

The Rufford Small Grants 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.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Alexandra Avila
Project title	Genetic Diversity and Conservation of the Misty Grouper (<i>Hyporthodus mystacinus</i>) in the Galapagos Islands, Ecuador”
RSG reference	10574-1
Reporting period	December 2011- December 2012
Amount of grant	£6,000
Your email address	alexandra.m.avila@gmail.com
Date of this report	02/10/2017

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
Determine Genetic Diversity of <i>H. mystacinus</i> population in Galapagos			X	
Educate local Fishermen on "shifting baseline" and importance of conservation			X	
Propose a management plan to the GNP			X	

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

Some jealousy arose among some of the fishermen because a few of them provided me with more fish samples than others. So from then on, I asked the fishermen not to discuss with other fishermen how much or how little they caught. In addition, the primers originally designed for the genetic analysis did not work, new primers had to be designed and made in the US. This added additional time and expenses to the project.

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

1) There were high levels of genetic diversity which suggest a healthy population as well as high population connectivity within the Galapagos. The variance component of genetic diversity at the individual level both within and between individuals suggests no inbreeding or assortative mating within each location. Our results suggest great levels of gene flow among the localities, due to the fact that there are no real geographic barriers to separate the individuals from one locality from the next.

2) Fishermen were very pleased to participate in the project not only because they benefited financially but also because they were being educated and are now more aware of the "shifting baseline" concept. They were eager to learn about my project and how it could affect them and enjoyed learning very basic genetic and management concepts.

3) One of the reasons why there are such high levels of diversity within individuals and such low levels among regions is because of the high levels of gene flow among localities which also explains the high levels of heterozygosity. In order to maintain these high levels of genetic diversity, gene flow among localities must be maintained. Historically, the Galapagos Islands fisheries have been focused on the *M. olfax*, but in recent years the trend has moved to a fishery focused on the *H. mystacinus*. According to local fishermen, the switch occurred because they can no longer fish *M. olfax* in the abundance that they used to. As demand for this species increased, its population started to decline because of overfishing and the remaining population is now found in deeper waters which gave the fishermen no other choice but to switch fish species. The information provided by the fisherman was confirmed by the Galapagos Marine Reserve (GMR) report by Murillo *et al.* (2003) and Molina *et al.* (2004); since the coastal species of grouper demersal fish are decreasing (specifically *M. olfax*), people are increasingly relying on species of demersal fish found in

the seamounts (“bajos” in Spanish) such as the *H. mystacinus*. As for conservation of the species, ideally, considering that the local fishermen are fishing within a marine reserve, the Galapagos Marine Reserve (GMR), the Galapagos National Park (GNP) should only allow fishing for local consumption and not for exportation to the main land or international consumption. However, due to the fact that this activity constitutes the fishermen’s livelihood this is not entirely feasible and other conservation efforts could be considered. An alternative would be to set aside no take zones on seamounts where *Serranidae* are usually found. Connectivity between all of the localities will likely maintain levels of genetic diversity, heterozygosity and gene flow in spite of overfishing of local populations at seamounts. The *H. mystacinus* is considered to be a metapopulation in Galapagos, which means that each one of the localities has the possibility of going extinct. The optimal harvest regime depends on the endogenous source-sink dynamics, which are determined by differences in population levels across space, as well as on the biological mechanisms acting on dispersal (Sanchirico *et al.* 2005) Therefore the key to understanding the optimal management of marine species is knowledge of dispersal and gene flow (Gerber *et al.*, 2003; Guichard *et al.* 2004). It must first be determined where the source of this metapopulation is located and where the sink is located and in order to accomplish this, further research is needed on the mainland. Taking ocean currents into account we might assume that the mainland could be the source of the Galapagos metapopulation but since there is no evidence of this yet I therefore suggested for the GMR to either set aside some of the seamounts as no take zones in which all fishing is prohibited or to set a maximum amount of fish that can be taken from any one of these seamounts in order to prevent depletion or overfishing of the species, as was the case with the endemic *M. olfax*. Another option would be to rotate the no 17 take seamounts on a yearly basis; i.e. in one year allow fishing in the Banco locality and setting the Isanco locality as no take zone and the following year reversing them. With each passing year, *H. mystacinus* fisheries are becoming more important commercially to the local economy in the Galapagos Islands.

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

The local fishermen community were an essential part of the project. They benefited economically and educationally. Not only did each fisherman who was willing to cooperate with the study receive a monetary reward of \$5 per sample but they also were educated in areas of basic genetics, management, ecology and conservation. The fishermen helped me with the sample collection which included learning how to record GPS coordinate data (and the name of the location or area where the samples were caught and, if possible, the depth at which they were caught), in addition to learning how to measure the total length and weight of each individual. The fishermen were also in charge of noting any morphometric or characteristic differences between each individual. They were proud of the role they played as they felt that they were cooperating in a project that would benefit them in the long run as well as the fish population of the islands.

5. Are there any plans to continue this work?

I would love to continue this work, and be able to compare the Galapagos population to the mainland population and to the Atlantic population but this depends greatly on future funding for this project.

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

The results of my work have already been shared among the fishermen that participated in this project and any member of the local community that was willing to listen. Also I plan on publishing my results in a scientific journal.

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 the RSG were spread out throughout the duration of the project, i.e., over a period of 11 months and 3 weeks. I applied for the RGS as soon as I received the GNP permit to do my research; unfortunately waiting for the GNP to actually approve the project and provide me with the permit took 1 year.

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
2 Airplane trips to Galapagos (one for sample collection and the other for the fishermen workshop)	375	375	0	
GNP entrance fee and INGALA	20	20	0	
Galapagos: Room rent for 3 months	656	600	-56	Negotiated for a slightly lower price
Food for 3 months in Galapagos (£12.49 per day)	1124	1200	+76	Price of food varies depending on whether shipment comes in or not
Reward for fishermen for 200 Samples	625	505	-120	I was not able to collect all 200 samples
Reward for fishermen for 5 whole fish (estimating a cost of £2.50 per kg, with individuals of 20kg)	250	300	+50	Some individuals were larger and weighed more
Cost of the workshop for fishermen	313	300	-13	
Printing of data sheets and procedures and lamination for fishermen	10	10	0	
Clip boards, box cutters, meters, pens, alcohol, paper and markers	64	75	+11	
materials needed for Field lab analyses (includes 12% sales Tax in Ecuador)	1647	3005	+1358	Need to re-order primers for genetic analysis due to the fact that the

				originals one did not work well
Transport to Ballenita (Gasoline)	40	65	+25	
Rent in Ballenita : £12.49 per night, 30 nights	375	750	+375	Had to stay an additional month when primers did not work
Ballenita Food: £6.24 per day, food for 30 days	188	375	+187	Had to stay an additional month when primers did not work
Ballenita: Use of laboratory specialized in genetic analysis of marine organisms	313	0	-313	Nothing was charged for the use of the specialized lab
TOTAL	6000	7580	+1580	

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

It would be very important to see that the GNP implements a management plan for the species. They have not always done so in the past and currently some species like *M. olfax* are suffering because of this.

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?

Yes. It was used in presentations made to the fishermen (workshop) and in pamphlets handed to them and to the community.

11. Any other comments?

I am very thankful to the RSGF for providing the funds for this project. It would have been impossible for me to carry it out without the RSG adequate funding.