

### **Final Evaluation Report**

Your Details	
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Project Title	Polycyclic Aromatic Hydrocarbons and Organochlorine Pesticides in the World's Largest Fish and its Food in the Whale Shark Refuge Area in Bahía de La Paz, Mexico
Application ID	39788-2
Date of this Report	12-12-2024



# 1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	<b>Partially</b> achieved	Fully achieved	Comments
a) To evaluate the presence of polycyclic aromatic hydrocarbons and organochlorine pesticides in whale shark skin biopsy, zooplankton and phytoplankton.				This objective was successfully completed by adhering to the budget and agreeing to lower the price per sample. It was observed that BLP is a source of pollutants for whale sharks. Additionally, it was demonstrated that biomagnification in organisms varies based on exposure time, diet, metabolism, trophic level, and other factors. The dilution between trophic
				levels is likely due to the size difference between predator and prey, at least for PAHs.
b) Searching for microplastics in the whale shark refuge area.				Another of our objectives that was successfully achieved. The microplastics from project 30058-1, funded by the Rufford Foundation, were supplemented by those obtained in the present study. The results indicated that the presence of these microplastics is influenced by land- based coastal activities, wastewater, fishing nets, cutlery, disposables, plastic bags, bottles, packing foam, fishing buoys, fishing gear, food containers, supermarket bags, swimsuits, textile residues, paints, varnishes, thermal insulators, pharmaceutical blister packs, toys, straws, pipes, ropes, tubes, and others. These microplastics showed degradation due to waves and mechanical abrasion from the coast. An increase in the number of pieces



		was observed over the years,
		compared to previous studies
c) Organize educational		Among the activities planned with the
activities to increase		community, they were carried out,
awareness of the results		although with some inconveniences,
achieved, the		such as the lack of participation in
importance of		responding to the survey and the
conserving whale sharks		limited willingness of restaurants to
and preventing marine		implement a composting system.
pollution through beach		Additionally, there was low attendance
clean-ups. As well as		at the beach clean-up events organized
the provision of		through a call for volunteers.
workshops in schools		However, the clean-up through
for the composting of		bartering was a complete success, as
domestic organic waste.		were the composting workshops.
Establish a record of the		
type of waste found in		
the home and in the		
facilities where it is		
available. In addition to		
conducting research on		
community knowledge		
of sources of pollution		

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

a) The analysis of polycyclic aromatic hydrocarbons and organochlorine pesticides in a short food web in Bahía de La Paz. This project helped us understand and provide more information about the biomagnification of persistent organic pollutants in marine food webs.

b) The study of microplastics found in the previous study in Bahía de los Ángeles was completed with the present study, where we collected samples and found a higher amount of microplastics in BLP than in BLA. Additionally, it was demonstrated that these microplastic pieces increase over time.

c) The activities carried out with the community were among the most important contributions in BLP. Beach clean-ups were essential, and we had people participating. However, the bartering activity, which exchanged one hour of free kayaking for beach cleaning, was one of the activities with the highest participation. The composting workshops in primary schools were another activity that had the greatest community impact, as the workshops were mandatory and replaced a class. A permanent composting system was set up at CICIMAR for the student and staff community.



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

One of the difficulties we faced at the beginning of the project was that we had not considered the community activities. When we included them, it completely altered the budget and the planned activities. However, we made numerous adjustments and were able to complete all of them. During the development of the project, one of the challenges we encountered was the low participation of people in completing the digital survey. Additionally, we did not have the participation of local restaurants in the composting workshops, as they found it difficult to set up and maintain the composting systems due to a lack of space and staff. For this reason, we focused on conducting composting workshops in primary schools with 5th-grade students, who showed the most interest. We also set up a composting system at CICIMAR to serve as an example for other institutions. Furthermore, we carried out beach clean-ups, particularly through the bartering activity, which was repeated at various beaches and over several weekends, becoming the most successful activity.

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

As mentioned in the previous point, community participation was complex. The restaurants did not show interest because setting up and maintaining the composting systems was difficult due to a lack of staff and space. However, they were willing to pay a company to handle the collection of organic waste and carry out the composting for them.

The workshops in the schools were practically mandatory, as they replaced a class. This strategy implemented by the teachers was very favorable for us, resulting in great participation from the children. They were asked to collect what they considered organic waste at home. Once at the workshop, they were taught how to separate the waste, as many children were unsure of what was considered organic and brought plastic bottles, single-use wrappers, etc.

A talk was given on how to make compost, its advantages, and its importance. The children worked in teams to learn how to identify and separate organic waste and create compost with and without worms. As complementary activities, they played compost bingo, and a few bags of humus were raffled off. The materials and worms were provided to the children so they could replicate what they had learned in the workshop at home.

At CICIMAR, two composting systems were set up, one with and the other without red Californian worms. To this day, the student community maintains it with organic waste from their homes and later takes the humus obtained, along with some worms, to set up their own worm composting systems at home."

Two beach clean-up activities were carried out:

- 1. Clean-up through calls for volunteers; however, there was less voluntary participation.
- 2. Kayak exchange for 1 hour of cleaning. In this activity, we set up at various beaches in La Paz, B.C.S., for 6 hours from Thursday to Sunday during the summer. We provided bags and a sieve to help collect small pieces of trash from the sand. Participants handed over their trash, and we lent them a kayak for one hour per person. This particular activity had great community participation, as well as participation from tourists living in other states of the country. It was our most successful activity. Additionally, we collaborated with A.C. Mar de Cortés.

As for the results of the contaminant analyses in whale sharks and Bahía de La Paz, the findings will be shared once the 2024 whale-watching season concludes, through a video that will also be



shared on social media to disseminate the results. Additionally, the findings will be published in scientific journals. We hope that, with these results, the community will take action to avoid pollution and visit the beach more often to participate in our bartering activity.

Overall, La Paz is a participatory city, and we expect the involvement of more complex companies and greater support from the government. The activities that will be permanently implemented include composting at CICIMAR and in other schools, such as 'school composting.

#### 5. Are there any plans to continue this work?

An Environmental Research Network (RIA by its Spanish acronym) was created, which is planned to be formally registered in order to continue with this project. More composting workshops are scheduled for 2025. We currently have a thesis student under our supervision who will graduate in April 2025.

We plan to change the study area but continue focusing on the same species, *Rhincodon typus*. Whale sharks are beginning to be sighted in Oaxaca, but there is currently no management plan, protected area in fishing zones, or total whale shark count. Additionally, the goal is to use them as bioindicators of the Oaxaca coastline and monitor the contaminants present in this area.

All the community activities we carry out in La Paz, B.C.S., are planned to be implemented in other beaches across the country. Additionally, we plan to replace the survey with another activity that will allow us to increase participation. Furthermore, we plan to establish a composting program in which we will handle the organic waste, create the compost, and provide the product (fertilizer and humus) to those who request the service, as many residents have mentioned that they would be willing to pay for it.

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

**Online and in-person presentations:** We shared the results of our project in presentations at schools such as Anahuac in Mérida, during Graduate Week in B.C.S., and at the PIFI-IPN Forum 2023.

**Scientific conferences:** We participate in scientific conferences and create a presentation about the project results and recommendations.

**Social media posts:** We will share our activities and findings through the Environmental Research Network.

**Peer-reviewed publications**: We will publish the results of our project in a peer reviewed journal, which will be useful to the public, particularly the scientific community.

Online and in-person presentations: We share the results of our project during

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

Composting workshops are scheduled for primary schools in 2025. The bartering activity will be repeated the summer of 2025. in The Environmental Research Network in Mexico will be formally registered. Additionally, to ensure the protection of the whale shark in Mexican waters, the project will be expanded to the coasts of Oaxaca, where the species has been sighted

## 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, we used the Rufford Foundation logo in our work. The foundation was mentioned and received publicity during our in-person and online presentations. Additionally, we wore the logo on our shirts, as can be seen in all the photos in the reports submitted.

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

**Dra. Itzel Villagómez:** Project leader; conceptualization; methodology; sample analysis; data analysis, formal analysis, funding acquisition, project administration, resources, supervision, beach cleaning by kayak activity; material setup, instructions, support for participants, photography; biopsy collection; photo ID of organisms; zooplankton and phytoplankton net towing.

**Dr. Felipe Galván Magaña**: Expert in sharks (shark biopsies collection; permit administration: N° SGPA/DGVS/07571/2 from PROFEPA and DGVS), supervision.

**Dra. Elsa Noreña Barroso**: Expert in contaminants (laboratory management at the Faculty of Chemistry, UNAM; sample analysis; data analysis; report and scientific article writing), supervision.

**Dra. Gabriela Rodríguez Fuentes**: Expert in contaminants (sample analysis; data analysis; report and scientific article writing)

**Dr. Rogelio González Armas**: Expert in zooplankton (fieldwork permits; zooplankton and phytoplankton sample collection in the field)

**Dr. Eduardo Méndez**: Fieldwork support (biopsy collection; photo ID of organisms; zooplankton and phytoplankton net towing)

**Dr. Nezahualpilli Tovar**: Captain (guiding the team to whale shark sighting areas; assisted with fieldwork during the 2020-2021 sampling season; fieldwork coordination from CICIMAR-IPN for the 2022 season)

**Dr. Omar Castañeda**: Community engagement (beach cleaning by kayak activity; material setup, instructions, support for participants, photography)

Allison Robledo: Community engagement volunteer (beach cleaning by kayak activity; material setup, instructions, support for participants, photography)

#### **10.** Any other comments?

This project would like to thank the government for the research permits that made this study possible. We would also like to express our gratitude to our team and volunteers for their contributions and participation; without you, this work would not have been possible. In addition, we would like to thank the elementary schools that allowed us to conduct the workshops.