

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	Daniela Haro
Project title	Characterization of the food web in the Francisco Coloane Marine Area, Chile: Trophic role of the humpback whale and of their principal preys
RSG reference	19469-1
Reporting period	January 2017 – January 2018
Amount of grant	£ 5000
Your email address	danielaharo@ug.uchile.cl
Date of this report	January 24, 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
Develop informative talks to the local community and generate information for the conservation of this Area				Several informative talks and activities with students were conducted successfully with local communities. This project generated unknown information about the humpback whale, fuegian sprat and lobster krill, relevant for conservation.
Determine the feeding ecology of humpback whales				31 samples of humpback whale skin and samples of their prey were collected. The analysis of stable isotopes of carbon and nitrogen suggested that in 2017 the whales fed mainly lobster krill and euphausiids. Preliminary results indicated that there are interannual variations in the diet of the whales.
Determine the trophic role of humpback whales				Preliminary results indicated that the humpback whale would be the most important predator in the food web for the fuegian sprat, lobster krill, euphausiids and amphipods, and that the whale is at a relative trophic level of 3.5. This objective is partially achieved, as soon more analyses of the ecotrophic model made for the Francisco Coloane Marine Area will be performed.
Determine the trophic role of fuegian sprat and lobster krill				An ecotrophic model was built for the ecosystem of the Francisco Coloane Area with the Ecopath & Ecosim programme. Preliminary results indicated that both the fuegian sprat and the lobster krill play a role in the organisation of the ecosystem. Simulations of biomass change indicated that the biomass of whales would decrease

			with a fuegian sprat fishery after 5 years, and after 2 years with a lobster krill fishery. This objective is partially achieved since more analysis of the prepared ecotrophic model will be carried out.
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2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

One difficulty in the field was the availability of the boat for the field trips to the marine area on the dates initially planned. In this project, field trips were considered in tourist boats, in a zodiac boat and an artisan boat leased for the research. The field trips in tourist boats, were only made in February and March, since in the other months, the ship was full with tourists. The zodiac boat trips were made only in March due to the number of tourists during the other months. However, initially only one trip of 5 days with an artisan boat rental was considered, but fortunately the money was enough to make two leases, with a field trip in February (4 days) and another one in April (3 days).

A second difficulty was the obtaining of fuegian sprat, since during field trips with tourist boats, fuegian sprat were observed on the surface only once and they were not collected. Only in the two field trips with the artisan boat, nine specimens of fuegian sprat could be collected.

It was not possible to analyse the lobster krill stomachs due to the degradation of the food consumed, therefore the ecology and the trophic role of this species was analysed mainly with the analysis of the ecotrophic model.

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

Community outreach. We highlight the great interest of the people who attended the talks of this project. Talks were held at the Chilean Antarctic Institute, the Fisheries Development Institute, talks to the tourism guides in the city of Puerto Natales and Punta Arenas (Magallanes region), talks at the Miguel de Cervantes School and the Museum of Río Seco. We emphasise that this project had a great diffusion since talks weren't only held in the Magallanes region, but also in the city of Santiago at the University of Chile and in the public square of Ñuñoa. In addition, the project was discussed on the radio and local television channel "Polar Radio" of Punta Arenas, at the 22nd Biennial Conference of the Society for Marine Mammalogy in Halifax, Canada and at the Second Symposium of Marine Mammal Research in Chile in the city of La Serena.

Feeding ecology and trophic role of humpback whales. In this Project it was possible to collect 31 samples of whale skin, samples of their prey (fuegian sprat, lobster krill, euphausiids and amphipods) and fish samples. The results indicated that the whales were fed mainly lobster krill and euphausiids in 2017, unlike previous years to this

project, in which the whales ate mainly fuegian sprat. An interesting result is that with this study, it was possible to collect individuals of juvenile and adult lobster krill, and differences were found in their isotopic values. The analyses indicated that the whales preferred to eat adult lobster krill.

Preliminary results indicate that the humpback whale would be the most important predator of the food web for fuegian sprat, lobster krill, euphausiids and amphipods, and that the whales are at a relative trophic level of 3.5 in the marine area. There would be a niche overlap between whales and hake (*Macruronus magellanicus*), species that consume the same prey. This interaction must be evaluated in greater detail. Soon more analysis of the ecotrophic model made in the marine area will be performed.

Determine the trophic role of fuegian sprat and lobster krill. The preliminary results of the ecotrophic model indicated that both the fuegian sprat and the lobster krill play a role in the organisation and development of the ecosystem. A high proportion of matter flowed through the fuegian sprat and this species showed a positive impact on the populations of whales and penguins. Lobster krill had a positive impact on the populations of penguins and sea lions.

Simulations of biomass change indicated that whale biomass would decrease with a fuegian sprat fishery after 5 years, and with a lobster krill fishery it would decrease after 2 years. Soon a more detailed analysis of the ecotrophic model will be made to be able to deliver to fishery institutions the results of simulations of dams fisheries and the impacts that this would have on the humpback whale population and on the structure of Francisco Coloane's food web.

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

We had a high attendance of public in the divulgation talks of the project. The talks dealt with the marine area, which despite being a protected area, is not well known by the community due to the difficult access. The community was told about the importance of fuegian sprat and lobster krill for the different populations of top predators in this area.

In the activities with children, a benefit for them was that after the talk, we had a practical class where they were shown individuals of fuegian sprat, lobster krill, euphausiids and amphipods, they could observe them, look at them in a stereoscopic magnifying glass and identify their parts. These marine organisms are not commonly available in schools, the teaching is only theoretical.

Talks were given to tourism guides from Puerto Natales and Punta Arenas, who had great interest in the research, they were told about the project that was being developed, the importance of fuegian sprat, lobster krill and the Marine Area, data that will be very useful for them, as complementary information in their work with domestic and foreign tourists.

In general, we emphasise that this project had a wide range of diffusion not only in the Magallanes region, but also in the city of Santiago, La Serena and in a congress in Canada.

5. Are there any plans to continue this work?

Yes. Our long-term objectives are to determine with greater precision the annual differences in the feeding of the whales, to determine on a longer time scale the prey preferences. It is also important to analyse if there are differences in the diet of male and female whales in this feeding area, in such a way as to determine the degree of vulnerability to possible fisheries.

In addition, we would like to continue holding activities with students so that children learn about the marine species that exist in the Strait of Magellan, giving them the possibility of observing different organisms.

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

We plan to continue sharing the results of this project through the website (<http://www.museodehistorianaturalrioseco.org/investigacioacuten.html>) and the Facebook of the Rio Seco Museum, museum to which we belong (https://www.facebook.com/pg/mhnrioseco/photos/?tab=album&album_id=411354422546452).

In the scientific field, we have published information about the project in Researchgate (<https://www.researchgate.net/project/Characterization-of-the-food-web-in-the-Francisco-Coloane-Marine-Area-Chile-Trophic-role-of-the-humpback-whale-and-of-their-principal-preys>), and presented the project at two conferences (22nd Biennial Conference of the Society for Marine Mammalogy and Second Symposium on Research of Marine Mammals in Chile). The results of this project will be published in at least two manuscripts in scientific journals and presented at the next Congress of the Latin American Aquatic Mammal Society, in November 2018 in Peru.

When the results of the ecotrophic model are analysed in detail, they will be presented in government institutions such as the Fishing Undersecretary and/or the Fisheries Development Institute. It is important to note that the Fuegian sprat fishery has not been opened in the Magallanes region, however, it is important to demonstrate the impacts that this fishery would have on the ecosystem. This project reaffirms the importance of lobster krill in the diet of whales and in the organisation of the food web, therefore it is important to deliver these results to institutions related to the marine area and regional fisheries.

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 funds were used exclusively for field trips between in February, March and April. They were used mainly for the renting of an artisan boat in February and April.

The money was used in the initial stage of the project, which was obtaining samples. In the following months, sample processing, laboratory analysis, construction of the ecotrophic model and the interpretation of results were performed. The last results of stable isotopes were received in November of 2017, for this reason the results are preliminary.

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
4 flights from Santiago-Punta Arenas (roundtrip - 2 person)	310	587	+277	We bought 2 air tickets more than planned, since a ticket is required for each month of field trips to the Marine Area (February, March and April) and a ticket for Benjamin Caceres, member of this project, who was outside of Punta Arenas in April for the last field trip RSG spent = £ 277
1 Transportation Punta Arenas - Francisco Coloane (roundtrip - 1 person)	52	26	- 26	This value corresponds to the trip Punta Arenas - Francisco Coloane Marine Area, to make the field trips in a zodiac boat. Originally there were 2 passages, but finally only one was used RSG spent = £ 0
Meals for 20 days (1 person)	648	324	-324	This food value was for the days of zodiac boat trips, initially for 2 people, but only 1 person traveled RSG spent = £ 0
Lodging for 20 days (1 person)	300	150	-150	This accommodation value was for the days of zodiac boat trips, initially for 2 people, but only 1 person traveled RSG spent = £ 0
Gasoline zodiac boat, March 2017	1200	120	-1080	Less fuel than planned was used RSG spent = £ 120
Research boat and gasoline (7 days)	4370	5913	+1543	Initially a field trip of 5 days was considered, but the rent of the boat did cost less than considered and 2 field trips were made, the

				first of 4 days (February) and the second of 3 days (April) RSG spent = £ 4376
Travel insurance (2)	190	190	0	This value describes the travel insurance for the researchers. All of them paid for their own insurance RSG spent = £ 0
Research permits	40	40	0	This value describes the fee of permits for collection of the samples for research RSG spent = £ 0
Isotopic analysis	490	490	0	This value describes the analysis of stable isotopes of carbon and nitrogen of all samples RSG spent = £ 0
Stomach content analysis	180	180	0	This value describes the stomach content analysis of fishes RSG spent = £ 0
Field equipment	320	320	0	RSG spent = £ 0
Transfer Punta Arenas - Port of shipment in Bahía Mansa (roundtrip - people and equipment)	0	193	+193	The transfer of people and sampling equipment to the boat had not been considered in the initial budget RSG spent = £ 193
Jerry cans for fuel and zodiac motor oil	0	34	+34	This value had not been considered in the initial budget RSG spent = £ 34
Total	8100	8567	467	RSG spent = £ 5000

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

Due to the inter-annual differences in the diet of the humpback whales in this feeding area, it is important to define their feeding in a time scale of several years, as well as to determine differences in both sexes, in order to determine with greater precision, the degree of vulnerability of the population of whales and of males and females before possible fisheries.

In the food web, it would be important to carry out population studies of Fuegian sprat and lobster krill, as well as studies of contaminants present in the ecosystem and the presence of red tide, biotoxins that are present in the Magallanes region. In addition, we would like to continue holding activities with students so that children

learn about the marine species that exist in the Strait of Magellan, giving them the possibility of observing different organisms.

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 shown in all the diffusion talks and activities with students who participated in this project. In addition, the logo was exhibited in two poster presentations at the 22nd Biennial Conference of the Society for Marine Mammalogy and at the school fair "The scientist goes to the street" held in the public square of Ñuñoa. The logo was also shown in the interview on the radio and local television channel "Radio Polar" of Punta Arenas.

The RF logo will be shown in the next congress of the Latin American Society of Aquatic Mammals, in the talk to government institutions and will be mentioned in the recognition sections of all the scientific literature produced by this project.

11. Any other comments?

This financing was fundamental to be able to achieve the objectives set out in the project. With this project we also realise the importance of the lobster krill in the food web and fortunately the fishery for fuegian sprat in the Magallanes region has not been opened. As young researchers we want to continue generating knowledge of our marine ecosystems and the species that compose them in order to propose effective conservation measures. We greatly appreciate the Rufford Foundation for this great support.