Baby shark project
Year-1 annual report

December 2019

OCEAN BLUE TREE

Baby Shark Project
Conservation for the future

MIGRAMAR

Photo: Edwar Herrero (Ocean Blue Tree)

Prepared by: Eduardo Espinoza, Johanna Moreira, Rosario Alvarez
Co-participants: Kevin Reyes, Francisca Hernandez, Deivin Intriago, Yimmy Intriago

Background

Hammerhead sharks are among the most endangered species in the world, mainly due to overfishing, low birth rate, late reproduction and selectivity in their eating habits. These characteristics of its population dynamics make it increasingly necessary to establish conservation strategies for the adequate protection of this species worldwide. The hammerhead shark (*Sphyrna lewini*) is classified as globally endangered on the IUCN Red List. The problem of overfishing, motivated by the high economic value of its fins and the consumption of its meat, has led to a decline in the abundance of the species during all stages of its life cycle. *Sphyrna lewini* is a circumglobal shark species native to warm, temperate and tropical coastal waters. Given current fishing pressures, in addition to a lack of management strategies, the high catch rates of *Sphyrna lewini* pose a serious threat to the survival of the species.

Galapagos Islands in Ecuador are recognized worldwide for its abundant biodiversity and endemism in the terrestrial and marine realm. The waters of Galapagos are known for their abundance of several species of sharks including hammerhead sharks. The Galapagos Marine Reserve RMG is home to one of the largest biomass populations of hammerhead shark species in the world (Salas E. 2016), it is considered that in Galapagos, shark populations of this species are still maintained in good health (Peñaherrera-Palma 2017). Hammerhead sharks, however, do not restrict their habitat only to waters of the Galapagos archipelago, hence the importance that conservation strategies for these species extend throughout the region.

In 2017, in the Galapagos Islands, a large aggregation of the scallop hammerhead shark (*Sphyrna lewini)* in neonatal and juvenile stages was detected. We began to monitor this area of shark nursing of this highly threatened species in the RMG. Monitoring the natural populations of sharks is of vital importance to know the levels of recruitment of sharks and the contributions they have to nature, as well as their migratory characteristics.

Through the funding provided by Ocean Blue Tree we have been able to promote this program of monitoring and follow-up of hammerhead shark nursing areas in order to implement effective and efficient management measures to conserve this highly endangered species, hoping to give an opportunity to this species that is highly threatened.

Project Aims, Objectives and Goals

The ultimate goal of this 3-year project is to implement conservation strategies in key nursery sites for hammerhead sharks in four countries of the Eastern Pacific. The hammerhead shark, listed as an endangered species by the International Union for the Conservation of Nature's (IUCN) (Baum et al. 2009) requires adequate management in their different life stages, this project focuses in protecting their nursery grounds. Some potential nursery grounds have been identified within coastal habitats spanning from Mexico to Peru. There is a need to establish whether these areas can be defined as nursery grounds, in order to develop a community-based conservation approach.

Goals of the first year of the project include the identification of at least three nursery sites in Ecuador, both in Galapagos and in the mainland, , and start conservation strategies with local fishermen in Ecuador through an outreach and environmental education campaign that highlights direct benefits to communities associated with nursery ground conservation. A third objective: define and share a standardized monitoring methodology with other Eastern Pacific countries, has also been incorporated for year 2 and 3.

The funds for the Project have been spend mainly in the monitoring of the nursery area, and the community based conservation awareness, detailed spenditures are in the countable report. For an effective project development, we have hired a group of biologist and field trip assistance, the number of people contracted are: 2 biologists, 1 coordinator and 3 fishermen for have.

Implementation of Planned Activities and Outputs

The following activities were developed during the course of this first year of the project:

1. Identify and protect hammerhead shark nursery habitat

A. Shark nursery grounds identified in Ecuadorian coastal waters and two more countries of the ETPS.
B. Abundance of shark juveniles monitored in nursery grounds in Ecuadorian coastal waters and two more countries of the ETPS.
C. Awareness program for fishing communities with an impact on shark nurseries developed and implemented in Ecuadorian coastal waters and two more countries of the ETPS.
D. Hammerhead shark nursery grounds conservation plan developed for countries of the ETPS.

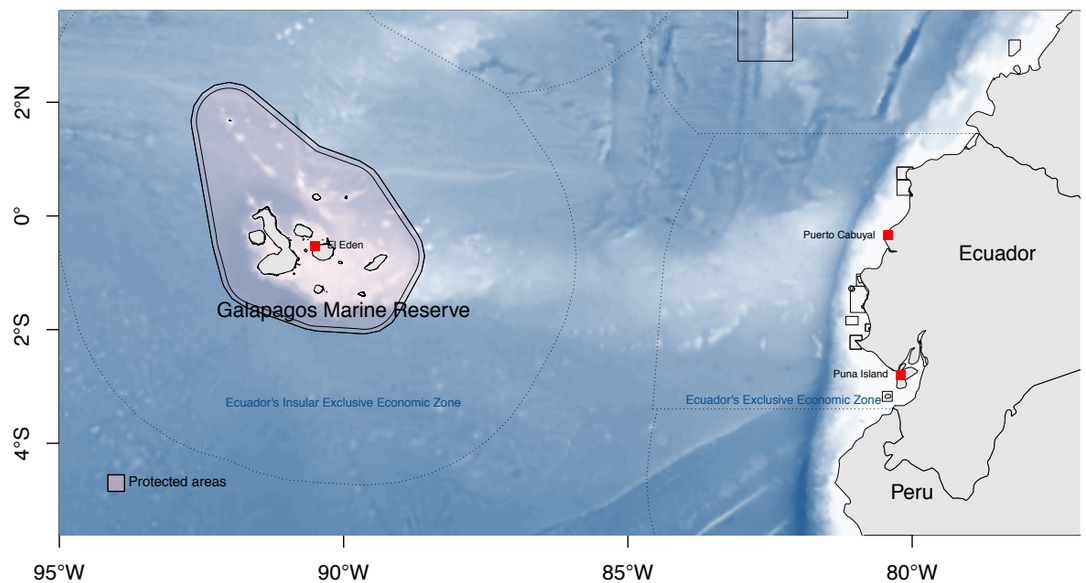
2. Develop an ocean conservation community outreach campaign

A. Promote the development of Ocean Literacy programs in primary and secondary schools along the Eastern Tropical Pacific, with particular focus on raising awareness regarding migratory marine species. These programs will engage teachers, children, youth and local community members.
B. Produce educational materials focused on elasmobranchs (e.g. storybooks, activity booklets, etc.) and disseminate to coastal communities across the ETP.
C. Conduct 10 fishermen workshops at coastal communities across the ETP to raise awareness regarding migratory marine species, share key findings and recommendations for conservation and management.
D. Pilot a community-exchange program, in which 5 selected fishermen, teachers or youth are selected to visit another conservation project in the ETP in order to build capacity and inspiration for conservation.
E. Design and develop an impacting social network campaign aimed at raising awareness regarding migratory marine species in the region.

Activities are planned to take place during the three-year period of the project based on the following time-table:

Activity	Year 1	Year 2	Year 3
1A	X		
1B	X	X	X
1C	X	X	X
1D			
2A	X	X	X
2B		X	X
2C	X	X	X
2D		X	X
2E	X	X	X

Identify and protect hammerhead shark nursery habitat

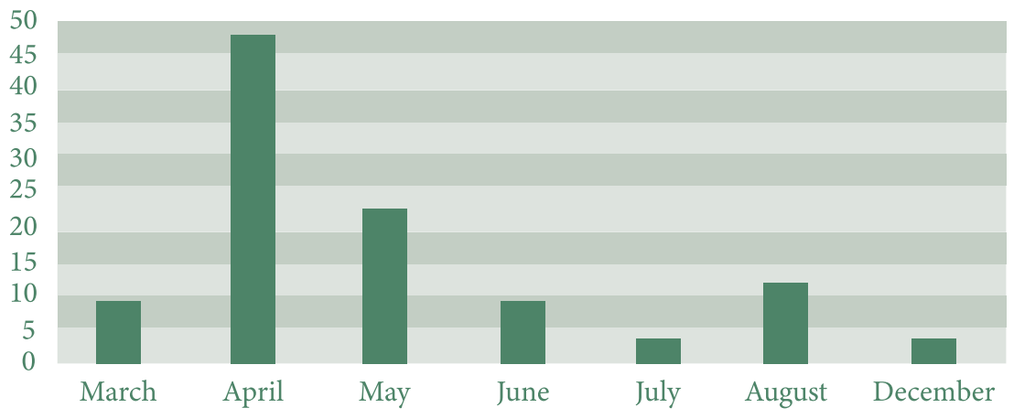


Identified nursiries sites

During the year, we were able to clearly identify two important hammerhead shark-nursing sites. We were able to maintain a continuous monitoring in these two areas, one in Continental Ecuador, in the site called Puerto Cabuyal and another in Galapagos in the El Edén zone, EL EDÉN was not even detected as a nursing site until we began the execution of this project. Two more potential sites were identified, in continental Ecuador, Isla Puná (Posorja) and Cojimies.

142 surveys were conducted among the fishermen of the following eighteen fishing coves in the northern, central-north and southern areas of the province of Manabí. In the Ports of Cojimíes, Playa de Pedernales, La Chorrera, Don Juan, El Matal, Puerto Cabuyal, Canoa, Briceño, San Vicente, Bahía de Caráquez, Leonidas Plaza, Jaramijó, Las Piñas, and in the province of Esmeraldas in the sites of Muisne, San Francisco, Tonchigüe, Tonsupa and Atacames. These areas are listed in the report "Ports, creeks and artisanal fishing settlements on the mainland coast of Ecuador" conducted by the National Fisheries Institute in 2013.

In interviews with fishermen, 77% said they have caught hammerhead sharks during their fishing operations, with April and May being the months of greatest incidence during the year, as shown in the graph below.



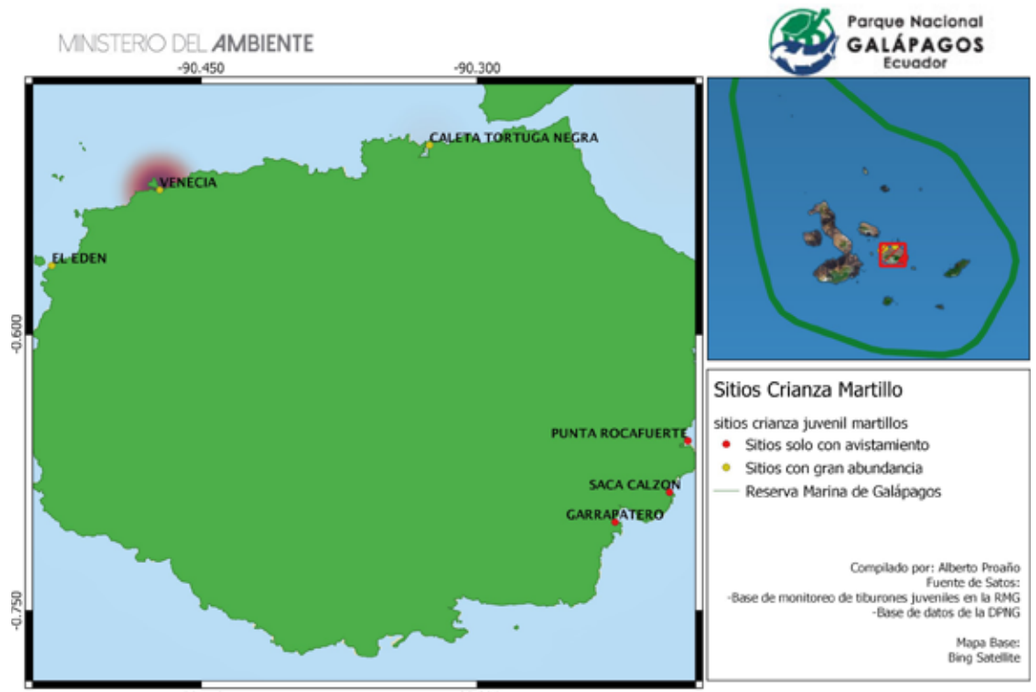
Hammerhead shark catch season registered in 2019 in Coastal Ecuador according to fishermen

The sampling sites correspond to the main coves where hammerhead sharks *Sphyrna sp* were reported to have been observed. In order to keep a record of the data at sea, the monitoring was carried out on the smaller fishing vessels (fiber).

New nursery area found in the Galapagos Marine Reserve a place called ¨El Eden¨

With the information obtained, it was possible to find a possible nursing area on the Ecuadorian coast (Puerto Cabuyal), in which a continuous monitoring has been maintained every day of the year of the incidence in the catches as well as the presence and geographical variation of its occurrence. This site would be the first place considered as a nursing area on the coast of Ecuador due to the records during the monitoring.

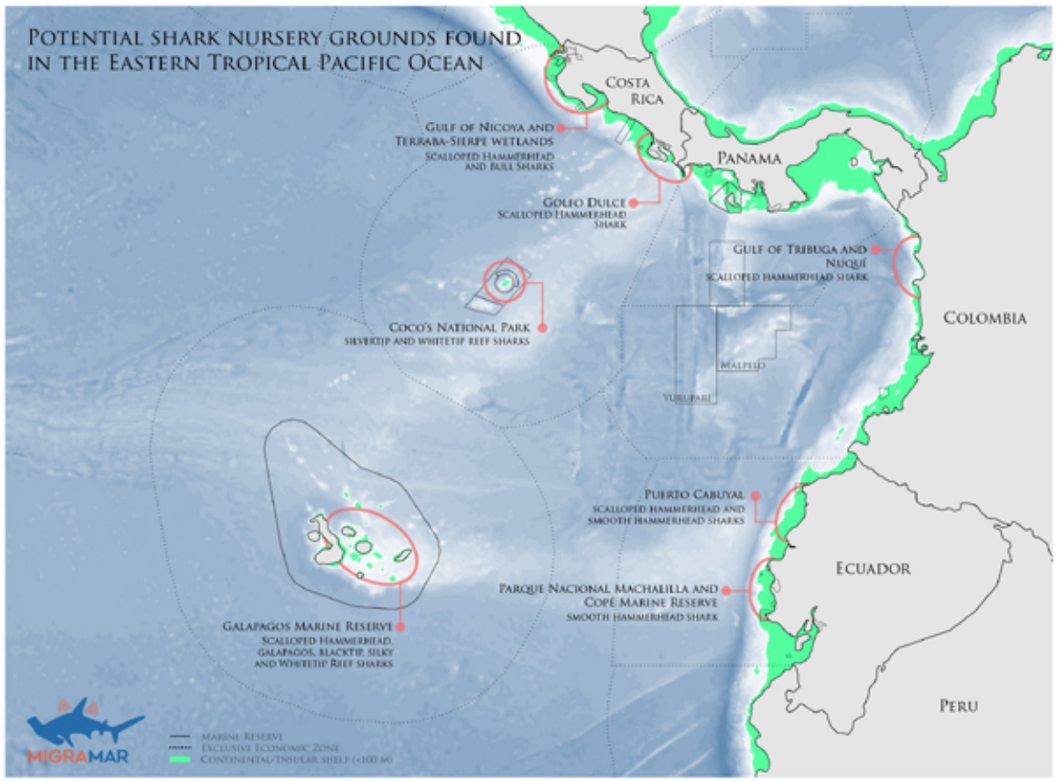
In Galapagos, a new site was identified for hammerhead sharks (*Sphyrna lewini*), which is located in Santa Cruz island and known as “El Edén”. Likewise, through initial surveys and field trips in the continental Ecuador, it was possible to identify other potential shark nursing sites such as Isla Puná (Posorja) and Cojimies. At the beginning of the year, samples were taken from hammerhead sharks caught in artisanal fisheries, but continuous monitoring could not be maintained due to the fact that the effort was concentrated in the site called Puerto Cabuyal.



Shark nursery areas monitored and identified on Santa Cruz - Galapagos Island

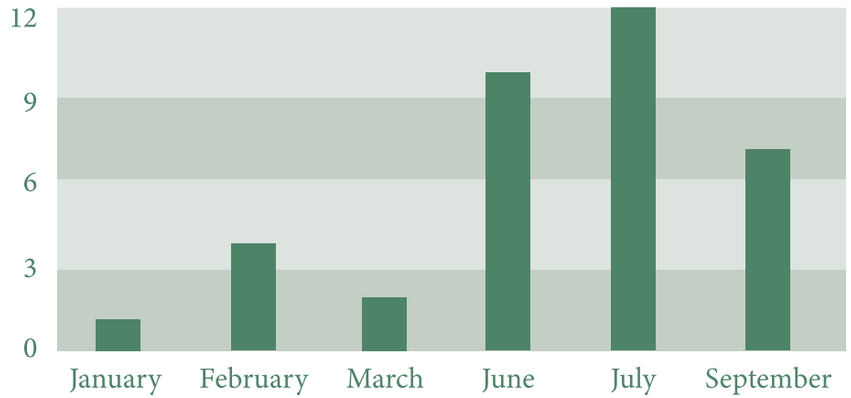
Outside of Ecuador, in other countries of the Eastern Tropical Pacific (ETP), the team together with other MigraMar researchers who are studying juvenile hammerhead sharks, at least two new sites were identified that would be considered as possible hammerhead shark nursing areas, one of which is located in Punta Chame, Panama, a fishing site two hours from Panama City (Annex 1 and 2).

A group of MigraMar researchers was formed explicit for the nursing area research. The group has initialy identified potential nursing areas in varios countries of the ETP and will work together to standarize research methodologies, community work and conservation measures in all nursing areas of juvenile hammerhead sharks.



Potential shark nursery grounds in the Eastern Tropical Pacific

Abundance of juvenile sharks monitored in nursery grounds



Trends in catches of juvenile sharks in the Galapagos nursery areas

In Galapagos, a total of 36 juvenile hammerhead sharks were marked in the identified nursing areas, monitoring was only carried out once a month. Iit can be seen in the graph above that trends in shark catches point to June and July, as the months with the highest number of catches, which indicates that they may be the months with the highest reproduction rates. The project used 36 t-bar tags and 16 acoustic tags.

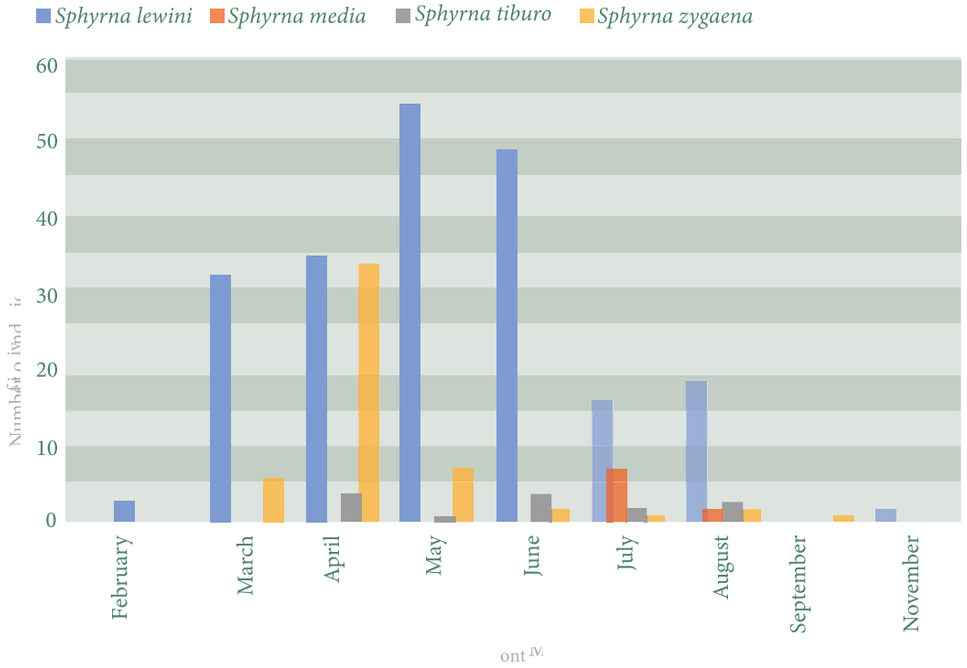
In the first year of monitoring, 270 hammerhead sharks were recorded along the Ecuadorian coast, of which 73.61% belong to *Sphyrna lewini* and 18.4% to *Sphyrna zygaena.*

The monitoring in the nursing area of Puerto Cabuyal in continental Ecuador has been carried out every day since February 2019. The monitoring includes both gathering empirical knowledge from fishermen to know first hand what the fishermen are registering as by-catch (abundance and distribution of juvenile sharks throughout the year). With this empirical information we can estimate the trends in the abundance of these individuals. Monitoring also includes the actual information our field staff collects.

Species	N. of individuals
Sphyrna lewini	194
Sphyrna media	9
Sphyrna tiburo	14
Sphyrna zygaena	53
Total	270

Figure 1. Number of individuals by species monitored in Puerto Cabuyal

The fishing ports were monitored during the summer season between October and November, from 6:00 a.m. to 8:00 a.m. in the areas of Leonidas Plaza, Bahía and San Vicente. In Canoa fish landing ocurr between 14:00 and 17:00. Biometric data was recorded, as well as sex, species identification, skin sampling for DNA analysis of all hammerhead sharks and other juvenile species that have been found. In addition to collecting data from fishing areas to have a more objective view of the distribution of them.



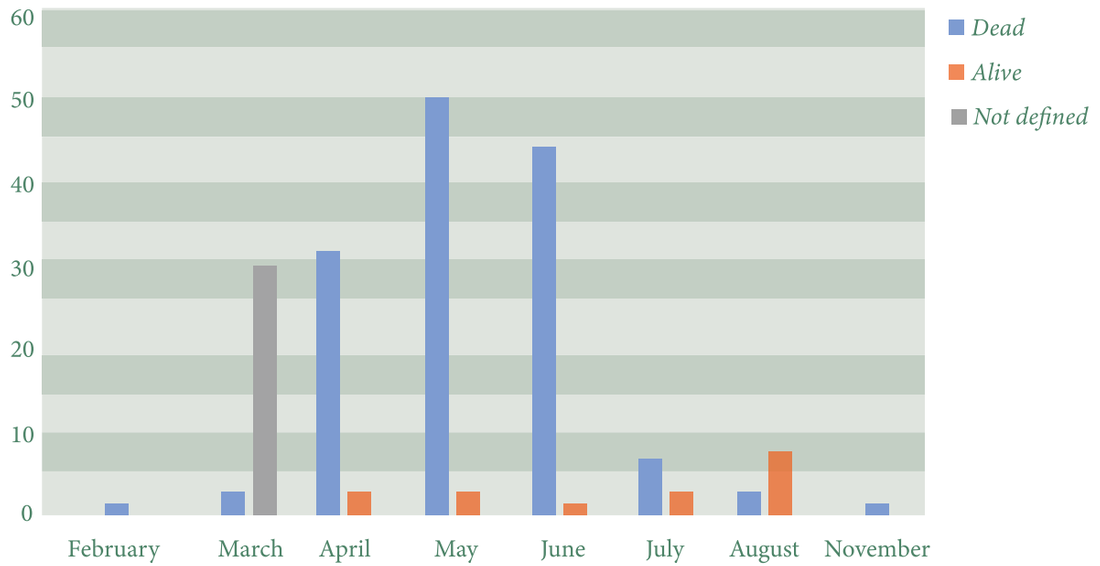
Trend of monthly shark catches in Pto Cabuyal

The results of the monitoring in the continent compared to the ones that were carried out by the fishermen are coincident, which shows us a great relationship between the empirical knowledge and what the monitors record in the field.

The monitoring in the continent had to adapt a new methodology different from the one used in Galapagos; given that the fishing dynamics are different, as well as the fishing gears and techniques.

In the case of the monitoring of hammerhead shark nursing areas in Galapagos, this has been maintained once a month in the established nursing areas with the protocols that have already been created, thus showing a continued presence of juvenile and neonate sharks throughout the year.

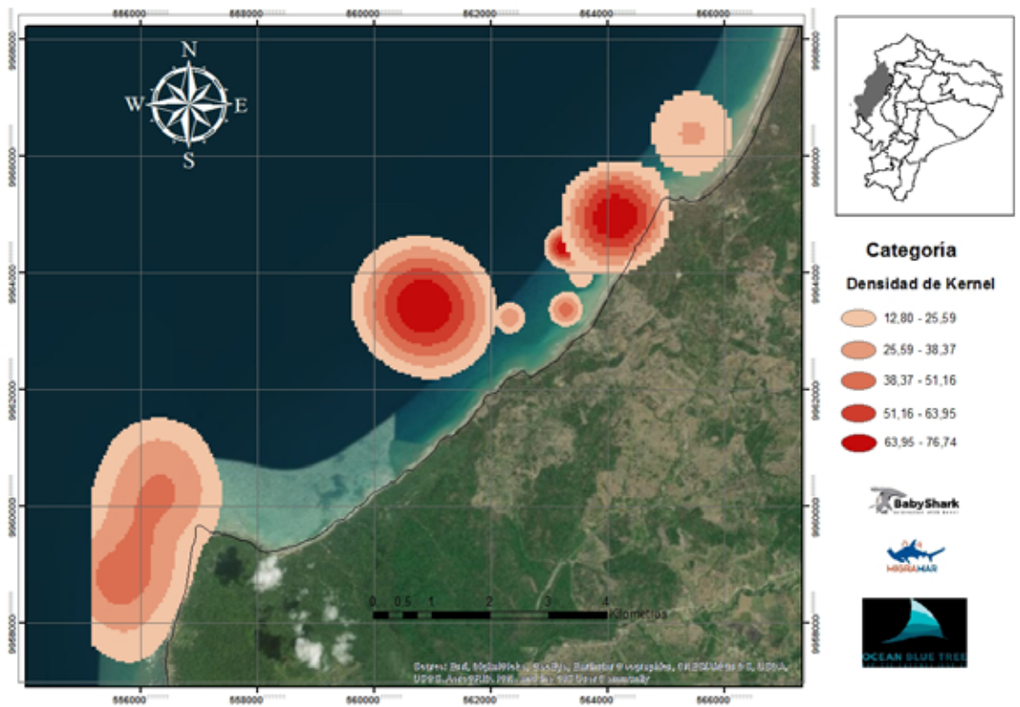
Finally it was possible to raise awareness and train local fishermen so that they can release as many live sharks as possible. At the end of the year we could register that a greater number of live sharks were released as shown in the chart below.



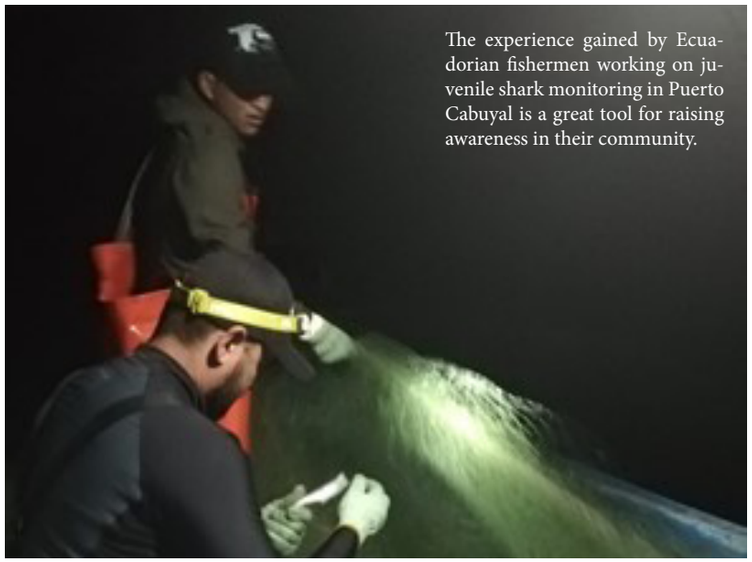
Number of sharks released alive during monitoring.
(Data from landings with no project staff participating in fishing operations.)

During monitoring it was possible to discuss with fishermen about the importance of releasing live sharks if caught in their fishing operations. We monitored fishing operations where 270 baby sharks were caught. Previously, all caught sharks were killed. With our capacity building work with fishermen, this figure changed and several sharks survived fishing operations. 270 sharks were monitored throughout the year, some were released alive.

	Dead	Alive	Unknown	Total
Monitored individuals	197	38	35	270



This map shows the area where the catches are concentrated, showing the range of area where the hammerhead sharks are distributed.



The experience gained by Ecuadorian fishermen working on juvenile shark monitoring in Puerto Cabuyal is a great tool for raising awareness in their community.

Awarness programs in fishing communities

In conjunction with Fundación Planeta Oceano, in Peru, whose director is an active member of MigraMar, we held a three-day workshop with local fishermen from the town of Zorritos in Perú, managing to catch and tag 9 hammerhead sharks. This activity showed Peruvian fishermen how they could release neonate sharks alive as well as resuscitation techniques.

Hammerhead shark nursery grounds conservation plan developed

We will pursue the declaration of conservation areas in the sites that we have identified for the second and third year of the project.

Develop an ocean conservation community oureach campaign

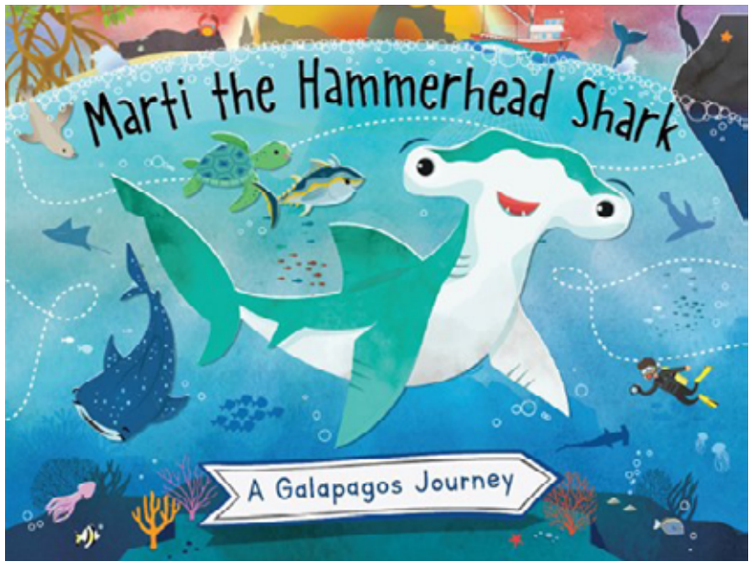
As for objective number two of the project, during this first year, it has been possible for the team to work closely to fishing communities living in the sites identified as nursing sites. Our close work and interaction has been able to generate a change in the perception towards management and conservation of marine resources.

Promote the development of ocean literacy programs in primary and secondary schools.

Workshops have been held to exchange experiences between fishermen from the community of Puerto Cabuyal in continental Ecuador and fishermen in Peru. These workshops have promoted an attitude change towards sharks and increased the willingness to conserve them.

The project staff is working in environmental education campaigns with elementary schools and colleges, as in the case of Galapagos where talks and conferences are given to students about the importance of mangroves as shark nursing areas.

In another important fishing site, Crucita in continental Ecuador, a “Connecting Schools” program has been developed together with Fundacion Planeta Oceano and Mision Tiburon, where schools from different countries Ecuador, Costa Rica and Peru are now virtually connected and the experiences and expectations that children have regarding sharks and marine ecosystems are shared.



In coordination with other members of MigraMar, we joined the distribution of our children's book called Marti The hammerhead shark about a young shark, on her journey from her home in the Galapagos Islands to Cocos Island, Costa Rica.

The children's book Marti the Hammerhead launched a social media campaign to fundraise for the editing and printing of the book. The sold copies of the book will guarantee free spanish version to be distributed among local schools in Galapagos.

Design and develop an impacting social networking campaign

For the second and third year of this project a robust social media campaign, targeted to local communties and other stakeholders, will be launched to increase awareness and interaction among local fishing communities.

Fishermen presentation in Zorrito the group from Puerto Cabuyal about their experiences in the monitoring and conservation awareness of the hammerhead sharks.

Conduct 10 fishermen workshops at coastal communities across the ETP to raise awareness

The experience gained by Ecuadorian fishermen working on juvenile shark monitoring in Puerto Cabuyal is a great tool for raising awareness in their community. In compliance with this same objective, awareness talks have been given to the community of Puerto Cabuyal that show the importance of the conservation of sharks and their ecosystems.

In the community of Puerto Cabuyal, we organized a clean beach day. We were able to join the effort of 80 people among children, youth and adults with this activity. A total or 940 kg of waste, maintly plastic were collected and 5 km of beach were completely cleaned.

Partnerships and Collaboration

Forming alliances, and working with others is one of the main success factors of the Baby Sharks project. MigraMar, as a network of 20 researchers, has been extremely helpful in standarizing monitoring procedures, helping in understandig scientific conditions required for defining a nursing site and to organize peer to peer fishermen workshops. Baby Sharks has established a working group with other members of the network to replicate the project in Panama, Colombia, Costa Rica and Peru.
In Peru, MigraMar member Kerstin Forsberg, Excecutive Director of Planeta Oceano, has collaborated with the project, colaborating in the coordination of an exchange program between fishermen from Peru and Ecuador.

In Panama, we have collaborated with Yehudi Rodriguez, a researcher from the Panama Maritime University, with whom we have maintained a close collaboration and have provided training in the techniques for monitoring shark nursing areas.

Define and share a standardized monitoring methodology with other Eastern Pacific countries

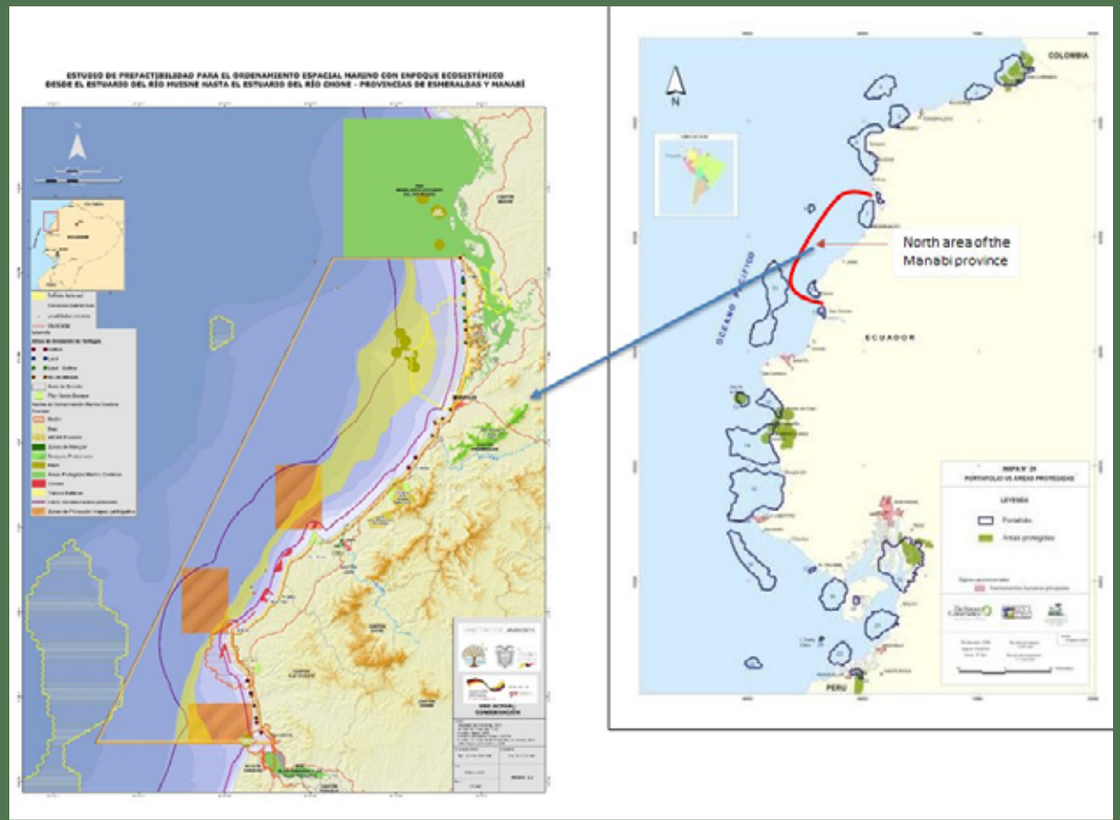
Project staff is colaborating with other MigraMar members in defining a standarized monitoring methodology than will be used all across the Eastern Tropical Pacific.

We had developed a protocol for nursing sites for juvenile sharks in continental Ecuador (Protocol as annex o nthis document). This protocol has been shared through MigraMar with other researchers in the region. In situ training has been carried out in countries like Panama and Peru, where scientists and students have been trained in techniques for monitoring and releasing live sharks, so that the methodology is standardized at the regional level.

Another important parthnership work has been developed with the Ocean Blue Tree (OBT). During the month of October, MigraMar researchers joined in a research trip in Cocos Island in Costa Rica financed by OBT. This research expedition allowed MigraMar members to share experiences of similar shark related work and define future activities as a collective group. This led to the formation of a MigraMar shark nursing sites related action group, where Baby Shark members have a leading role.

New protected area in the North of Manabí

Another important cooperation that has taken place in the development of this project is the work that has been done with high officials of the Ministry of the Environment of Ecuador. We have been in conversations with them to propose the creation of a marine protected area in the zone where hammerhead shark nursing areas have been identified. Meetings have also been held with authorities of the Undersecretary of Fisheries, where we are discussing the development of an action plan for sharks in Ecuador where nursing areas will have certain degree of protection for newborn and juvenile sharks.



Proposed area for the creation of a marine and coastal protected area in the North of Manabí

Lessons learned

With the hammerhead catch trend data we can see that the nursing peaks are in May and June, which indicates that for next year we will concentrate our monitoring efforts on those dates, giving us a little more time to look for other nursing areas along the Ecuadorian coast.
We have learned, with all year work, that the nursing sites in continental Ecuador have a completely different dynamics than the ones in Galapagos Islands.

With the genetic samples we intend to perform regional analysis to better understand the connectivity that exists between individuals captured in Ecuador with other regions such as Panama, Colombia, Costa Rica and Mexico, where MigraMar colleagues are collecting similar samples.

Working with others has been a great lesson learned, with the environmental education book, Marty the hammerhead shark, we collaborated with Alex Hearn, a MigraMar member who was producing this book that perfectly fitted with our project. We can support this ongoing effort and have a larger audience with less resources.

During this first year of the project we have made a significant aproach with government authorities to develop and establish management measures to promote the conservation of sharks, very few activities that were proposed have not been fulfilled.

Action plan for next year

The main goal of this project is to generate conservation strategies for hammerhead sharks in their juvenile stage, ensuring the conservation of this species in the long term. The results obtained so far are providing unpublished information that did not exist before, that will scientifically support management measures in Ecuador and other countries in the Pacific. Working with decision makers and authorities will ensure that the results of this study are sustained over the long term.

On the other hand, the results that are being shown with the involvement of the community of fishermen of Cabuyal in conservation actions such as the release of newborn sharks when they are caught in nets. We are creating environmental awareness and concern for the conservation of marine resources and endangered species.

One of the threats faced by the Project is the political instability of the country, mainly the changes of ministers, which can cause that the efforts made to create management measures by the authorities are diluted if the political will is lost. The strategy that is being used to avoid this hipotesis is to work with the technicians of both fishing and environmental ministries so that they can continue with the processes of implementing management measures in spite of the changes of government authorities.

In order to continue with the second year of the project based on the original goals and objectives and after face the real situation and challenge for the monitoring program of the nursery area and for redefine the activities planned we plan to develop an more adaptive plan linked to the real situation of the fisheries dynamic and the communities development.

Also we have joined two activities (1C and 2A) to be able to be more efficient time and resources of the project.

Activity	Year 2
1.A. Shark nursery grounds identified in Ecuadorian coastal waters and two more countries of the ETPS.	Identify at least one additional shark nursery area in mainland Ecuador.
1.B. Abundance of shark juveniles monitored in nursery grounds in Ecuadorian coastal waters and two more countries of the ETPS.	Maintain the monitoring of the sites already identified (Puerto Cabuyal-Ecuadorian coastal) (El Eden and Venecia-Galapagos).
1.C. Awareness program for fishing communities with an impact on shark nurseries developed and implemented in Ecuadorian coastal waters and two more countries of the ETPS.	Have regular meetings with fishing communities in Ecuador and with 2 other countries. Promote peer to peer workshops with fishermen.
1.D. Hammerhead shark nursery grounds conservation plan developed for countries of the ETPS.	Meetings with key actors for the development of the conservation plan for shark nursery area.
2.A. Promote the development of Ocean Literacy programs in primary and secondary schools along the Eastern Tropical Pacific, with particular focus on raising awareness regarding migratory marine species. These programs will engage teachers, children, youth and local community members.	Visit local schools of fishing communities, generate environmental education curricula with teachers. Continue with the connecting school program adding at least one school in each country.
2.B. Produce educational materials focused on elasmobranchs (e.g. storybooks, activity booklets, etc.) and disseminate to coastal communities across the ETP.	Publish the Marti the hammerhead in spanish and share with local schools in Galapagos and Coastal Ecuador.
2.C. Conduct 10 fishermen workshops at coastal communities across the ETP to raise awareness regarding migratory marine species, share key findings and recommendations for conservation and management.	Worshops will concentrate on capacity building and socializing potential MPAs in the region.
2.D. Pilot a community-exchange program, in which 5 selected fishermen, teachers or youth are selected to visit another conservation project in the ETP in order to build capacity and inspiration for conservation.	Develop experience exchange activities among fishermen who manage to show the importance of shark nursery areas.
2.E. 2.E. Design and develop an impacting social network campaign aimed at raising awareness regarding migratory marine species in the region.	Disseminatethis campaigh through the social networks of Migramar and other important sites

Sustainability of Project Outcomes

The results obtained so far are providing information that did not exist to scientifically inform management measures that will help conserve this species. All information that has been generated is critical to inform action plans in Ecuador. The information that Baby Shark project is generating will be a part of the countries conservation strategy. The information we are currently generatings is also supporting similar processes in other countries in the ETP.

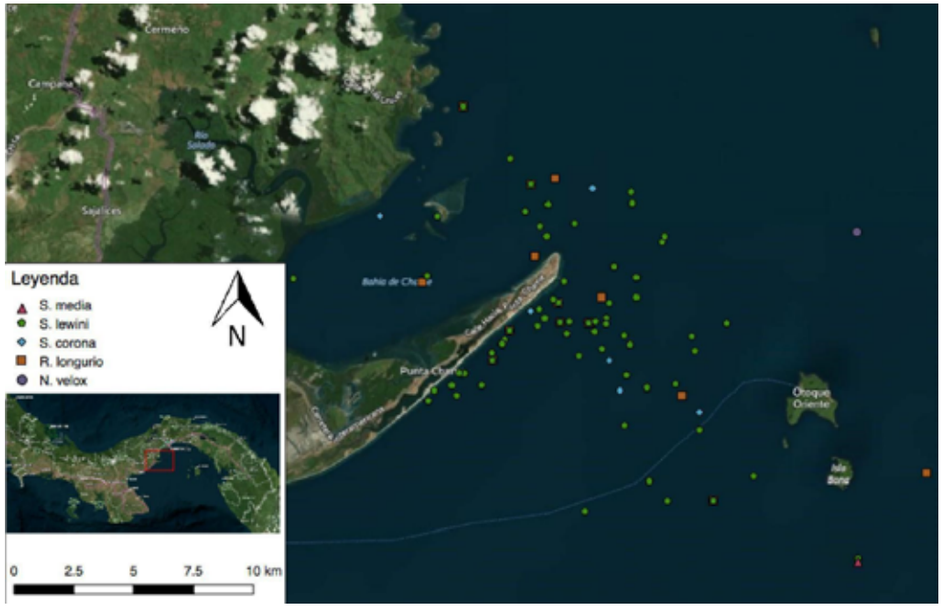
The information currently generated is being used by fisherment communities in Cabuyal to promt actions such as the release of newborn sharks when they are caught in nets. The interaction with fishermen and the results of our capacity building workshops has shown that there is a positive impact in fishing communities creating environmental awareness and concern for the conservation of marine resources and endangered species.

Unintended Outcomes

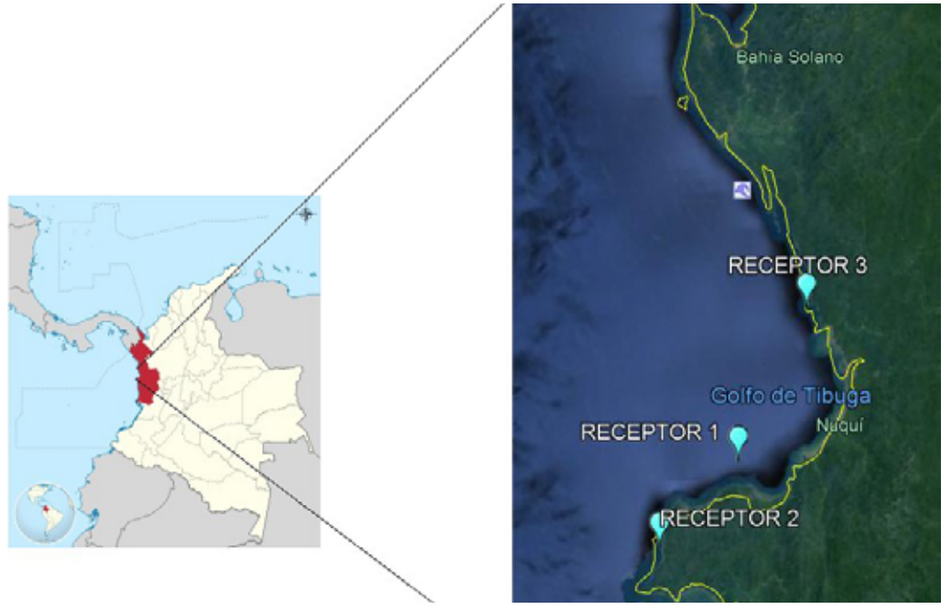
One of the products that was not expected in this first period of development of the project is the interest and opportunity that exists to create Marine Protected Areas in the nursing hammerhead sharks sites, coinciding with previous intentions of coastal communities that have expressed interest in creating a Marine Protected Area. This is an opportunity to be seized next year and where more effort will be concentrated into archieving political will.

Also, there is a growing interest in working to conserve shark nursing areas at the regional level. MigraMar has created a working group dedicated to this topic that aims at strengthening these activities along the Pacific.

Annexes



Annex 1. Monitoring in Panamá Punta Chame Panamá



Annex 2. Hammerhead shark nursing area found in Colombia in the Gulf of Tibuga by members of Fundación Malpelo y Otros Ecosistemas Marinos (Migramar).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