

Final Evaluation Report

Your Details	
Full Name	Carlos Abraham Castillo Morales
Project Title	Evolution, history and conservation of two species of sea turtle in the coast of Oaxaca, Mexico
Application ID	33344-1
Date of this Report	4 November 2022

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
Compare the genetic diversity of the leatherback sea turtle and the olive ridley sea turtle				We managed to obtain and compare the genetic diversity of both species. Furthermore, from genetic analyses, we discovered a new lineage in the population of leatherback turtles in the eastern tropical Pacific Ocean. The leatherback turtle and the new lineage could be two completely different species (taxonomic analysis is necessary to confirm this). This is a very important discovery that brings into question the taxonomic uncertainty that has existed for the leatherback sea turtle since the late 1800s.
Conduct a focus group workshop with local experts to identify the factors that shape the contrasting population trajectories of the leatherback and olive ridley turtles in the coast of Oaxaca, Mexico.				We successfully conducted the focus group workshop with a total of 12 participants plus three organisers. The workshop was held at the Mexican Turtle Center, a place where the turtle camps of the region are coordinated and there is also a living museum of sea turtles that helps the conservation of sea turtles in the region.
Publishing				The results of this work will be published in my master's thesis. An article was also prepared which was submitted to the journal "Scientific Reports". Currently both the thesis and the article are under revision. Plus, a micro website is under construction. There all the results and pictures of the project will be posted. This will be part of ECOSUR's webpage

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

a). Through analysis of genetic diversity and local ecological knowledge we discovered a new leatherback turtle lineage that is possibly a new leatherback turtle species that nest on the beaches of Oaxaca, Mexico. This idea is reinforced by the taxonomic dilemma that has existed since 1884 with Garman's description of a new species. Later Phillipi, a Chilean researcher, also describes a new species of leatherback turtle. Through the results of genetic analysis, we can contribute to help resolve this dilemma. This is an important discovery that has implications for conservation. What we originally believed to be a small and threatened population of leatherback sea turtles would be two smaller populations. The population of the leatherback sea turtle on the brink of extinction and another population of a new leatherback even more rare and threatened.

b). We obtained genetic diversity values for the leatherback sea turtle and the olive ridley sea turtle on the beaches of Oaxaca, Mexico. These values allow us to know the health and structure of the population at the genetic level. With this information we can make better decisions to help the conservation of both species of sea turtles. This information alone is a valuable contribution to the knowledge of these species. In addition to discovering a new species of leatherback sea turtle, we can relate population trajectories to genetic diversity.

c). Through a focus group workshop, we identified the main threats to leatherback and olive ridley turtles on nesting beaches in Oaxaca. Although other scientists have previously identified threats at the Eastern Tropical Pacific Ocean level, we present the threats at the local level. The main threats were identified by local experts who work with these animals every day and know what the threats are for these species in each locality. In addition, we conducted interviews with local experts from the main nesting beaches of these species to find out if they differentiated the two lineages of leatherback turtles and to identify the main threats to these turtles.

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

During the genetic analyses, we had problems amplifying the mtDNA control region with the primers used. We solved this problem by trying different concentrations of DNA and reagents until we managed to find the right proportions for the reaction to work. Also, this work was part of my master's degree, so I had a time limit to complete it. Due to the pandemic, the collection permits were delayed so I missed the opportunity to sample the leatherback turtle during the 2020 season, this delayed us in the field work. We were able to sample until the 2021 season. Despite the delay We managed to achieve all the objectives set within the time limit.

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

This work involved local communities by inviting local experts (people who are or have been involved in the conservation or exploitation of sea turtles in the region). Due to the years that they have been in these activities, they have a clear and

concise perspective of the problems that these animals face on the nesting beaches.

It is intended to give continuity to this project, so it is expected that the results as well as the conservation actions will help local communities to conserve their resources. We also heard that there is a need to develop an updated management plan for the olive ridley turtle, so we plan to follow up on this idea in the future.

5. Are there any plans to continue this work?

Yes, there are plans to continue this project through various contributions. The most important, in my opinion, is clarifying the taxonomic uncertainty found in the leatherback sea turtle of the Eastern Tropical Pacific Ocean. This through morphometric and genetic studies in northernmost regions (states of Michoacán, Guerrero, and Sonora in Mexico) and southernmost regions (Costa Rica and Chile). It is also planned to visit the Museum of Natural History of Chile where they have an embalmed specimen of *Dermochelys coriacea* (leatherback sea turtle) and *Dermochelys angusta* (which we believe could be our new species) to compare them and determine whether there are two species of leatherback turtles in the region.

In addition, for my doctoral project I plan to correlate the displacement of the leatherback population in Mexico with changes in abiotic factors.

Besides, during the realisation of this work we heard about the need to carry out a management plan for the olive ridley turtle in the Oaxaca area so we would like to follow up on that idea until we achieve a sustainable use of this animal as occurs in Ostional beach in Costa Rica.

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

The results of this work will be published in my master's thesis at ECOSUR. We also wrote a paper (now is under revision) that was submitted to Scientific Reports, an open access online multidisciplinary journal from the editors of Nature.

Finally, we will include the results of this work in a web microsite belonging to ECOSUR. In this page will be post every result and picture obtained in this project.

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

I think that the most important step is to carry out the genetic and morphometric analysis to clarify if there are one or two species of leatherback in the region. And in case there are two species, it will be necessary to make the taxonomic description of the new species.

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?

Since I was awarded with The Rufford Foundation first grant, in all my presentations related to the project I have used your logo and talk about the foundation and the opportunity given to me, besides I have advised students to apply for this grant. In addition, the respective acknowledgments were given in the thesis and in the paper that will be published. I have also had the opportunity to publicise the project through classes that I taught for a course in which I recommend the foundation to the students. I have also publicised it through the workshop held at the Mexican Turtle Center giving to you the acknowledgment for make this project possible. Outside the professional field, I have made the project and the foundation known through my personal social networks.

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

PhD. María Andrea Saénz-Arroyo de los Cobos: was my thesis director and the main support to coordinate, organize and plan all the work for this project. She also helped me organize and conduct the focus group workshop and the interviews with local experts. She also helped me with the redaction and preparation of the thesis and the scientific article.

PhD. Gabriela Castellanos Morales: helped me with the processing and analysis of genetic data. It was my main support for genetic data analysis, for example sequence editing as well as molecular clock analysis.

PhD. Lorena Ruiz Montoya: she was my main support for the doubts that arose during the processing of the samples in the laboratory, but she also helped me with the analysis of the genetic data.

All the members of my team made contributions from the planning of the work. They were a fundamental part of deciding that we would do genetic analyzes and a focus group workshop. They helped me decide on the required sample size as well as the primers to be used for sample processing. Each one helped me with questions that arose during the processing of samples and data. They also helped me choose the analysis we performed as well as their interpretation.

10. Any other comments?

I believe that all the objectives set during the planning of this project were achieved. Therefore, we obtained good results that contribute to the research and conservation of sea turtles in Mexico and in the Eastern Tropical Pacific. It is important to mention that through this work a new lineage of leatherback sea turtle was discovered that could be a completely different species than the leatherback turtle. This is a highly relevant discovery for the conservation of sea turtles since it implies that more conservation efforts are necessary, as well as basic research that helps to understand the structure of these populations. It further implies that what we considered to be one small leatherback population is two even smaller populations.

That of the highly endangered leatherback sea turtle and that of the new species that is even rarer and more threatened than the conventional leatherback sea turtle.

Despite the challenges and time constraints, the objectives were achieved, and very interesting discoveries were made along the way.