

## The Rufford 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](mailto:jane@rufford.org).

Thank you for your help.

**Josh Cole, Grants Director**

Grant Recipient Details	
<b>Your name</b>	Dalia Carolina Barragán Barrera
<b>Project title</b>	Studying the Foraging Ecology, Heavy Metals Bioaccumulation and the Health Status of the Bottlenose Dolphins of Bocas Del Toro, Panama
<b>RSG reference</b>	18297-B
<b>Reporting period</b>	
<b>Amount of grant</b>	£10000
<b>Your email address</b>	daliac.barraganbarrera@gmail.com
<b>Date of this report</b>	December 10, 2016

**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
<p>Conduct outreach activities in local schools for discussion about research activities and engage local stakeholders in management steps.</p>				<p>Several talks and workshops were conducted successfully with local communities. We also conducted a workshop with local teachers, who pledged to transmit the information about dolphins between their students in order to increase conservation efforts in the archipelago. We also achieved a first oncoming with local government to create local measures for conservation of this bottlenose dolphin population.</p>
<p>Determine health status of potential preys of bottlenose dolphins in Bocas del Toro.</p>				<p>We use fish health assessment indexes to determine health status of potential prey's for dolphins in Bocas del Toro. These indexes include HIS (Hepatosomatic index), GSI (Gonadosomatic index), FI (Fullness index), and CF (Fulton's condition factor). These indexes indicate a higher well-being of fish found in coral reef habitats.</p>
<p>Determine trophic position, and habitat use of bottlenose dolphins Bocas del Toro.</p>				<p>During two fieldtrips conducted this year we have collected 19 new samples from different dolphins in diverse localities of Bocas del Toro. In total we have collected 44 samples of bottlenose dolphins in Bocas del Toro. In addition, we have collected 212 samples from fish in different seasons (rainy and dry), localities, and ecosystems in Bocas del Toro.</p> <p>In general, isotopic analyses show that dolphins are top predators feeding</p>

			coastal preys. The remaining analyses will soon be conducted.
Determine mercury concentrations in skin samples of bottlenose dolphins in Bocas del Toro and their potential preys.			<p>During two fieldtrips conducted this year we have collected 19 new samples from different dolphins in several localities of Bocas del Toro. We have collected 44 samples of bottlenose dolphins in Bocas del Toro in total. Mercury analyses in skin samples of these dolphins show low values of mercury concentrations in contrast to other populations worldwide, but similar to individuals from Florida in the Caribbean. Although we have few samples from Almirante bay, area influenced by the local port, individuals from this bay showed high values of mercury concentration. However, it is necessary to collect more samples from this area.</p> <p>In addition, we have collected 212 samples from fish in different seasons (rainy and dry), localities, and ecosystems in Bocas del Toro. In general, fish showed low values of mercury concentrations, which could explain coastal habits of bottlenose dolphins in Bocas del Toro.</p>
Determine genetic diversity in the Major Histocompatibility Complex (MHC) of bottenose dolphins from Bocas del Toro.			<p>Although we have all reagents and materials to conduct MHC analyses using the Ion Torrent Sequencer, we were not able to obtain successfully results in all samples. Preliminary results show some genetic diversity in nuclear genes (microsatellite). We plan to send samples to other lab and pay for sequencing service in order to obtain complete results for MHC.</p>

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

During the first fieldtrip we encountered several problems in the field while collecting fish samples. We used some traps to collect fish samples in the field. However, most of them did not provide any sample. In addition, some of these traps were stolen. For these reasons, we decided to contact some local fishermen to help us to collect enough fish samples. For the second field trip, all traps were damaged, so we contact local fishermen again in order we can collect enough fish samples.

In the lab we also have some problems mainly with genetic work. Although we have all reagents and materials to conduct Major Histocompatibility Complex (MHC) analyses using the Ion Torrent Sequencer, we were not able to obtain successfully results in all samples. We could not obtain good quality in PCR products processed in the lab. For this reason, we plan to send samples to a specialized lab and pay for sequencing service in order to obtain complete results for MHC.

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

🐬 Community outreach. We highlight outreach activities as the key for conservation of dolphins in Bocas del Toro. This year the Panacetacea team achieved a good oncoming with local government and local stakeholders to create a dolphin centre in Dolphin Bay to control the number of boats interacting with dolphins. Although this is a first approach, we are optimist because local people are recognising that bottlenose dolphins in Bocas del Toro are vulnerable and they need to be protected. In addition, we conducted several talks and workshops in local schools and with local teachers, who pledged to instil in their students the commitment to preserve bottlenose dolphins.

🐬 Mercury and health results. Most of toxicological studies use samples from dead animals to conduct mercury analyses. Only a few of recent research have showed the usefulness of skin samples to determine pollutant concentrations in wild cetacean populations, which allows to determine real status of marine ecosystems. This study is the first approach to determine mercury levels in skin samples of bottlenose dolphins in Central America. We successfully obtained mercury results from skin samples of bottlenose dolphins from Bocas de Toro. Although our results show low mercury levels in these dolphins, we found high mercury concentrations in the Almirante Bay. This area is influenced by a local port that has affected local ecosystems. Our results agree with previous research studies that have found bioaccumulation of mercury in corals inhabiting the Almirante Bay. We hope that

with divulgation of these results, local authorities ensure importance of conserve this population, and implement soon the management plan to protect these dolphins.

🐬 Ecological results. Bottlenose dolphins in Bocas del Toro have affected by boat traffic, and although dolphins have changed their distribution in the Archipelago, they still inhabit these area. It is possible that Bocas del Toro offer a good food supply to dolphins, since we found a great diversity of fish in the archipelago, and fish health indexes indicate a wellbeing on fish, particularly fish found in coral reef habitats. Isotopic analyses showed that dolphins are located in a high trophic level, and they feed coastal preys. These results agree with low mercury (Hg) concentrations found in skin samples of bottlenose dolphins, since coastal fish are not Hg-rich. These results are very important for conservation of this population, since we are providing ecological evidence that suggests these dolphins belong to the "inshore form". Although we need more samples from offshore areas, we hope that with divulgation of these results, local authorities implement soon the management plan to protect these dolphins.

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

The involvement of local communities in our project has been very essential to achieve conservation of bottlenose dolphins. We were successful in conducting talks in different local schools of Bocas del Toro (e.g. Buena Esperanza, Bocastorito, and Shark Hole), and we worked with local teachers from Bocas del Toro and neighbouring regions such as Almirante. These outreach activities, and all that we have conducted until now, have allowed that local people know conservation status of the bottlenose dolphin population in Bocas del Toro, and therefore they have increased awareness of dolphins conservation. Unfortunately, during last field trip one dolphin appeared dead in the bay. This dolphin was an identified male, and his name was Samwise. The support of local community was vital to found this animal, which showed some cuts and hits probably from boat propel. In addition, Panacetacea team and local community have participated in conversations with local government and stakeholders to create a dolphin centre, which will allow control the number of boats interacting with dolphins in Dolphin Bay. This has been the most important outcome that we have achieved working with local community.

#### **5. Are there any plans to continue this work?**

Yes. Our long-term goals include two important outcomes:

➤ The creation and establishment of a dolphin centre, which will be located in Dolphin bay in order to control the number of boats interacting with dolphins. The creation of this centre will be managed by local community, and will allow that tourists know the situation of dolphins in the bay with the intention of increase awareness about conservation of this bottlenose dolphin population.

➤ Maintain the long-term research program in order to generate needed data for Panamanian Government and IUCN propose a new conservation status to an endangered categorisation for bottlenose dolphins in Bocas del Toro. Genetic data supports that this population is isolated in the Caribbean. Ecological data suggest that this is an inshore population, which increase its vulnerability to anthropogenic activities such as boat traffic and pollution. However, it is necessary to generate more data related to population abundance, health of individuals and genetic status in neighbouring areas to achieve a threaten categorisation in dolphins from Bocas del Toro.

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

Our interest is sharing our results not only with scientific community, but mainly with local people and local government. For this reason, we have posted information about our work in Facebook (@bocasdolphins), and we plan to publish our results in a report for consideration of the scientific committee of the International Whaling Commission (IWC). Due to reports that we have presented before, the IWC have presented several "strong recommendation" to Government of Panama to they manage boat traffic activities in Bocas del Toro. We think that these recommendations have been relevant to local government show interest in create the dolphin centre to protect bottlenose dolphins in Bocas del Toro. However, it is necessary to ensure that conservation status of this bottlenose dolphin population changes in the middle-term. For this reason, we also plan to present our results in talks to stakeholders, and publish them in peer review scientific journals.

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

The funds from RSG were expected to be used during two field collections in a period of a year (20 days for each fieldtrips for 40 days in total), and in some genetic analyses and materials. Because of difficulties encountered to coordinate all researchers to work in the field, we had to shorten our field season to 30 days in total. Because we save some money in fieldtrips, but cost of eco-toxicological analyses were more expensive than we expected, we used residual funds to cover part of these mercury and isotopic analyses. We also could cover the remaining cost of

eco-toxicological analyses because we saved money in MHC expenses, since LEMVA-lab provided reagents and materials to conduct these MHC analyses.

**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
Flight from Colombia - Panama (roundtrip - 3 people, two trips)	822	<b>682,58</b>	139,42	This value describes airplane tickets for three researchers in their visit to the study area. The differences in the values are because only two researchers went to the study area in the second trip. <b>RSG spent = £ 682,58</b>
In-country air travel (Panama - Bocas del Toro, roundtrip - 4 people, two trips)	952	<b>701,05</b>	250,94	This value describes airplane tickets for two researchers in their visit to the study area. The differences in the values are because only two researchers went to the study area in the second trip. <b>RSG spent = £ 701,05</b>
Weekly transport to STRI in Bocas del Toro	117	<b>106,65</b>	10,35	This value describes daily transportation from Smithsonian Institute to downtown (roundtrip) in Bocas del Toro. <b>RSG spent = £ 106,65</b>
Lodging (4 people)	1600	<b>782,10</b>	817,90	This value describes accommodation for the researchers during 31 days. The differences in the values are because we save money in a cheaper accommodation in downtown for all researchers during the first trip. Furthermore, in the second

				<p>trip, only two researchers went to the study area.</p> <p><b>RSG spent = £ 782,10</b></p>
Meals (4 people) and field materials	912	<b>1303,50</b>	391,50	<p>This value describes food expenses for the researchers. The differences in the values are because we include here some materials that we needed in the field (e.g. darts to collect skin samples, papers, pen, etc.).</p> <p><b>RSG spent = £ 1303,50</b></p>
Boat operator	780	<b>497,70</b>	282,30	<p>This value describes the payment of boat operator during the fieldtrip. The differences in the values are because although boat operator fee increased this year, during first fieldtrip we covered this item expenses with other funds.</p> <p><b>RSG spent = £ 497,70</b></p>
Research boat and gasoline	2344,80	<b>1323,25</b>	1021,55	<p>In this item we include boat and gasoline because we did one payment to STRI for all. The differences in the values are because we used a middle boat, which is cheaper than the larger one, and because we worked in the field for 30 days. Also, during first fieldtrip we covered this item expenses with other funds.</p> <p><b>RSG spent = £ 1323,25</b></p>
STRI Admin and Bench fee (4 people)	781,31	<b>742,60</b>	38,71	<p>This value describes the Smithsonian (STRI) registration and bench fee for researchers in STRI station. The differences in the values are because only two researchers went to the study area in the second trip, so we saved money in the bench fee. This item was covered with the RSG</p>

				<p>expenses due we saved money in other field items.</p> <p><b>RSG spent = £ 742,60</b></p>
Travel Insurance (4 people)	260	<b>260</b>	0	<p>This value describes the travel insurance for the researchers. All of them paid for their own insurance. Therefore, we did not pay this item with the Booster Rufford grant.</p> <p><b>RSG spent = £ 0</b></p>
Research permits	85	<b>85</b>	0	<p>This value describes the fee of permits for research. We did not pay this item with the Booster Rufford grant.</p> <p><b>RSG spent = £ 0</b></p>
GPS Navigator	120	<b>120</b>	0	<p>These values describe the equipment we used during fieldtrips. We did not pay this with the Booster Rufford grant.</p> <p><b>RSG spent = £ 0</b></p>
Binoculars w/ Range Finder	90	<b>90</b>	0	
Digital Camera with Zoom Lens 75-300mm	1496	<b>1496</b>	0	
DNA extraction	195	<b>272,04</b>	77,04	<p>This value describes DNA extraction kit. The value of this kit increased in Colombia due to changes in the TRM.</p> <p><b>RSG spent = £ 272,04</b></p>
PCR (including sequencing expenses)	250	<b>336,39</b>	86,39	<p>This value describes laboratory material such as gloves, PCR tubes and tips used to prepare PCR mix. In addition, we include sequencing expenses which was paid with the Booster Rufford grant. PCR reagents were not pay with the Rufford grant.</p> <p><b>RSG spent = £ 336,39</b></p>
Microsatellites	1500	<b>1513</b>	13	<p>This value describes the cost of microsatellite sequencing for new samples collected.</p> <p><b>RSG spent = £ 1513</b></p>
MHC analyses (including reagents and sequencing expenses)	12166	<b>12166</b>	0	<p>This value describes the cost of reagents and sequencing expenses to conduct MHC analyses. As LEMVA-lab provide all these materials, we</p>

				<p>did not pay this item with the Booster Rufford grant. We used this residual to cover expenses related to fieldtrips, genetic, and ecotoxicological analyses.</p> <p><b>RSG spent = £ 0</b></p>
Ecotoxicological analyses (Isotopic and mercury measurements)	326	<b>1739,74</b>	1413,74	<p>This value describes the cost of ecotoxicological analyses, which include technical services of isotopic and mercury measurements for all samples collected.</p> <p><b>RSG spent = £ 1739,74</b></p>
<b>TOTAL</b>	24797,11	<b>25214,43</b>	4542,84	<b>RSG spent = £ 10000,60</b>

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

Since during this year Panacetacea team achieved a first oncoming with local government and local stakeholders to create a dolphin centre in Dolphin Bay in order to control the number of boats interacting with dolphins, the most important next step is maintain these conversations for establishment of this centre. Furthermore, it is paramount that we continue with outreach activities with local community.

Eco-toxicological results found during this year provided more evidence that bottlenose dolphins in Bocas del Toro are vulnerable. This population appear to be isolated and formed only by "inshore" individuals, and therefore it is vulnerable to boat traffic and pollution. However, we need more evidence needed to IUCN and local government change the conservation status of this population. Therefore, next steps include maintaining the long-term monitoring with local students to generate more biological information that include:

- 🐬 Population estimation to assess number of individuals present in Bocas del Toro.
- 🐬 Reproductive parameters to determine reproductive success and calf mortality in Bocas del Toro.
- 🐬 Interactions between dolphins and boats may cause stress in dolphins, so it is necessary to collect more samples from individuals and assess stress hormones in these biopsies.
- 🐬 Evaluate health status of bottlenose dolphins in Bocas del Toro sequencing MHC genes in all samples collected.

- Determine genetic status of neighbouring populations in order to confirm degree of isolation of bottlenose dolphins in Bocas del Toro.
- Establish the management unit for bottlenose dolphins in Bocas del Toro using genomic data.

**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 was displayed in several materials we distributed and presented in the community during outreach activities. Furthermore, RSGF logo was posted in our social media (webpage and Facebook). The logo was also displayed in poster and oral presentations in three scientific events: The 21st Biennial Conference on The Biology of Marine Mammals, the first workshop on RIEMMCCA: Network of Aquatic Mammal Specialists of Central America and the Caribbean, and in the First Biological Sciences Intern Congress of Universidad de los Andes. Additionally, the RSGF was mentioned in the acknowledgment sections of the manuscript "High genetic structure and low mitochondrial diversity in bottlenose dolphins of the Archipelago of Bocas del Toro, Panama: a population at risk?", recently submitted in a peer-review journal.

**11. Any other comments?**

The support of the Rufford Small Grants has been the key for generate relevant data for conservation of the Bocas del Toro's bottlenose dolphin population. Therefore, we want to thank the RGS board committee for providing us needed funding to achieve the most important outcomes in our project. We really appreciate your support in conservation projects in developing countries, since you are contributing to conservation of many species and ecosystems in our continent, and also you are empowering young Latin American researchers to follow their careers and promote conservation issues in developing countries. Thank you for all your support.