Final Evaluation Report

Your Details	
Full Name	Simon Gartenstein
Project Title	Effects of habitat complexity and management on size structure and function of marine communities in Lessonia trabeculata kelp forests of south-central Chile
Application ID	29424-1
Grant Amount	£6000
Email Address	simon.gartenstein@alumnos.uach.cl
Date of this Report	16 September 2021

1. 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
Fieldwork			■	10 dive trips (two dives each trip) were completed during the project period. We now have a robust methodology to sample the kelp forest ecosystem (fish, invertebrates, marine mammals, algae, kelps, and habitat complexity characteristics). In addition, we are building our datasets from established sites. We have been reporting, presenting and publishing the results from these datasets (explained below). A monitoring plan of fixed sites has been initiated with support from the local fish communities, who assist with logistics/monitoring activities. We will continue to dive and undertake our investigations. This project is one of the first in south-central Chile to assess the biodiversity, function and structure of the kelp forest ecosystem.
Data management & production of results			■	The field data has been safely entered, checked, analysed. The use of results and project outputs is detailed below.
Community engagement (explorer/outreach program)			■	Photographs of biodiversity (taken with equipment purchased with Rufford funding) has been used to produce a poster, which describes the kelp forest ecosystem. **Link to poster can be made available on Google Drive.** The funding to produce the poster was provided by our explorer/outreach programme. Our laboratory manages an explorer/outreach programme that involves a number of local schools. We currently have 60 active students (and their teachers). A member of our project team, Eliseo Fica, did a public talk in March 2021 in which he promoted the poster and our work in the kelp forests.

				The poster has been distributed to the following groups: Explorer schools, NGOs (Oceanosfera, Corallina), The Nature Conservancy (TNC), Universidad Austral de Chile. Oceanites (a group of marine biology students from the Universidad Austral de Chile who work in outreach programs with people from Valdivia and coastal communities). Municipalities of Valdivia and Corral (local councils) Many friends, family and colleagues Sharing biodiversity photographs in our social media accounts (mostly Instagram).
Community engagement (consultation with fishing community and environmental groups)				Direct consultation with the fishing community was made during fieldwork, with many informal social discussions about the research project and resource management. Many new contacts and relationships were formed during these occasions. Due to Covid restrictions more formalised onsite presentations were not able to be done. However, communication was achieved via online presentations (see point 5 below), a project video (see point 5), reporting to TNC and their collaborators (see point 6), production of photographic outputs (poster and photographic portfolio), and sharing of information in social media, especially Instagram. I participated in a regional workshop (3 September 2020): "*Análisis Manejo y Gestión del Espacio Marino Costero de la Región de Los Ríos*" (Analysis and Management of marine and coastal zone environments in the south-central region of Chile): Participation from local fishing communities, local government, TNC, and the Universidad Austral de Chile. Early discussions and planning took place on the feasibility of a joint management, monitoring and education plan for the region focusing on biodiversity and sustainability of marine resources.

Scientific/ presentations/project video				I presented at the 34th Annual Conference Australasian Society of Phycology and Aquatic Botany (23 and 24 November 2020). Title: Predator-prey dynamics in *Lessonia trabeculata* kelp forests of south-central Chile (Zoom meeting). Formal project/thesis presentation to PhD programme committee, colleagues and visitors at the Universidad Austral de Chile (14 April 2021) (Zoom meeting). Many short presentations to team and laboratories within the university (Zoom meetings). A video of me presenting our research project was made by the Universidad Austral de Chile, that was presented at the conference, Congreso de Ciencias del Mar in May 2021 (Punta Arenas, Chile). The video is also being used within the university to promote scientific research activities. **Video can be made available on Google Drive.**
Delivery of reports to The Nature Conservancy and their collaborators				As part of my contract with TNC (contract no. 028-2020), the following reports were delivered containing data, photographs, and other results that will be included in their updated conservation plan. Here are the titles and dates of the deliverables: Predator-prey interactions in kelp forests of *Lessonia trabeculata*. Delivered 25 September 2020. Biodiversity and community structure in kelp forests of *Lessonia trabeculata* of south-central Chile. Delivered 31 January 2021. Delivery of final report and photographic portfolio. Delivered 4 May 2021. **Portfolio can be made available in Google Drive.** The reports have been distributed to community members and collaborators of TNC from the Valdivian Coastal Reserve, and local NGO Oceanosfera, to assist with their marine education and conservation programs. The development of the new conservation plan is still work in progress. It

				is estimated to be over 250 pages.
7.Academic publications				I am currently working on two scientific papers. One of these papers was submitted to the Latin American Journal of Aquatic Research but requires further information to be published.

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

- We have had Covid restrictions e.g., quarantine, during the project period. Even though we were delayed for a few months at the start of the project, in accordance with university protocols we were able to continue diving throughout the rest of the project period.
- Despite challenging weather and ocean conditions during the autumn and winter months, fieldwork went smoothly, with very few logistical/technical problems.
- Despite Covid restrictions, engagement with the wider community and other stakeholder groups occurred during field activities (applying safety protocols), via online options, reporting, photographic outputs (see point 3 below for detail), and social media.

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

- By applying appropriate safety protocols, we were able to continue with all project objectives during quarantine. Obviously, some modifications were made, such as how we engaged with stakeholders, but with online communications we were able to proceed successfully with the project.

- Using our photographs from our fieldstrips we were able to produce a photographic portfolio (delivered to The Nature Conservancy) containing most of the fish, marine mammals, invertebrates and seaweed species recorded during our surveys. From these photos a poster of the kelp forest ecosystem was produced and shared with multiple stakeholders. Our photographs were also shared with our friends and colleagues in the social media.

- We established a robust methodology for sampling the kelp forest ecosystem, and now we have fixed monitoring sites, which are essential for monitoring and reporting on ecosystem health. Also, we have baseline data of biodiversity associated with the kelp forest ecosystem in the region. Apart from TNC having a short list of some species that inhabit the kelp forests of Valdivia, their information has not been previously summarised in papers or reports.

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

Copies of the poster that we produced have been distributed to many local environmental and community groups (detailed above), which they can use in their work programmes.

As part of our outreach program, many copies of the poster were delivered to local schools, to assist with their environmental education programmes.

Financially we have supported local communities through the hiring of boats and renting of dive gear.

Our project objectives are directed towards the conservation of kelp forests, which supports the conservation and management goals of environmental organisations and local communities in the area.

5. Are there any plans to continue this work?

Yes, we plan to continue our investigations in the kelp forests of south-central Chile. As the exploitation of kelp forests continue in the central to northern parts of Chile, our research is becoming more important. We think it is imperative that we continue monitoring the kelp forest ecosystem, because with longer term data we are able to make a more accurate analysis of the temporal changes in biodiversity, function and structure of the kelp forests under natural seasonal disturbances. To better understand this ecosystem, we plan to do the following additional investigations:

- Determine the physical effects of waves, surges, currents, and tides.
- Measurement of water quality parameters (nutrient availability, chlorophyll-a temperature), which can indicate levels of productivity and ecosystem health.
- Determine the risk of biodiversity, function and structure of kelp forest ecosystems to the range expansion of invasive species (i.e., the northern black sea urchin).
- Continue monitoring our established sites, and sample new sites within and outside of the Valdivian Coastal Reserve.

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

The data, results and photos have been shared in:

- Presentations (academic, explorer programme, and stakeholders from the Valdivian Coastal Reserve).
- TNC objectives, directed at conservation of the Valdivian Coastal Reserve.

- Shared field data (fish and invertebrates) with the international Reef Life Survey team.

- Scientific publications (including those of fellow PhD student, Eliseo Fica, who is also using the project data).

- Social media i.e. Instagram

- Local communities during fieldwork activities.

We will continue to share our results in scientific publications, academic forums in the university, our stakeholders (local communities, NGOs, environmental organisations e.g., TNC, external universities in Chile and abroad), and social media.

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

From September 2020 to September 2021. This was in line with the original timeframe of the contract and project.

8. Budget: 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. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Underwater camera package (camera, housing, wide angle lens, and mounting accessories)	2543	2068	-475	The wide-angle lens and mounting equipment was cheaper than initially anticipated.
Scuba diving package (BCD, 2 X regulators, air gauge)	552	810	+258	Due to lack of availability of the regulator from the initial quote, a more expensive regulator was purchased.
Dive computer	257	247	-10	
Misc. diving equipment (mask, hoods, gloves, dive slates, cinturon, antifog)	127	748	+621	The dive team had less equipment than previously thought, so extra equipment (e.g., masks, gloves, dive slates, dive hoods, torch, dive

				belts and weights) were purchased. Good quality equipment was purchased, and is necessary, due to diving in cold water during the winter period
Undergarment for diving	114	210	+96	A better-quality product was bought for the cold water and winter conditions.
Dive tanks	988	1329	+341	Initially we planned to rent dive tanks, but we decided to buy 6 new tanks. This change of plan was communicated with the Rufford Foundation. We are now better equipped with our own gear to do future dive trips.
Maintenance/servicing	500		-500	As our equipment was new and we had no technical issues maintenance/servicing was not required. This money was used to purchase misc. diving equipment that was required for other team members.
Computer/printer replaced with temperature logger	719	384	-335	Instead of purchasing the computer and printer we decided to buy a needed temperature logger for our experiments. Also, there was no need to buy the computer and printer for the laboratory because of the closure of the university campus during the covid pandemic.
Management of overheads	200	200		Costs of paying for couriers within Chile.
Co-funding items (miscellaneous materials, car rental, food, boat hire, car fuel)	7,199	7,199		Co-funded items that were funded by the laboratories research project were completed under budget.
Total	**6000**	**5996**	**-4**	

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

Continue our investigations in the kelp forests of south-central Chile to better understand the biodiversity and function of these ecosystems. Even though we are

progressing well, from a scientific perspective we need to do more studies and increase our datasets. In this way, we can do more robust analyses and reporting. Over the last year we have invested considerable time in the development of our methodology, site selection and use of equipment. Now with our experienced team we are in the perfect position to continue our research and expand our understanding of the kelp forests, taking into consideration local and external factors (water quality indicators, local climate factors), and pressures (risks of invasive species).

Due to the destruction of kelp forests in the north of Chile by harvesting (Chile is the largest exporter of kelp products in the world with > 40% of the world export), and because we are the only kelp forest research team working in the relatively unexplored coastline of south-central Chile, our research will be very important to better understand the function of the kelp forest ecosystem. We want to be able to show that conservation and sustainable management of kelp forests is imperative to maintain marine resources for future generations, while maintaining the ecological integrity of the kelp forests. With the publication of information and education of stakeholders through presentations and social media, we hope to prevent any future large scale harvesting activities taking place in this region of Chile. Also, we want to work closer with research teams from other universities and organisations to promote the importance of kelp forests, not just for marine resources but also for climate change reasons i.e., kelp forests are more than 20 times more efficient than terrestrial forests in the capture and storage of atmospheric carbon.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

The logo was used for the following outputs:

- Project/thesis presentation to PhD programme committee, colleagues, and visitors at the Universidad Austral de Chile (14 April 2021) (Zoom).

- The production of the university made video promoting the Rufford project, that was presented at Punta Arenas (May 2021) during a conference and is currently in use to promote marine biology activities at the Universidad Austral de Chile (see above for detail).

- My three deliverables to TNC (September 2020, January 2021, and May 2021) (see above for details).

- Poster showing biodiversity in kelp forest ecosystem (see above).

- Acknowledgements to the Rufford Foundation in the academic publication that was submitted to the Latin American Journal of Aquatic Sciences, "Prey selection in *Lessonia trabeculata* kelp forests of south-central Chile".

- The project was promoted in our laboratories Instagram account (ecologia. litoral)

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

The dive team were:

1. Eliseo Fica (PhD student/scientist, ecosystem monitoring, and data entry)

2. Catalina Velasco (Director of NGO, Fundación Mar y Ciencia, PhD student/ scientist, ecosystem monitoring, and in charge of social media for the laboratory)

3. Vicente Ignacio Villalobos (scientist, ecosystem monitoring and data entry)

4. Diego Fernando (scientist, ecosystem monitoring and data entry)

Laboratory supervisor, Dr. Nelson Valdiva, managed co-funding support, and gave scientific guidance.

12. Any other comments?

Project funding from The Rufford Foundation has allowed us to advance successfully with our project, and to show for this, we have produced many important outputs. We are very motivated and excited to keep the ball rolling and, for this reason, I would like to apply for a Second Rufford grant. This will allow us to continue our research. We are very appreciative of the support from The Rufford Foundation. Thank you.