

Robin Rigby Trust Final Report

Project: The Impacts of Fishing and Marine Reserves on the Bacalao, *Mycteroperca olfax* Population at the Galápagos Islands, Ecuador

Principal Investigator: Tyler Eddy, Postdoctoral Fellow, Dalhousie University

Proposal Summary

The Galapagos Marine Reserve hosts ecologically important, diverse and fragile ecosystems, with very high levels of endemism. For local people living at the Galapagos, fisheries within the Galapagos Marine Reserve are a vital source of income. While the endemic bacalao (grouper; *Mycteroperca olfax*) fishery is not as economically important as the lobster and sea cucumber fisheries, historically it was more significant and its importance has increased with the recent collapse of the sea cucumber fishery and the heavy decreases of the lobster fishery. The IUCN Red List currently categorizes *Mycteroperca olfax* as vulnerable due to its limited range and declining fishery catches (IUCN 2008). To achieve the management priority set out by the Galapagos National Park (administrator of the Galapagos Marine Reserve) to evaluate the effectiveness of rights-based management of fisheries, it is necessary to understand the relationship between bacalao populations, human exploitation (fishing), marine reserves, el Niño events, and fishery management strategies. Since 2010, the Charles Darwin Foundation, the official scientific advisor to the Galapagos National Park, has been conducting research on the life history of the bacalao; the present study aims to support and complement the Charles Darwin Foundation's research to inform the Galapagos National Park on the best management practices for the endemic bacalao artisanal fishery.

Collaboration with the Charles Darwin Foundation at the Galapagos Islands on this project will achieve an important management goal set out by Galapagos National Park to evaluate the effectiveness of rights-based management of fisheries. Dr. Pelayo Salinas de León, Senior Fisheries Ecologist at the Charles Darwin Foundation, has identified that there is a lack of information about the bacalao (*Mycteroperca olfax*) fishery at the Galapagos Islands, required for evaluation of the effectiveness of rights-based management for this fishery. This project has been identified as high priority by the Charles Darwin Foundation and the Galapagos National Park as the majority of present fisheries research efforts focus on the already collapsed sea cucumber fishery and the declining lobster fishery.

Reconstruction of historical bacalao baselines at the Galapagos Marine Reserve using an inter-disciplinary approach will allow for a comparison to current stocks. Identification of information gaps will prioritize field research efforts to determine bacalao abundance throughout the Galapagos Marine Reserve. Following this, a spatially explicit bio-economic fishery model that explains the relationship between fishing effort, fishers' behavior, marine reserves and bacalao populations for different regions at the Galapagos Islands will be

constructed. The model will be used to evaluate the effectiveness of rights-based management, the impact of marine reserves and future el Niño events on fishery catches and bacalao populations. This will allow for informed management decisions to ensure the future sustainability of the fishery.

Project Implementation

This project was carried out as a collaboration between Dalhousie University and the Charles Darwin Foundation. As a result of this project, a three year memorandum of understanding has been signed by both institutions, to foster a working relationship and collaborations. In addition, I was appointed as a visiting scientist at the Charles Darwin Foundation for 2014. Two scientists from Dalhousie University also participated in the field project, further building the relationship between the two institutions.

The field aspect of the project was highly successful, as the Charles Darwin Foundation was able to leverage the Robin Rigby Trust funding in order to raise another \$18 000 toward the field costs of the project. As a result, the field component of the project comprised 25 days of field work, based on two vessels, which allowed researchers to survey all of Galápagos Archipelago, except the far north islands of Darwin and Wolf (Figures 1 & 2).

Additionally, I worked closely with Dr. Salinas de León, at the Bio-Mar department of the Charles Darwin Foundation for two weeks preceding and two weeks following field exercises, in order to gather necessary information to inform the bio-economic model, as well as integrate the field data, and develop the model. During my time at the Charles Darwin Foundation, I gave a seminar to the staff about the project approach (Figure 3). I am also writing a report for the Charles Darwin Foundation on these model outcomes, with plans to publish the work as a paper afterward.

Accomplishments

➤ **Time:** Was the time in the field sufficient to accomplish your project objectives? Was the time spend on site optimum for the work or would another season been more appropriate?

The time in the field was sufficient to accomplish field objectives, made possible by counterpart funding secured by Dr. Salinas de León. The time spent on site was optimum for the work.

➤ **Replication:** Would you consider it reasonable to repeat/replicate this project? If so what changes would you recommend in the planning or implementation? If not, why?

There is talk about repeating the project to fill in further information gaps that exist for bacalao, and the fishery for it. This would require another field project, and this has tentatively been

talked about for 2015, funding dependent. Additionally, there is definitely the need to assess fisheries for other exploited species at the Galápagos Marine Reserve, as most do not have any management plan nor management regulations.

➤ **Cooperation:** Cooperation may well have been integral to the project implementation. Are you aware of any cooperative skills you or any of those working with you acquired while in the Field? If so, please discuss and note how this skill will enhance your future working relations.

Cooperation was a big factor for implementation of the project. Along with cooperation with staff at the CDF, we worked with staff at the Galápagos National Park and fishers. A lot of this communication took place in Spanish, which is always a bit challenging, however I believe that I progressed my communication ability in Spanish, which allowed for better exchanges.

➤ **Linkages:** The prime rationale of the Trust is to assist early-career researchers to have overseas coastal research experiences, and to improve existing or develop additional or new linkages with organizations and individuals focused on coastal resource assessment, development, and sustainable management. In Trust projects, people from different geographical areas and cultural backgrounds have on site opportunities to observe and assess both the natural and human resources. Did you forge linkages which will provide opportunities for further identification or resource development in the same or another coastal area?

Yes, there were many linkages forged during the project, between myself and my assistants at Dalhousie and the staff of the Charles Darwin Foundation, the Galápagos National Park, and fishers. We hope to be able to continue this work in the future and also hope to host Dr. Salinas de León at Dalhousie University for a seminar, and to continue working on this project. This work is focused on sustainable fisheries practices at the Galápagos Marine Reserve.

➤ **Sustainability:** Did your study/work in itself provide insight into sustainable resource management? If yes, please note how you or others you worked with might use this awareness to further develop and/or maintain sustainable human (particularly at the personnel level) and natural resources in the focus area.

Yes, the study is going to inform the first management plan for bacalao. The Charles Darwin Foundation is the official science advisor to the Galápagos National Park, who is responsible for fisheries management. We are presently writing a report to inform a management plan for bacalao, which presently does not have management regulations. The report will be given to the Galápagos National Park, and will be used to develop the management plan.

Financial Summary

Item	Total required	Rigby Trust	Counterpart CDF
Travel from Halifax to Galápagos Islands (flights, taxis)	\$1 780	\$1 780	
Boat charter for 25 days at \$1000/day	\$25 000	\$7 000	\$18 000
Accommodation (\$50 x 30 days)	\$1 500		\$1 500
Research Permits & Admin	\$1 000		\$1 000
Personnel time (CDF Senior Scientist & Field assistant x 25 days)	\$3 125		\$3 125
Field gear (Dive gear, laboratory equipment, consumables, light traps, plankton nets, temperature loggers)	\$1 220	\$220	\$1 000
Total	\$33 600	\$9 000	\$24 600

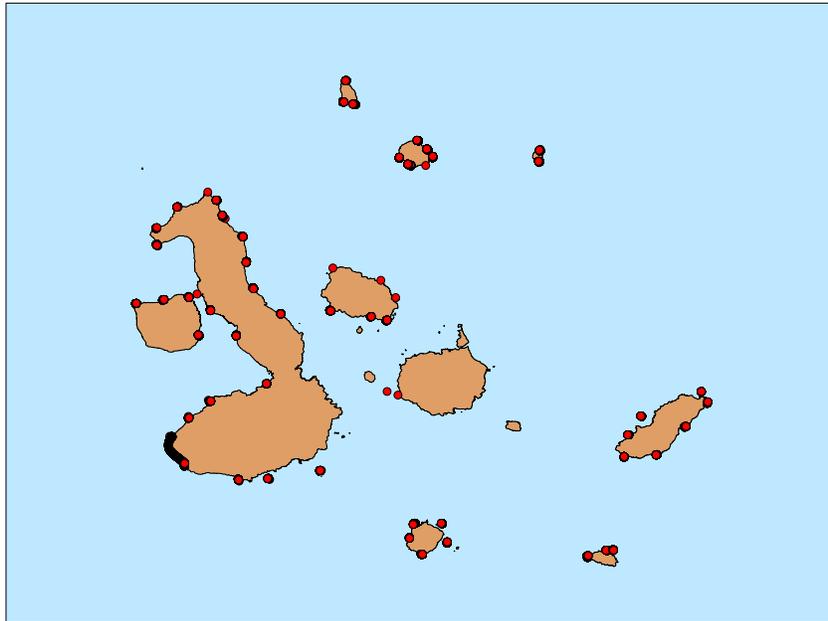


Figure 1. Study sites surveyed for bacalao in the Galápagos Marine Reserve.



Figure 2. The Pirata, used to survey the northern and western regions of the Galápagos Marine Reserve.

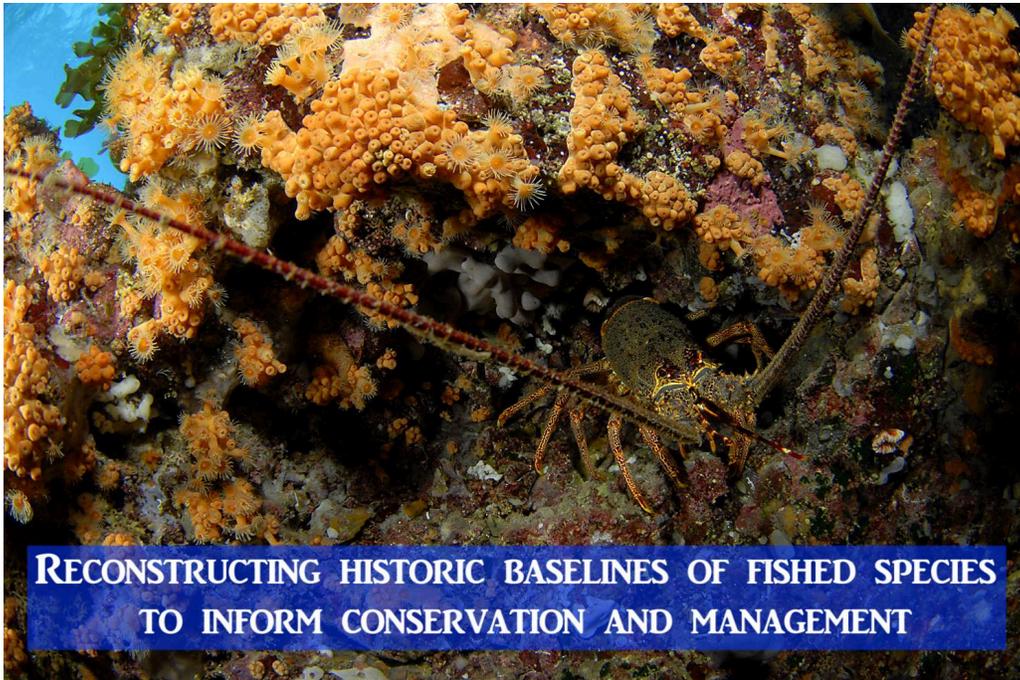


Figure 3. Poster for Seminar at the Charles Darwin Foundation.