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	Gabrielle Alexandra Rubiano Pinzón
Project title	Humpback whales in Bahía Málaga – Pacific Coast of Colombia: Health and anthropogenic stressors
RSG reference	19879-1
Reporting period	August 2017-October 2018
Amount of grant	£ 5.000
Your email address	gabrupi@gmail.com
Date of this report	November 2018

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
Characterize the activity of whale-watching to identify and analyse the variables that affect the structure and the activity path.			✓	This objective addressed the whale-watching Socioecological System´s (SSE for its initials in Spanish) characterisation in Bahía Málaga, Valle del Cauca, Colombia. Research was conducted during 2017-2018. Designed methodology is based on the Social Ecological Systems Framework (McGinnis & Ostrom, 2014) and DPSIR framework (Drivers, Pressures, State, Impacts and Responses) (e.g. Atkins et al 2011). These two methodologies allowed us to understand and analyse the interactions and outcomes of the social and ecological sub-systems in an integral way. Complementary methodological tools included a bibliometric analysis, surveys, focal groups, and social network analysis. Research process included the following steps: First, surveys were conducted to different actors (N=70), from the three communitarian councils (Juanchaco, Ladrilleros, and La Barra), involved in whale watching, and transport companies in Buenaventura. The surveys facilitated characterisation of whale watching as a socio-ecological system (SES) and identification of interactions among actors (operators, hotels, interpreters, and tourists). Second, a sample of stakeholders of the Whales Inter-institutional Local Committee (CILDB for is initials in Spanish) was interviewed (N=17) in

				order to deepen on the SES characterisation, their participation in this system and activities connected with the planning and operation of the whales´ watching season. Third, behavioural observations of humpback whales were recorded (N=50) from commercial whale watching vessels operating from Juanchaco's harbour. Behavioural observations allowed the identification of short-term effects of tourist boats on the whales and recognising the most frequent whales´ behaviour during the activity. The templates allowed to describe the way in which the activity is done and the response of the individuals during the sight. Interviews, surveys and direct observation, based on the selected methodologies, facilitated a more comprehensive understanding of the SES and the relationships between social and ecological subsystems. The following five interactions were prioritised: self-organisation, conflict, cooperation, learning, and resilience. The outcomes generated by these interactions are decisive for the structure and trajectory of the current SES, and because of that influence, we treated them as key variables. These variables work as part of the SES structure but also behave as emergent SES attributes. This dual condition will be subject of a complementary analysis and the base for a scientific publication.
Provide tools to develop a management plan for this activity, to protect whales and to present possible future scenarios to				To reach this objective we conducted a Prospective Structural Analysis workshop with participation of different stakeholders of the system (N= 18). In this workshop, we identified drivers influencing the SES´ structure and, as a result, the five influential

| stakeholders in the development of a public policy related to whale-watching in Colombia. | | | | variables identified in the previous objective. Identified drivers were prioritised with the software Micmac (https://micmac.ensg.eu/index.php/Accueil): support, price, normativity, touristic capacity, and environmental protection practices. They were selected for the construction of three 10-year future scenarios: possible, undesirable, and desirable. Following this method, participants selected the desirable scenario to create a future strategy to improve agency of the SES. In this process, participants selected the creation of a cooperative as a key future action to improve of the management of the whale-watching system. |
| Determine pollutants in whales as indicators of health of the ecosystem in general. | | | | This objective was accomplished by establishing total mercury concentrations [THg] in humpback whale's skin and blubber, determined by atomic absorption spectrometry, ranging between 3,63 and 45,70 µg/kg (mean=20,37 µg/kg, SD=9,99). These results showed a significant difference between the tissues types, where skin showed the highest concentration because it is the organ where the bioaccumulation of mercury takes place. Bearing in mind that humpback whales feed in the Antarctic Peninsula, these findings suggest that mercury is circulating in the food chain. However, if occasional feeding is happening in the breeding area, whales could be exposed to high concentrations of mercury due to the environmental release caused by illegal mining that occurs along the Colombian Pacific coast. This coupled with ecosystem degradation and several other anthropogenic effects, can have huge impacts on the health of these |

				organisms. The proposed methods permitted the development of the research, as sampling and mercury concentration analyses were successfully performed. Nonetheless, isotopic analyses were not performed since the mercury results were already conclusive.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).
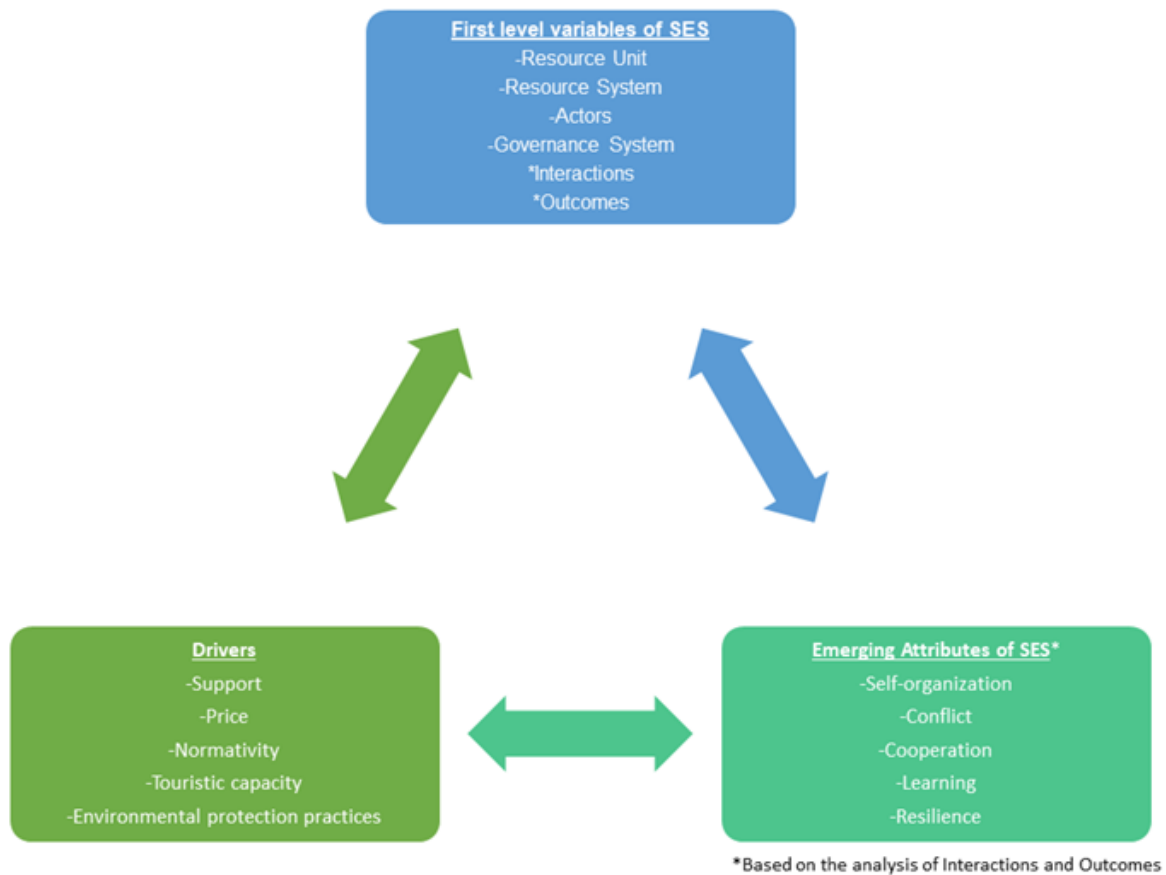
We faced three unforeseen difficulties. The first one was caused by a delay in the process of obtaining the permits at the Ministry of the Interior and with PNN, which finally came out in April and June 2017, respectively. Chronological adjustment of activities facilitated to overcome this institutional delay.

Due to public disorders in the study area, we had to postpone some of the activities planned for 2017 to the first semester of 2018. Furthermore, since the whales are migratory animals, the CILDB ensures that the whale watching season occurs between July 15th and October 15th 2018, causing some inconveniences to apply behaviour survey formats and sampling.

Data collection faced two main difficulties. On one hand, individual tissue samples data collection was low, because the weather made it difficult to distinguish individuals in the field (recognised by their backs and tails), and also because the darts not always hit the target, or failed, probably as a result of salt accumulation. Since we were in the field, we were not able to buy new darts on time to collect more biopsy samples. To avoid this problem from recurring in the future, we purchased extra darts for emergency situations while in the field. On the other hand, we faced several obstacles obtaining the necessary permits to access the national park area. Yet, we overcame this situation making agreements with the boards of communitarian councils who formally manage the territory and samples were taken outside the national park. Results did not affect the structure of the project.

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

We designed a methodology oriented to explore three specific dimensions of the SES: structural characteristics of the SES, identification of drivers influencing SES trajectory, and identification of pollutants affecting the system.

First level variables of SES
- Resource Unit
- Resource System
- Actors
- Governance System
*Interactions
*Outcomes

Drivers
- Support
- Price
- Normativity
- Touristic capacity
- Environmental protection practices

Emerging Attributes of SES*
- Self-organization
- Conflict
- Cooperation
- Learning
- Resilience

*Based on the analysis of Interactions and Outcomes

The main result obtained in this research is a detailed description of the whale-watching Socioecological System. Based on the SSE framework we selected six out of nine groups of first level variables: 1. Resource System, 2. Resource Unit, 3. Actors, 4. Governance System, 5. Interactions, and 6. Outcomes. We found that tourism managed in inappropriate ways could have a negative impact on the population viability with time and the resilience of the SES. Improvement of communication among actors may improve learning and cooperation, further influencing conflict resolutions capacities and the resilience of the SES. SES governance process and structure need an important reorientation that considers the involvement of new actors in the CILDB, active consideration of diverse actors´ interactions and functions, agency related with pollutants influence, command and control guidelines, and the role of informal institutions.

The second important outcome was the identification of key variables and drivers influencing SES trajectory. Although the SES is currently functioning it is not completely consolidated, and the continuity in the behaviour of structural variables may conduct the whale watching SES to a collapse. Regarding the SES structural variables we found that concentration of political and management power reflected in prevalent command and control rules to regulate the SES, no consideration of the pollutants role in the SES, low capacity for conflict resolution, low levels of cooperation, limited access of different actors in the process of decision making, particularly of the communitarian councils, and limited access to biophysical and socio-economic

information, are negatively affecting SES resilience. Statistical analysis of the SES reticular structure illustrate some of these problems (see figure No.2). Regarding the system drivers, we found five drivers affecting the SES structure and trajectory: the level of support and communication among actors, environmental protection practices, prices management, touristic training, and policies. The influence of these drivers deepens the current behaviour of structural variables and as a result reinforces whale watching SES current trajectory.
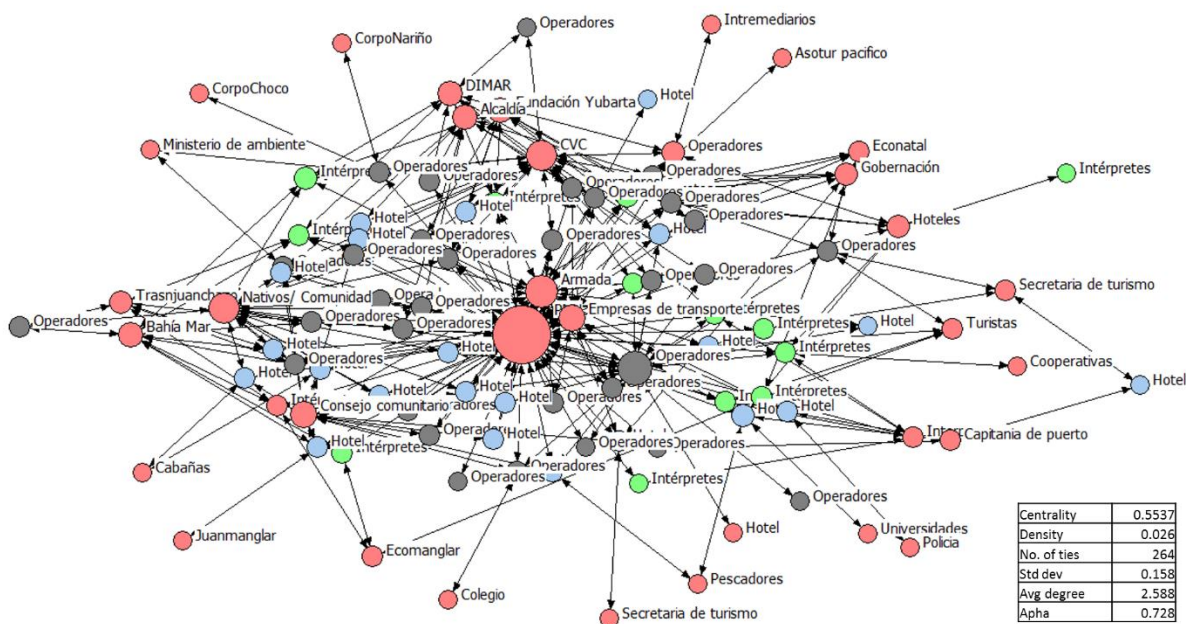

Figure 2. Management network for whales-watching in Bahía Málaga.

Finally, behaviour and mercury results helped to describe the biophysical SES subsystem. We found that the most frequent behaviours are blows, displacement and diving, and to a lesser extent, breaching and resting. Most of the sights lasted between 10 and 20 minutes per group and did not have any significant effect on the type of response of the individuals (p-$value$ = 0.17, f = 1.95). Behaviour and sights were not affected by the presence of boats in the area, however further analysis regarding the influence of boats increasing numbers, noise and gasoline additives must be conducted. Mercury concentration assessment as a proxy of health: this is the first assessment of total mercury concentrations from skin and blubber samples collected from free-ranging individuals, using non-lethal biopsy sampling methods. These results indicate that whales are exposed to pollutants such as mercury that have impacts on health, associated to immune suppression. Considering that humpback whales are mesopredators, they present low concentrations of total mercury, which means that mercury is circulating in the food chain and can be affecting each trophic level, having an impact in the whole socio-ecosystem.

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

Today, the local communities depend on whale-watching tourism, which is the most important source of income in the region. For this reason, we conducted surveys, interviews and workshops in all of the three aforementioned communities. Through the research process, we involved 104 persons, 32 women and 72 men, representing the diversity of actors identified in the SES. At the beginning of 2018, we presented our preliminary results, which helped to increase awareness of the inequalities in income distribution among participant actors and mismanagement of the system. Furthermore, the results obtained through research activities provided new information for the local communities and public institutions to improve the management and agency in the whale watching SES. Local communities have now more and higher quality information about the governance of the whale watching SES, which can help them not only to improve their participation in the decision making process but also improve their organisational an learning activities to empower local communities, protect the whales, and improve the system in the future.

5. Are there any plans to continue this work?

We intend to continue the work in the following areas:

a) Deepen the analysis of variables related to economic and political power to find the role of the interface between formal institutions (public policies) and informal institutions in order to contribute to improve knowledge about these particular form of SES.

b)Further analysis of the system from the perspective of the Institutional Analysis for Development framework in order to improve knowledge about the role of action arenas and particularly the influence of specific variables such as cooperation, trust, and reciprocity. This knowledge may influence local capacities for agency and management of the whale watching SES.

c) Further analysis of the system from the perspective of the sustainability transition framework which can enhance current knowledge about the influence of the socio-economic planning regime, this way improving knowledge about the current trajectory of the SES and find more information about the context´s role in this area of research.

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

We will use two main ways to share the obtained results. The first one is a public presentation of the results to local communities, NGOs and public institutions in Bahía Málaga. We plan to conduct this activity by February 2019. In this context, we will share a copy of a detailed report.

The second one is the preparation of scientific article, based on the detailed report, which we are going to present in INSNA international conference, and publish in an international scientific journal. This activity has already started and we plan to submit our article in March 2019. In both cases, we grant acknowledgment to the Rufford Foundation for its support.

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 funds were provided by The Rufford Foundation for a period of 12 months according to the letter signed. We received the funds on January 23, 2017, and the resources were used from August 2017 to August 2018 taking into account unforeseen difficulties that arose during the project.

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
Round trip flight Bogotá-Cali	327	1088	761	A total of four trips.
Bus Airport-Bus Station in Cali (four roundtrips)		48		
Bus Cali-Buenaventura (four roundtrips)		119		
Round trip boat Buenaventura-Juanchaco (four roundtrips)	81	143	62	
Internal Transport (during the four trips)		158		
Lodging (four trips)	891	1060	169	This value differs by: • Not all investigators travelled on all trips. • The trips had a different duration. • Some hotels included one or two meals.
Food and meals	1002	552	450	This value differs by: • Some hotels included one or two meals. • Additional expenses were incurred for hydration and food not included in accommodation.

Workshop	383	447	64	This value includes the workshop's logistics, beverages, materials (i.e. templates, markers, etc.), and transport for the participants.
Whale-watching trips	1012	919	93	We had support from the local operators
Gasoline, Boat and Captain (150 days)	608			We did not pay this item with the Rufford's small grant.
Sending samples to Laboratorio Littoral, Environnement et Sociétés in the Université de La Rochelle in France for mercury analysis.	607	305	302	This item describes the cost of the analysis of mercury samples taken in the field.
Absolute ethyl alcohol AR analysis x 2.5 Lt Carlo Erba and Latex gloves x 100 pcs. (S)	80			We did not pay this item with the Rufford's small grant.
Others		152		This value indicates unexpected expenses such as banking transactions, internet access in the field, among others.
TOTAL	**4991**	**4991**		Local exchange rate 1 £ sterling = 3.772,67 COP

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

We consider five important steps to support local communities depending on the whale watching SES:

i) Support in planning and development of a local tourism cooperative.

ii) Support in the organization and construction of good management practices.

iii) Support in the design and construction of an economic incentive for the conservation of whales.

iv) Strengthen local tourism education.

v) Improve local and institutional knowledge about the whale watching SES through the three areas described in section No 5

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 RF logo was displayed in the materials like surveys, interviews, list attendance, results presentations, prospective workshop, and in the final document that we will present and distribute to the community and local authorities (communitarian

councils) in Bahia Malaga. The Rufford's logo and acknowledgement of the support from the foundation is granted in the forthcoming congresses, presentations and article publication.

11. Any other comments?

The outcomes of this research can be actively used for conservation and management in the whale watching SES in Bahia Malaga. Thanks to the Rufford Small Grants funding, we achieved these results. For this reason, we would like to thank the board committee for this invaluable support. With your financial support, you are not only contributing to the conservation of the humpback whale, but also with the enhancement in the management of tourism service by the local communities.