

Final Evaluation Report

Your Details	
Full Name	Angela Palomino Gaviria
Project Title	The transboundary movements of smooth hammerheads (<i>Sphyrna zygaena</i>) in Ecuador and Peru
Application ID	27687-1
Date of this Report	18/05/2022

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
Active tracking of 6 juvenile smooth hammerhead sharks				No smooth hammerhead sharks caught in three attempts in different locations and periods of time
Analysis of the movement patterns, home range, and habitat preference of smooth hammerhead sharks				Without shark data, not possible for data analysis
Community participation and involvement				External tagging training activity with the personnel from the Pacoche Coastal Marine and Wildlife Refuge

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

a). Outreach & education

Our shark education and outreach programme include working with the community through workshops and public presentations. Especially in groups of citizens such as fishermen, students, and the local community in collaboration with the national park and local and regional NGOs

b). Scientific publication & media coverage

Scientific results with recommendations for research and marine policy management will be presented in reports to the Galapagos National Park in 2022. Since the project is designed as long-term research, the publication of final results will be accomplished within a time frame of up to 2 years.

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

Generally, conducting a pilot study is hard, one of the biggest challenges of this research project is to find smooth hammerhead sharks in their natural environment. The smooth hammerhead shark is one of six species of hammerhead sharks found in the Exclusive Ecuadorian Zone (EEZ) within the Eastern Tropical Pacific (ETP), (Martínez-Ortiz & García-Domínguez, 2013), (Weigmann, 2015). This species is characterised by having a migratory behaviour, with a preference for temperate to tropical waters (Miller, 2016).

During the project's pilot phase in 2019, the team did the first field trip expedition to Bajo Cope, a MPA located 20 miles from the coastal area of Ayangué during June, one of the months with a mayor incidence of youth landings on the coast of this

species, as reported in Ecuador (Martínez & Galván, 2007), (Coello, & Herrera, 2018) and Peruvian (Torres, 2018) fisheries department. We established collaborations with the national park and WWF-Ecuador which facilitated the organisation and operation of the expeditions; it wasn't successful because no *S. zygaena* was caught.

As a result of this event, the team decided to carry out a second expedition in February 2020, changing the time period, and also the study area. The team headed to Manta, further north of the first study area, to capture pregnant female smooth hammerhead sharks that come from December until February to leave the pups. Even though no smooth hammerhead sharks were caught, we were able to perform external tagging training with staff from the Pacoche Coastal Marine and Wildlife Refuge.

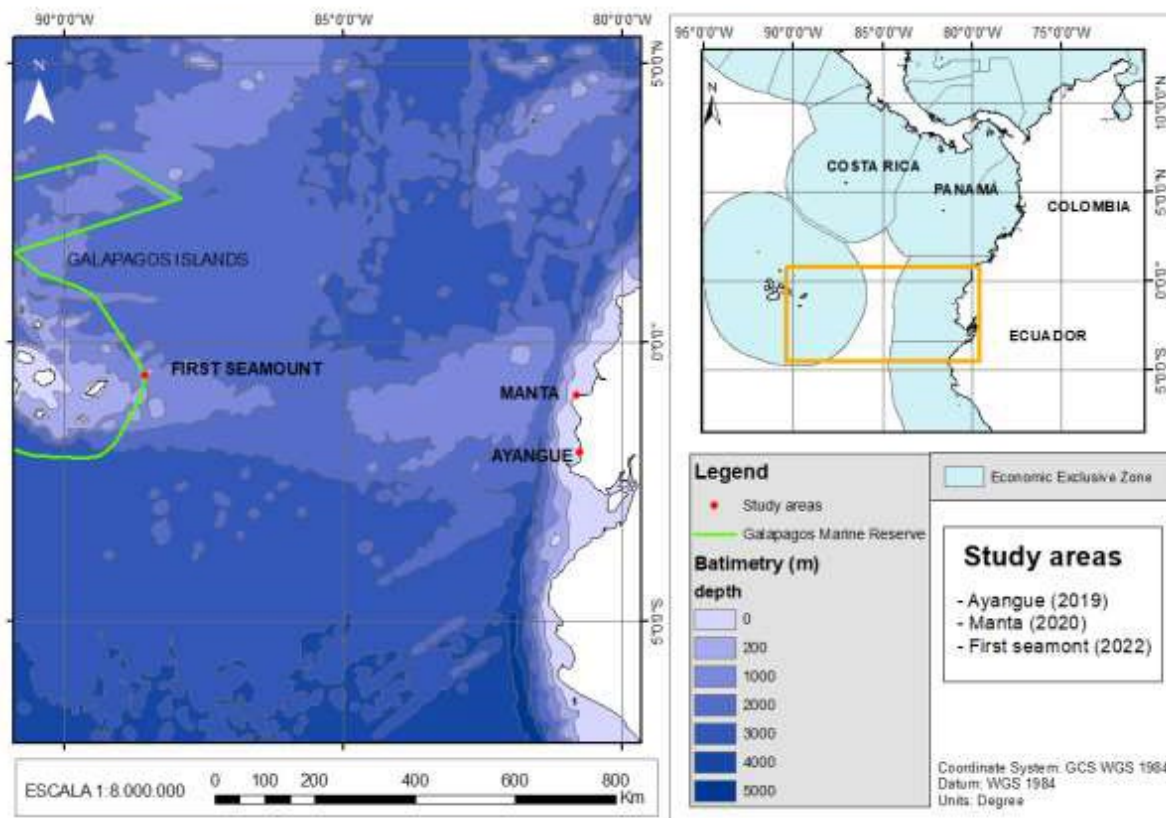


Figure 1. Study areas.

A third expedition was carried out in March 2022, during a multi-species field trip in the Galapagos Marine Reserve (GMR), thus changing the period and study area location again. Although we had decided that the next field trip would be when the females returned to the coast (December-February) or wait until the next juvenile season between March and June (Martínez & Galván, 2007), the team decided to take advantage of the multiple tagging expedition to try other points in the region.

In Ecuador, there are records of landings in March, not as much as in December or June, but since *S. zygaena* is an oceanic shark, we decided to go to some seamounts (1st and 2nd seamounts) outside the GMR in an area above the

Carnegie Ridge, located between the marine reserve and the mainland. Historically, GMR and mainland fishermen have recorded catches of smooth hammerhead sharks in this area, and there was recently a report from local fishermen who had caught and released live specimens of this species at the proposed study site. Finally, we were able to capture four blue sharks (*Prionace glauca*) in this study area, which allows us to continue with another project that also started in 2019, however, no *S. zygaena* were captured.

A La Niña event in 2021-2022 based on the Oceanic Niño Index (ONI) was moderate (ENSO, 2022), however, smooth hammerheads like temperate waters, it wasn't possible to encounter the species during the expedition. It is a coastal pelagic and semi-oceanic species found near shore and in shallow waters, however, it often prefers habitats on continental and insular shelves to offshore areas (Miller, 2016), making project development demanding.

The idea of having a researcher in the study area with 100% availability was difficult due to the Covid-19 pandemic situation, plus there is not enough funding. Therefore, due to the difficulties that have arisen during the development of the project, it was agreed that the next expedition will be within the waters of the new marine reserve in Puerto Cabuyal - Punta San Clemente.

A hammerhead shark (*Sphyrna lewini*) nursery area has been identified at this study site, and some smooth hammerhead pups have also been reported so we will work together with this team to conduct exploratory trips to catch smooth hammerhead sharks. The interest of the local community and the artisanal fishermen in protecting this area is of great help and example to demonstrate that cooperative work will improve the management of the new marine reserve managing to recover an overexploited area, not only to conserve, recover and protect biodiversity, but also increase over time the income of the artisanal fishing sector and improve the quality of life of coastal communities.

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

Communities in Ayangué, Pacoche, and surroundings, both sites of expedition trips, had been involved in environmental education projects, related to a Migramar project called Marti, the hammerhead shark. Through a brief history, this project seeks to make known the migratory species and their movement between Galapagos and Cocos Island, with a special focus on children who belong to fishing families. To provide information on the importance of shark conservation in the continental and insular regions. We want to expand environmental education with future shark tagging field trips to the Puerto Cabuyal - Punta Sanclemente Marine Reserve.

5. Are there any plans to continue this work?

Hammerhead sharks cannot currently be landed in Ecuador, it is prohibited by law (Organic Law No. 187, 2020). Although it is a great step for the conservation of this

genus, there is still much to be known about hammerhead sharks, where there are no formal studies on their stocks, so it is impossible to know what their current situation is and therefore it is not possible to determine if there is an adverse effect of fishing or any other factor (Sasa et al., 2015). Specifically, the smooth hammerhead shows clear gaps in life history, movements, and population status (Gallagher & Klimley, 2018), and is currently vulnerable to a declining status (Rigby, 2019). For a species that currently does not have sufficient data on its spatial ecology or breeding ranges (Stoffers et al., 2021), it is important to continue to focus on research to reinforce protection measures following Integrated Coastal Management (IUCN 1996). Therefore, the next step is to return to the mainland and try another location for an exploratory field trip in search of smooth hammerhead sharks.

From the beginning, the project has well-established collaborations with the national park at multiple spots and other researchers which facilitates the future organisation and operation of exploratory field trips. Both the National Park Services and the MigraMar Foundation have expressed their interest in continuing to collaborate to investigate key areas for shark conservation. Through these collaborations, we have managed to increase our time in the field while reducing costs and to cope with the costs of the upcoming expeditions for the field research, more funding has been requested.

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

The project and the results of the expeditions have been communicated to the community and interested institutions through press releases and final reports. During the development of the project, alliances were established with the Galapagos National Park, the Galapagos Science Center, Universidad San Francisco De Quito, Refugio Pachoche, and soon with the new Puerto Cabuyal - Punta Sanclemente Marine Reserve, as well as with local and regional NGOs, which have collaborated and facilitated the development of the project.

With the Pachoche Refuge, we can carry out training on one of the tagging methodologies that we use in our work procedures. The next step will be to carry out training workshops, outreach, and educational activities for park rangers, fishermen, and the local community with a focus on children.

Within the new work proposal, the team will work with the community of Puerto Cabuyal in collaboration with the village school. We will provide materials and training for the children to develop workshops related to their community conservation activities (turtles and sharks), including field activities.

The idea is to encourage children in science and enable them to participate in shark monitoring activities and actively participate in the long-term evaluation of the effectiveness of the marine reserve.

A report of the 2022 multi-species tagging expedition was prepared through a press release and a field report for the Galapagos National Park, the Galapagos Science Center, the University of San Francisco de Quito, and the local community.

The RF logo will continue to be used in oral scientific presentations to publicise the project and its results.

Links to online publications: <https://galapagossscience.org/es/cientificos-usanavionetaultraligera-para-marcar-y-rastrear-fiburones-ballena-en-el-sur-de-lareservamarina-de-galapagos-por-primeravez/?fbclid=IwAR0zCG8tPuujyBwCWeWksYZk0Abc3fQRIEPWLyjQveXb5Jha6pVnCyat4>

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

The habitats used by various species of migratory sharks in their early life stage are still uncertain. Therefore, scientific and regulatory institutions seek to emphasise research focused on the population status, movements, and habitat use of shark species in the region. The national park is explicitly interested in continuing to investigate the movements of juvenile hammerhead sharks in other potential nursery areas on the islands and the mainland to increase the efficiency of the zoning scheme in protecting shark species throughout the Ecuadorian EEZ.

According to the initial information obtained from the previous project "Baby Shark Project" developed by members of MigraMar, park rangers and local artisanal fishermen, high catches of baby hammerhead sharks have been recorded in Puerto Cabuyal, so this is likely a breeding/rearing area. Consequently, the team will collaborate with this project and look for a potential breeding area for smooth hammerhead sharks (*Sphyrna zygaena*) in the recently created Puerto Cabuyal-Punta San Clemente Marine Reserve.

These results will increase our regional understanding of the behaviour and habitat use of these species at different life stages while contributing to the sustainable use of fishery resources by providing a great opportunity to recover fish stocks decimated by poor management.

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?

Up to date, the RF logo has been used in a press release and field report for the Galapagos National Park, Galapagos Science Center, University of San Francisco De Quito, and the local community.

Additionally, I will continue to mention the RF as one of the sources of funding for this project and incorporate the logo in oral scientific presentations.

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

Dr. Alex Hearn, MigraMar member and Professor at Universidad San Francisco de Quito, specializes in the study of fish movements with a strong focus on conservation. His main research interest is the connectivity of migratory sharks in the Eastern

Tropical Pacific. Coordinator and principal investigator of the project. He was present at all the field trips and at the external tagging training activity carried out at the Pacoche refuge.

Lic. Stefania Garcia, field assistant and thesis student of the Biological Sciences career at the Pontificia Universidad Católica del Ecuador. She was present on two of the field trips (2019 and 2020) and participated in the external tagging training activity carried out at the Pacoche Refuge. She continued to work in scientific outreach and environmental education in the study areas with Marti, the Hammerhead Shark project.

MSc. Ángela Palomino, has a main research interest focused on the ecology and movement patterns of migratory species and associating which factors determine the use of the habitat of these species in their different stages of life, to adapt and/or improve conservation measures for marine megafauna around marine protected areas and oceanic islands. Coordinator and principal investigator of the project. She was present at the multi-specie field trip in the Galapagos marine reserve (2022)

Fernando Rey Diz, Fisheries and Aquaculture Program Officer of the WWF – Ecuador and advanced technician in biology, marine ecology, and fisheries. He was present at two of the field trips (Bajo Cope and Pacoche). His work has allowed him to integrate into the smallest fishing communities and participate in large governance processes at the national level. Fishermen, help us with the transport by boat and with the manipulation of fishing gear to catch, hold and release the bycatch without causing unnecessary injuries.

10. Any other comments?

I appreciate the Rufford Foundation's focus on smaller conservation projects and especially the project deadline extension due to the Covid-19 pandemic situation.

Its financing has allowed us to create new alliances and future work proposals, which will surely lead us to achieve the initial objectives of the project. We hope that in the future it will be possible to establish a base on the mainland coast for future conservation research on this species, at the same time that we will contribute data to the National and Regional Action Plans on Sharks to generate local information and transboundary conservation measures.

Bibliography

Coello, D., & Herrera, M. (2018). Desembarque de tiburones en las pesquerías artesanales del Ecuador durante el 2012 Shark's landing from the artisanal fisheries of Ecuador during 2012. *Revista Científica Ciencias Naturales y Ambientales*, 12(1), 1–8. Retrieved from: https://www.researchgate.net/publication/342465117_Desembarque_de_tiburones_en_las_pesquerias_Ecuador_2012

ENSO: El Niño and La Niña Years and Intensities based on Oceanic Niño Index (ONI). (2022/16/04). Golden Gate Weather Services. Retrieved from: <https://ggweather.com/enso/oni.htm>

Gallagher, A. J., & Klimley, A. P. (2018). The biology and conservation status of the large hammerhead shark complex: the great, scalloped, and smooth hammerheads. *Reviews in Fish Biology and Fisheries*, 28(4), 777-794. DOI: 10.1007/s11160-018-9530-5

Martínez-Ortiz, J., Aires-da-Silva, A. M., Lennert-Cody, C.E., & Maunder, M. N. (2015) The Ecuadorian Artisanal Fishery for Large Pelagics: Species Composition and Spatio-Temporal Dynamics. *PLoS ONE* 10(8): e0135136. DOI :10.1371/ journal. pone.0135136

Martínez-Ortiz, J., & García-Domínguez, M. (2013). Guía de campo de condricios del Ecuador. Quimeras, Tiburones y Rayas. Martínez-Ortiz, J (ed). Ministerio de Agricultura, Ganadería, Acuacultura y Pesca (MAGAP) /ViceMinisterio de Acuacultura y Pesca (VMAP) / Subsecretaría de Recursos Pesqueros (SRP). Guayaquil-Ecuador. 246p.

Miller, M. H. (2016). Endangered Species Act Status Review Report: Smooth Hammerhead Shark (*Sphyrna zygaena*). Report to National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD. June 2016. 167.

Organic Law N. ° 187. For the Development of Aquaculture and Fisheries. Supplement April 17, 2020. Office No. AN-SG-2020-0155-O. Retrieved from: <https://www.asambleanacional.gob.ec/es/multimedios-legislativos/56374-leyorganicapara-el-desarrollo-de-la>

Rigby, C. L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Herman, K., Jabado, R.W., Liu, K. M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R. B., & Winker, H. (2019). *Sphyrna zygaena*. The IUCN Red List of Threatened Species 2019: e.T39388A2921825. DOI: 10.2305/IUCN.UK.2019-3.RLTS.T39388A2921825.en

Sasa, M., Carvajal, J. M., Canet, N., Wong, G., Sandoval, I., Arauz, R., Quesada, R., Alvarado, J. J., Durán, F., Baldi, M., Blanco, M., Dick, B. (2015). Consejo de Representantes de Autoridades Científicas CITES de Costa Rica (CRACCITES - Costa Rica). Dictamen de Extracción No Perjudicial (DENP) para el tiburón martillo común (*Sphyrna lewini*) y las dos especies semejantes (*S. zygaena* y *S. mokarran*) de Costa Rica, incluidas bajo el Apéndice II de la Convención Sobre el Comercio Internacional de Especies Amenazadas de Fauna y Flora Silvestres (CITES). San José, Costa Rica. 85p. Retrieved from: <https://www.cremacr.org/wp-content/uploads/2018/08/DENP-Tiburon-martillo-CRACCITES-Agosto-2015-1.pdf>

Stoffers, T., Hoetjes, P., Pauly, A., Bent-Hooker, H., Svoboda, A. M., Kingma, I., Vermot, J., Fries, E., Pivard, S. (2021). Propuesta para la inclusión del tiburón martillo liso *Sphyrna zygaena* del Anexo III al Anexo II del Protocolo sobre Áreas y Vida Silvestre Especialmente Protegidas (Protocolo SPAW). 33p. Retrieved from: <https://www.car-spaw-rac.org/?Tiburon-martillo-liso-Sphyrna-zygaena>

Torres Carrasco, A. A. (2018). Variación espacio-temporal en las capturas provenientes de la pesquería artesanal de tiburón con red de enmalle de superficie, durante octubre 2016 a marzo 2018. Dissertation, Universidad Nacional de Piura

Weigmann, S. (2015). Annotated checklist of the living sharks, batoids, and chimaeras (Chondrichthyes) of the world, with a focus on biogeographical diversity. *Journal of fish biology*, 88, 837-1037p. DOI: 10.1111/jfb.12874





Marti, the Hammerhead Shark Project - Pacoche Coastal Marine and Wildlife Refuge.