species. It's also important to study the diet of bull sharks and prey dynamics in order to develop sound management and conservation strategies for the local shark and prey populations. Furthermore, it's very important to stay in contact with the local communities in order to create awareness about the shark conservation and the protection of marine resources.

10. Did you use The Rufford Foundation 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 used in presentations at local communities, high schools and universities. I am planning to use the logo on a poster to be placed in the main town, and to be used at international workshops and symposiums. It will also be included in any scientific publications if permitted. I will continue to mention the RSGF as one of the main sponsors of this project and will incorporate the logo in future presentations related with this research.

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

12. Any other comments?

I really appreciate the support given by the Rufford Small Grants Foundation. Your funding was critical in the accomplishing this project's goals. Further support will make it possible for us to keep working in this geographical and research areas. Thank you.