Final Evaluation Report

We ask all grant recipients to complete a project evaluation that helps us to gauge the success of your project. This must be sent in **MS Word and not PDF 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 – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please DO NOT fill in and submit this form until the project has been completed.

Complete the form in English. Note that the information may be edited before posting on our website.

Please email this report to jane@rufford.org.

Your Details	
Full Name	Mayra Lizzeth Núñez Vallecillo
Project Title	Meta-Ecosystems: Connectivity and Energy Flow between Marine-Coastal Ecosystems in the Honduran Caribbean
Application ID	43563-1
Date of this Report	12/11/2025

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
Evaluate the effects of land-use change on water quality and marine biodiversity in four watersheds along the North Coast of Honduras			X	The monitoring campaigns (two conducted during the dry seasons and two during the rainy seasons) were successfully completed across the four watersheds: Ulúa, Lis Lis, Cuero–San Juan, and Los Micos. During each campaign, physicochemical parameters were measured in situ using multiparameter probes, while nutrient concentrations were determined using spectrophotometric analyses. Data were collected from marine sites, lagoons, and river mouths, providing a comprehensive temporal and spatial dataset. These data were used to demonstrate clear correlations between land-use change, water quality degradation, and reef health, particularly highlighting the strong influence of the Ulúa watershed on nearby coral reef conditions within the Mesoamerican Reef System.
2. Analyze trophic connectivity and energy flow between terrestrial and marine ecosystems using stable isotope			X	A total of 195 fish, 105 coral, and 182 baseline samples (primary producers and consumers) were collected for dry and rainy season. All samples have been processed, and carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$), and sulphur ($\delta^{34}S$)

analysis (C, N, S)				were analysed. The full set of processed tissue samples (fish, coral, and baseline primary producers/consumers) was submitted to the specialized stable isotope laboratory, where isotopic composition for C, N, and S was successfully measured for all samples.
3. Identify fish movement and connectivity patterns through otolith microchemistry			X	Otoliths from both target species 116 lane snapper (*Lutjanus synagris*) and 79 common snook (*Centropomus undecimalis*) were extracted and prepared for microchemical analysis to track movement patterns between freshwater, estuarine, and marine environments. All specimens were collected with the support of local artisanal fishers at previously identified fishing sites, whose participation was essential for the successful and ethical collection of biological samples.
4. Strengthen local conservation capacity and coordination among protected area co-managers			X	The project was conducted in close collaboration with The Coral Reef Alliance, FUCSA, PROLANSATE, AMATELA, ASIDES, and HRI, fostering partnerships for integrated coastal management.
5. Disseminate results to local stakeholders and support evidence-based management strategies		X		Preliminary results have been shared with co-managers, and final dissemination (including workshops and outreach materials) is planned after completing isotope and microchemistry analyses.

2. Describe the three most important outcomes of your project.

a). The project demonstrated a clear relationship between land-use change and reef health along the Honduran Caribbean. Among the four studied basins, the Ulúa watershed showed the strongest influence on the Mesoamerican Reef System, where the expansion of African palm (Elaeis guineensis) and banana plantations represented the main anthropogenic drivers of change. These land-use transformations were associated with increased nutrient runoff and sediment inputs, which were reflected in the condition of nearby coral reefs. In contrast, a positive correlation was detected in basins with higher coverage of preserved native vegetation, where better water quality conditions and healthier reef indicators were observed.

b). Establishment of a multi-ecosystem baseline for energy flow and connectivity Through the collection and processing of 195 fish, 105 coral, and 182 baseline samples, the project created a comprehensive dataset that integrates marine, coastal, and freshwater systems. This baseline will support isotopic and microchemical analyses to understand energy transfer across ecosystems and the role of key species such as lettuce coral (*Agaricia tenuifolia*), the common snook (*Centropomus undecimalis)* and lane snapper *(Lutjanus synagris*) in connecting habitats. This represents one of the few studies in the region addressing connectivity from a meta-ecosystem perspective.

c). The project strengthened collaboration among local organizations including The Coral Reef Alliance (CORAL), Healthy Reefs for Healthy People (HRI), FUCSA, PROLANSATE, AMATELA, and ASIDES. This coordination improved fieldwork logistics and built local capacity for integrated land–sea management, promoting better water quality and the protection of critical marine habitats.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

One of the main difficulties during the project was obtaining sufficient funding to complete all planned activities, particularly the laboratory analyses. To address this challenge, FUCSA and CORAL incorporated the project into their ongoing conservation programs and provided additional financial support, which ensured that all samples could be processed and analysed as planned. Additionally, weather conditions caused delays during the first field campaign, as heavy rains and rough sea conditions required postponing the initial sampling effort. Despite these challenges, the team successfully completed all campaigns. This experience highlighted the importance of contingency planning in coastal fieldwork, where weather variability can significantly affect access, safety, and sampling schedules.

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

Local community participation was essential for the success of this project. In each protected area, we had the support of at least two local volunteers, along with one international volunteer, who assisted with field logistics, data recording, and sample processing. Artisanal fishers were key collaborators in the collection of biological

samples, providing valuable local knowledge and helping with fish capture during the field campaigns.

The co-managing organizations of the protected areas played a fundamental role in coordinating field activities, ensuring effective collaboration with local stakeholders. In Trujillo, the local Fire Department (Cuerpo de Bomberos) and the Honduran Naval Force (Fuerza Naval de Honduras) provided logistical and security support during the field trips, particularly in transportation and site access.

In addition, the in-situ water quality data collected during the campaigns have already been presented to the Protected Area Committees of Trujillo and Tela, contributing to local decision-making processes and increasing awareness about watershed impacts on coastal ecosystems.

These collaborations not only strengthened the coordination between local communities and conservation institutions but also built local capacity and understanding of how land-use change and water quality affect marine ecosystem health and connectivity in the Honduran Caribbean.

5. Are there any plans to continue this work?

In the long term, the goal is to expand the project to additional watersheds that may also have significant effects on coral reef ecosystems, including the Agua River, Lean River, and the Motagua River basin in Guatemala, which discharges into the Mesoamerican Reef System. Expanding the study to these regions will strengthen regional collaboration and generate comparative data that can guide transboundary conservation and management efforts within the Mesoamerican Reef.

This continuation will also build upon the partnerships established with local organizations and co-managers, ensuring that the results contribute to evidence-based management and to the design of integrated land–sea conservation strategies for Honduras and the wider region.

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

The results of this project will be shared through multiple channels to reach both scientific audiences and local stakeholders. At the local level, the findings will be presented to protected area co-managers, community committees, and local authorities in Tela, Trujillo, Cayos Cochinos and Cuero y Salado through participatory meetings and workshops. Results and outreach materials will also be disseminated through local media outlets, including community radio stations, newspapers, and social media, to increase public awareness about the importance of water quality and land–sea connectivity for coral reef conservation.

At the scientific level, part of the project's preliminary results has already been presented at the Gulf and Caribbean Fisheries Institute (GCFI), contributing to regional discussions on integrated watershed and reef management. Further dissemination will include peer-reviewed publications, conference presentations,

and sharing of findings on ResearchGate and LinkedIn. The project is being implemented in close collaboration with The Coral Reef Alliance (CORAL), Healthy Reefs for Healthy People (HRI), Fundación Cuero y Salado (FUCSA), Asociación Amigos de la Tierra de La Tela (AMATELA), Fundación para la Protección de Lancetilla, Punta Sal y Texiguat (PROLANSATE), Fundación Cayos Cochinos (FCC), Asociación de Investigación para el Desarrollo Sostenible de Honduras (ASIDES), as well as with central and local government agencies, ensuring that results contribute directly to management and policy processes.

Finally, outreach materials such as infographics, videos, and community presentations will be developed to communicate key findings in accessible formats, emphasizing how integrated watershed and marine management can improve water quality, reef health, and the sustainability of marine resources in the Honduran Caribbean.

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

Looking ahead, the most important next steps are to strengthen local and regional collaboration and expand the study to include mid- and upper-watershed areas, which are essential for understanding how inland land-use practices influence coastal and marine ecosystems. Strengthening cooperation between organizations working on terrestrial and marine conservation will be crucial, as reef health is directly linked to watershed management and freshwater inputs.

One of the main goals moving forward is to establish an integrated land–sea management committee that brings together stakeholders from watershed management, fisheries, and marine conservation sectors. This group would promote coordinated decision-making and the implementation of sustainable practices to reduce sediment and nutrient runoff that threaten reef ecosystems.

It is also important to continue studying connectivity between terrestrial and marine environments through the movement and trophic relationships of key marine and estuarine species. Expanding this research to include species such as the common snook (*Centropomus undecimalis*), the yellowtail snapper (*Ocyurus chrysurus*), and the staghorn coral (*Acropora cervicornis*) will provide a broader understanding of how energy and nutrients move across ecosystems and how these processes sustain biodiversity and fisheries productivity.

Regionally, engaging partners from Guatemala, Belize, and Mexico will be vital, as these countries share the Mesoamerican Reef System and face similar transboundary challenges related to river discharges and coastal pollution. Strengthening regional collaboration and data sharing will enable the development of joint management strategies to protect connectivity and improve ecosystem resilience.

Finally, securing additional funding will be key to supporting long-term monitoring, laboratory analyses, and capacity building, ensuring that local communities, managers, and policymakers continue to benefit from science-based strategies for the conservation and sustainable management of the Honduran Caribbean.

8. 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?

Yes. The Rufford Small Grants Foundation logo was included in the presentation of preliminary results at the Gulf and Caribbean Fisheries Institute (GCFI) conference, as well as in reports shared with protected area co-managers and partner organizations involved in the project. The logo was also used in social media posts to acknowledge Rufford's support and to highlight fieldwork and project achievements.

The logo will continue to be included in future scientific publications, outreach materials, and upcoming conferences, ensuring proper recognition of Rufford's contribution to the project and its role in supporting marine conservation research in Honduras.

9. Provide a full list of all the members of your team and their role in the project.

- Ph.D.(a). Mayra Lizzeth Núñez Vallecillo – Project Leader and Principal Researcher

Mayra directed the project from its design and planning through implementation, data collection, and reporting. She coordinated all field activities across the four study basins, managed collaboration with partner organizations, and led the scientific writing, data interpretation, and overall project coordination. Mayra also served as the main liaison between local institutions, communities, and international collaborators, ensuring the integration of research and conservation objectives.

- Dr. Konrad Górski – Principal Advisor

Konrad served as the main academic supervisor and provided guidance throughout the project. He supported the laboratory procedures and data interpretation, particularly in the otolith microchemistry and stable isotope analyses, and contributed to the overall design and scientific direction of the research.

- Dr. Antonella Rivera – Co-supervisor and Community Collaboration Lead

Antonella facilitated collaboration with fishing communities and participating organizations in Honduras. She played a key role in building partnerships, coordinating with local institutions, and guiding the implementation of fieldwork and water quality monitoring activities at the national level.

- MSc. Marcela Garay – Field and Water Quality Assistant

Marcela supported the field campaigns, particularly in the collection of water quality data and biological samples. She assisted in sample management, field logistics, and the application of standardized protocols for data collection.

- MSc. Jorge Anariba – Spatial and Land-Use Analysis Specialist

Jorge was responsible for the analysis of land-use change and its relationship with coastal and marine variables. He processed and analyzed satellite imagery (Landsat and Sentinel) to identify spatial patterns and supported the integration of remote sensing data into the project's environmental models.

- Field Biologists and Volunteers

Several marine biologists and local volunteers supported fieldwork in the four study basins. They assisted in the collection of fish, coral, and water samples, as well as in in-situ data recording and logistics. Their contribution was essential to complete all sampling campaigns successfully and to strengthen local engagement in the research process.

10. Any other comments?

I would like to express my sincere gratitude to The Rufford Foundation for their financial support, which made it possible to successfully complete this project. The grant was essential to carry out the fieldwork, laboratory analyses, and community collaboration activities.

This project represents an important step toward understanding the connectivity between terrestrial and marine ecosystems in the Honduran Caribbean. I truly hope to continue working with the Rufford Small Grants Programme in the next phase to expand this research and further contribute to the conservation of the Mesoamerican Reef System.

ANNEX – Financial Report

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