

Implementing a Fisheries Refuge in

SAN BASILIO B.C.S. MEXICO

YEAR 2 FINAL REPORT

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This report is a summary of the results from the research activities completed during September 2021 through August 2022. These new findings have been integrated into a technical report that the team has been improving since Year 1, and which may be useful for other scientists and government officials. All complementary reports are available upon request; all data gathered has been organized in databases and is available through dataMares or upon request.





INTRODUCTION

San Basilio is a small bay located 53 km North of Loreto, in Baja California Sur, Mexico (Figure 1). San Juaniquito is a small settlement composed of a few families that depend on fishing for subsistence. The Aburto Lab, in collaboration with the Gulf of California Marine Program (GCMP) and the Centro para la Biodiversidad Marina y la Conservación A.C. (CBMC) has coordinated four scientific expeditions (2019, 2021 and 2022) to generate information related to fisheries, estuaries and rocky reefs in the region. During Year 1 of this project, researchers described the ecological traits and oceanographic characteristics of this small area. Such information, included in a technical report¹, allowed us to establish a baseline showing how marine ecosystems in San Basilio are connected to other areas like Loreto to the south through oceanographic processes. We also learned that the rocky reefs along San Basilio's coastline are comparable to those in marine protected areas like Loreto and Cabo Pulmo in terms of biodiversity.

Since the launch of the project in 2019, the team began to build and established a collaborative relationship with the small fishing community of San Juaniquito to find ways to involve them in our research program. They support ecological monitoring activities and have consistently generated fisheries data, working under the guidance of the fisheries monitoring team. During Year 2, most of our efforts focused on characterizing the fishing dynamic of San Juaniquito's fishing fleet. Understanding how fishers work and how much they depend on fishing has helped us gain knowledge and a better understanding of the challenges and opportunities this small community faces in terms of sustainable development.

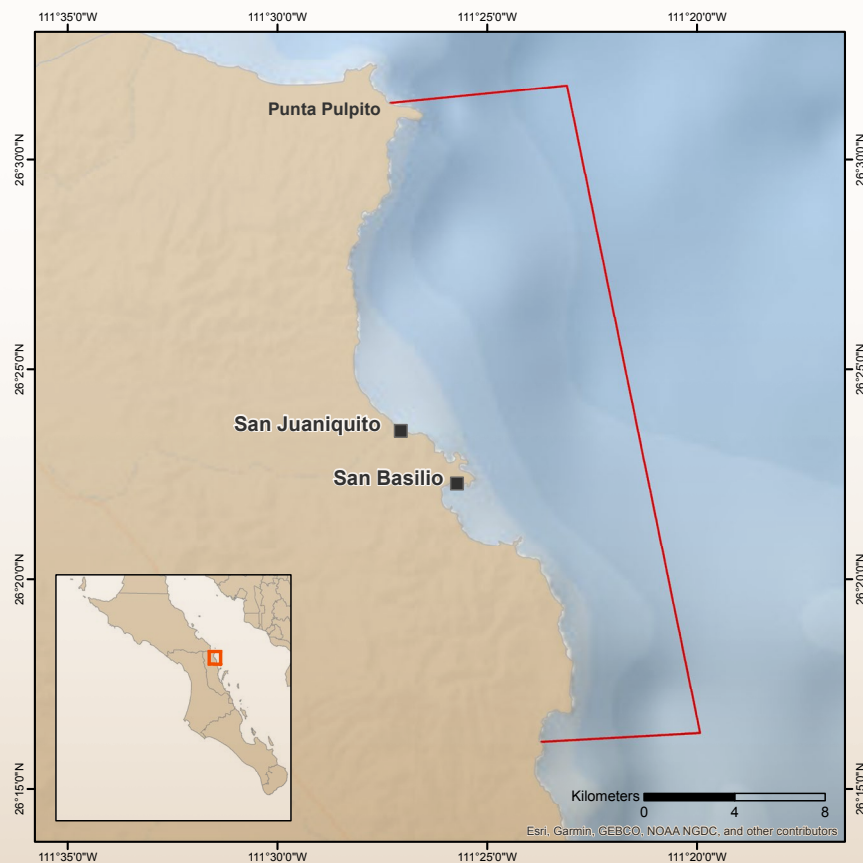


Figure 1. San Basilio Bay and the small fishing community of San Juaniquito are located north of Loreto in Baja California Sur, Mexico.

¹ Appendix II. Estudios ecológicos y pesqueros de la zona de San Basilio. Technical Report.



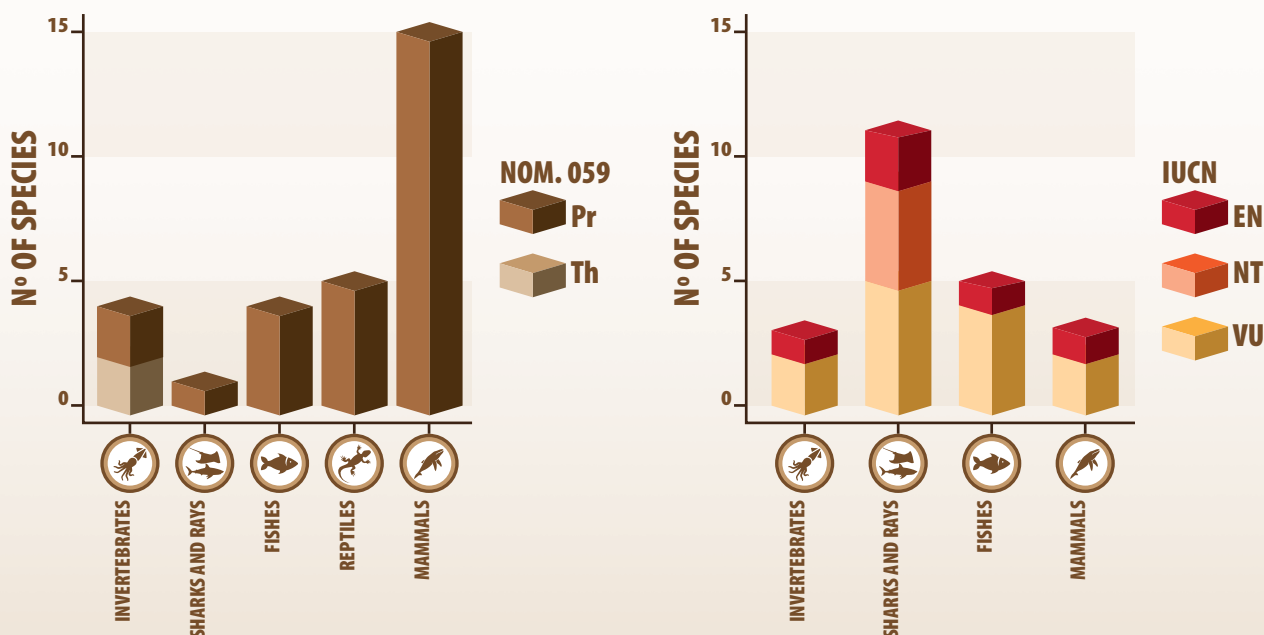
COLLABORATIVE RESEARCH

The core philosophy of our work is collaboration and both monitoring programs, fisheries and ecological, prioritize community members' participation. Whether it be generating data, providing support during field work, or sharing empirical knowledge during the design and data interpretation stages, involving local stakeholders will ensure these efforts stand the test of time.

So far, the research team has completed four research campaigns that includes three teams: (1) blue carbon ecosystems monitoring team; (2) rocky reef monitoring team; and (3) artisanal fisheries monitoring team. The three estuaries located in the study area have been monitored in collaboration with Dr. Sula Vanderplank from EcoAlianza's Centro de Estudios del Medio Ambiente (CEMA). Rocky reef monitoring is coordinated by the CBMC and has had the participation of researchers from UABCS and CICIMAR; while the GCMP coordinates the fisheries monitoring team and oversees community involvement.

MARINE BIODIVERSITY AND CONSERVATION STATUS

The research team has recorded 340 species of marine plants and animals since launching this project in 2019². Our records include 34 species of algae (Rhodophyta, Heterokonthophyta, Chlorophyta); one plant (*Ruppia maritima*); 99 invertebrates; 18 sharks and rays (Elasmobranchii); 161 species of fish (Actinopterygii); five marine turtles and 15 Marine mammals. Of these, 29 are included in Mexico's endangered species list³ and 23 are on the International Union for Conservation of Nature Red List of Threatened Species⁴. Artisanal fisheries are managed through a combination of tools, including fishing permits that specify target species, fishing gear and any fishing closures that may apply. While fin fish are pooled together into one category, sharks and rays require a separate permit and are regulated by a federal norm⁵.



² A complete report on the region's terrestrial and marine biodiversity can be found here:

<https://nextgensd.com/san-basilio-biodiversity-and-conservation/>

³ Norma Oficial Mexicana NOM-059-SEMARNAT-2010, Protección ambiental-Especies nativas de México de flora y fauna silvestres https://www.dof.gob.mx/nota_detalle.php?codigo=5578808&fecha=14/11/2019

⁴ The International Union for Conservation of Nature's Red List of Threatened Species; <https://www.iucnredlist.org/>

⁵ Norma Oficial Mexicana NOM-029-PESC-2006. Pesca responsable de tiburones y rayas. Especificaciones para su aprovechamiento.



FISHERY DYNAMICS IN SAN BASILIO

The interviews completed during the first year of this project allowed us to gather relevant information regarding San Juaniquito and its inhabitants. San Juaniquito has a fleet of eight pangas, each operated by a family. These vessels are 22 ft in length and have an 75-85 HP outboard motor and each take GPS data logger to monitor every fishing trip. Thus far, we have been able to collect data from 190 trips in 2020, 159 in 2021 and 60 in 2022. Fishers fill out a log at the end of each trip where they record the day's catch (volume and species), fishing gear used (hook and line or gillnet), and an estimate of gasoline consumed⁶. All data collected thus far was used to characterize the fishing fleet's dynamic, as well as improve our understanding of how fishers use this area.

About 82% of fishers are independent (pescador libre) and are not members of any fishing cooperative as the other 18% does. Being part of a cooperative has some benefits, including having fishing gear and equipment at your disposal. Independent fishers reported that they either borrow gear and equipment from a family member or the owner of the fishing permit (45%), while others reported owning their own gear (36%).

Fishing effort is not distributed evenly throughout the study area, but there are certain spots that tend to concentrate effort depending on the species that fishers are targeting (Figure 2). Because species distribution is influenced by habitat and season, the fishing fleet's movements can be used as a proxy for species distribution patterns. Monitoring data shows fishing takes place where coastal rocky reefs are located; however, there is a small cluster of reefs located in deeper waters where species like sharks, jacks and seabass tend to inhabit.

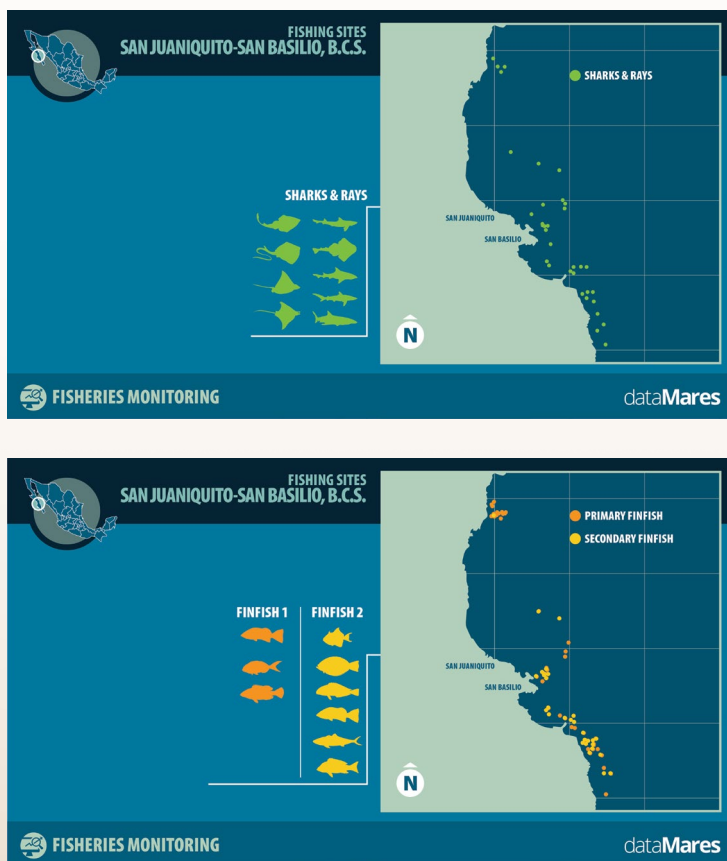


Figure 2. San Juaniquito's fishing sites identified for the three main target species groups. Sharks and rays are fished with gillnets, while finfish are targeted with hooks and line. Source: Artisanal fisheries monitoring program, GCMP.

⁶ Protocolo para la colecta de información espacio-temporal y pesquera. <https://escholarship.org/uc/item/1dn35930>



Using the information from the GPS data loggers, fishing effort can be mapped to help visualize where fishers spend most of their time or where the majority of the product is being caught (i.e. we can identify the most productive areas or reefs) (Figure 3). Fishers have preferred fishing grounds where they can confidently fish enough product to make the trip worthwhile.

Although fishers mentioned having periods of time in which resources are scarce, reefs have remained productive. Landings tend to decrease when environmental changes or disturbances take place (e.g. water temperature, storms, red tides), and the increase in presence of fishers from Loreto and mid-size fishing boats is increasing the fishing effort being exerted on these coastal reefs.

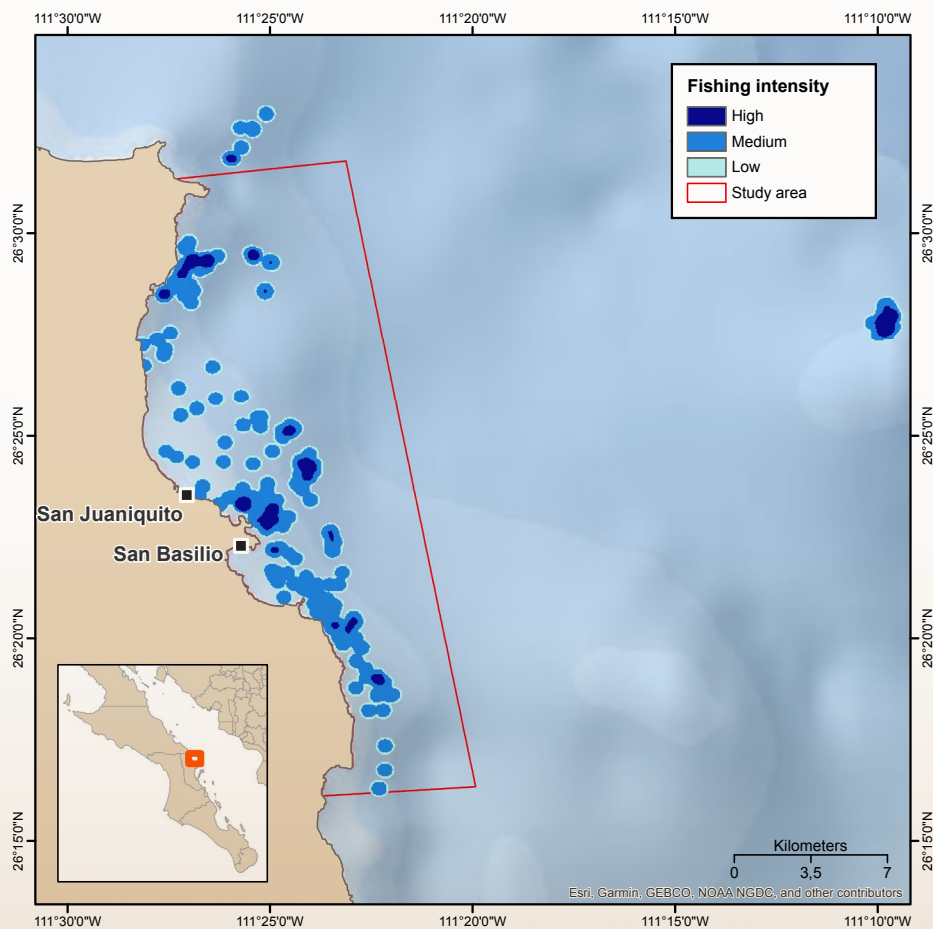


Figure 3. Fishing effort is distributed among the coastal rocky reefs of the San Basilio region. Color gradient represents the relative volume of landings reported by fishers from San Juaniquito. Source: Artisanal fisheries monitoring program, GCMP.





A concern that consistently comes to light when discussing resource management, whether it be species-specific or area-based, is how such measures impact people's livelihoods. The monitoring method implemented in our research was specifically designed to generate detailed information that allows us to analyze data to highlight different aspects. For example, 80% of San Juaniquito's fishing sites are within our study area and we know how much fishers depend on each of these sites (Figure 3), therefore we can estimate what the impacts of a conservation and/or management efforts on fishers will be.



One of the biggest challenges fisheries management faces is the lack of data that helps understand a fishery and its dynamic. To determine the best management tool, we need to know, not only where fishers are fishing, but how they fish. Our data can be segregated based on fishing gear so, if needed, fisheries could be managed using a combination of area-based and gear-specific scenarios (Figure 4). In San Juaniquito, hook and line fisheries produce 55% of landings with fishers focusing their efforts on reefs where high-value species tend to aggregate. Fisheries using gillnets have a broader distribution and produce 45% of landings.

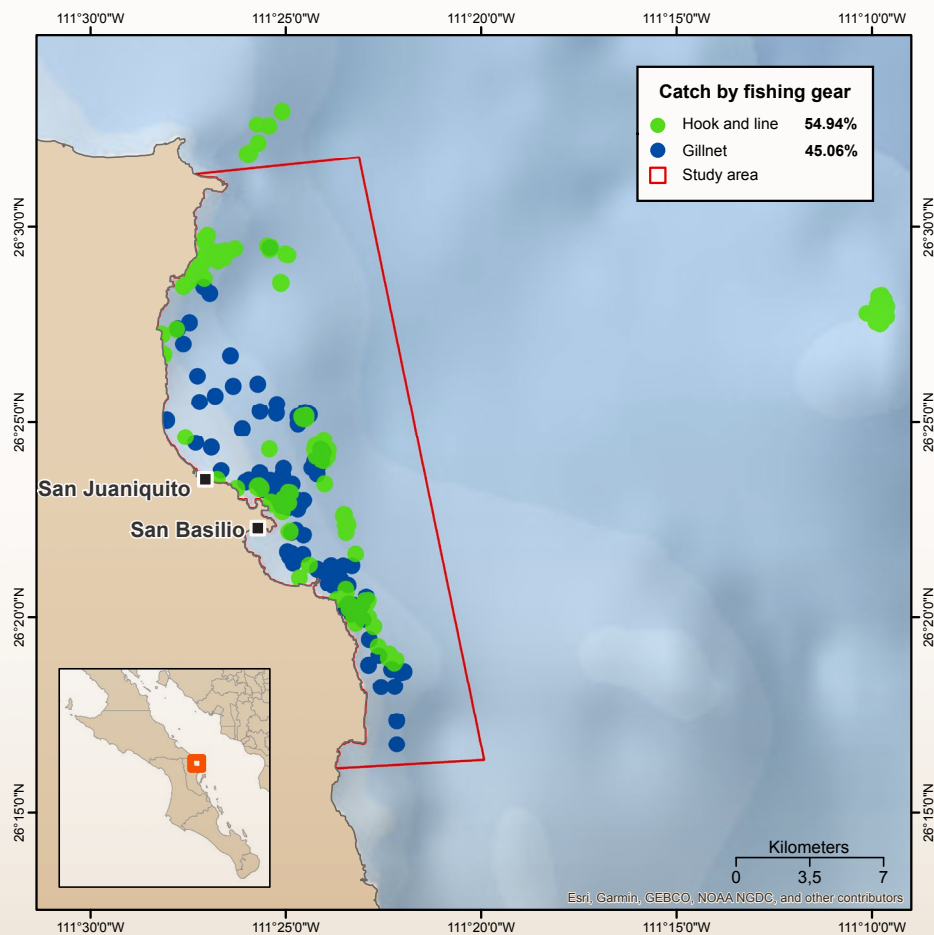


Figure 4. Fishers from San Juaniquito use hook and line or gillnets to target local resources. Gillnets are used to catch sharks and rays, highly mobile species, while several fish species are targeted using hook and line. Source: Artisanal fisheries monitoring program, GCMP.

San Juaniquito's artisanal fishing fleet operates all year, targeting finfish during the warm months and elasmobranchs in the cooler months. The fishery targeting sharks and ray has an annual closed season that runs from May through July, so during those months fishers depend solely on the finfish fishery. These two target groups not only have differences in terms of seasonal abundance and availability, but also in consumer demand and market price (Figure 5).

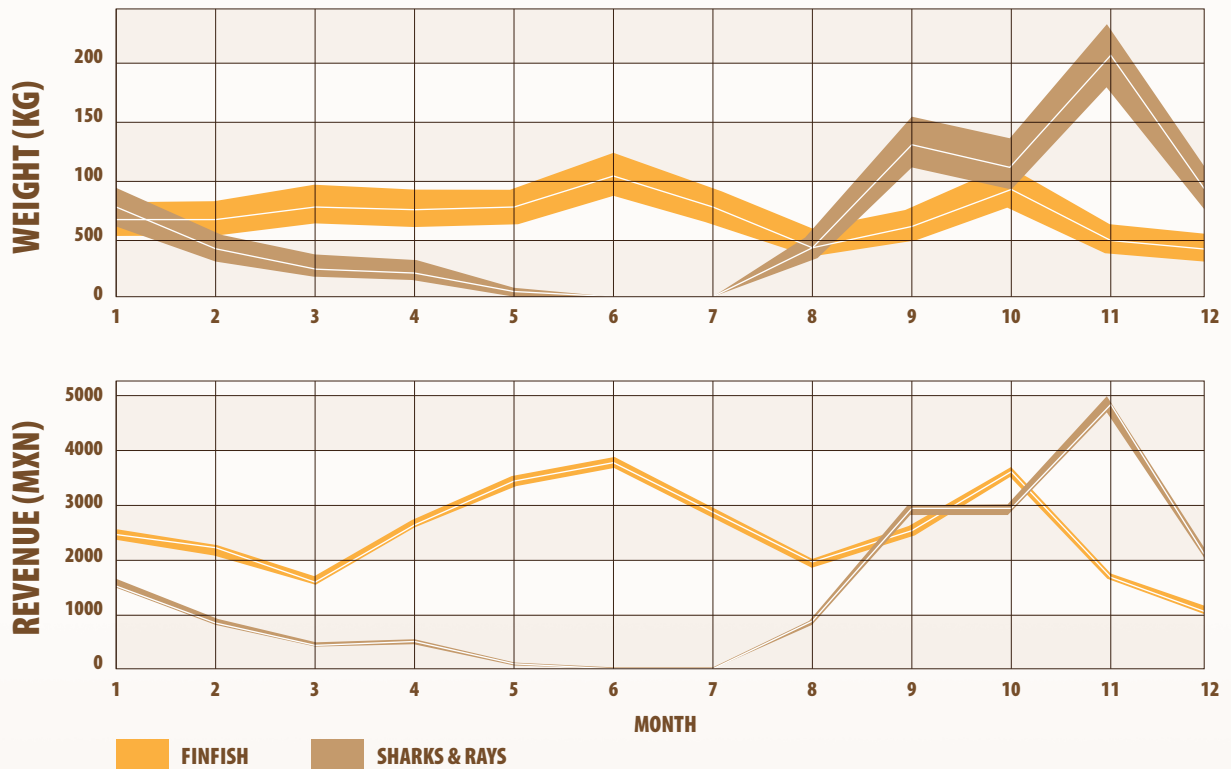


Figure 5. Price and profit trends for both target groups. The dip in values from May through July for sharks and rays corresponds to an annual closure.
Source> Artisanal fisheries monitoring program, GCMP.



Using the data generated through the GPS data loggers and the fishing logs from the fishermen, we have been able to make some initial estimates of the economic contribution generated by fishing activities (Table I). This small fishing fleet tends to travel short distances and their average daily catches are small (Table I.A). Decisions on where to fish and movement between reefs depends on resource availability. In addition to the direct costs of fishing, fishers from San Juaniquito have other monthly expenses associated to fishing, the biggest one related to gasoline needed to travel to and from Loreto every time they have a delivery (Table I.B). Fishers reported having to pay bribes to “buy” the right to use the road in and out of San Juaniquito and, while the amount may vary, we use \$1,000 pesos as an estimate since there is hesitance to talk in detail about organized crime. Also, trips to Loreto are not only meant for deliveries; families use these trips to take stock up on groceries, visit the doctor, buy supplies and re-stock on gas, ice and bait.





After factoring in all expenses, each fisher can earn an average of \$26,895 pesos in revenues per month, which means they can potentially generate \$322,748 pesos a year. Collectively, fishing can generate about 2.5 million pesos a year for San Juaniquito, with an average \$215,165 pesos/month (Table I.C).

A. GENERAL CHARACTERISTICS OF EACH TARGET FISHERY IN SAN JUANIQUITO.

Fishery		Average catch/trip (kg)	Average distance/trip (km)	Average volume of gas/trip (lt)	Average price of catch (pesos/kg)	Average cost of fishing gear/trip (pesos)
Sharks and rays		53.22	17.46	13.35	\$20.89	\$72.50
Finfish		55.46	22.60	18.25	\$46.56	\$16.60

*Average price of liter of gasoline = \$19.39 pesos/lt.

**Estimates based on 200 fishing trips a year per boat.

B. INDIRECT COSTS ASSOCIATED TO FISHING IN SAN JUANIQUITO. THESE EXPENSES ARE RELATED TO THE TWO MONTHLY TRIPS TO LORETO TO DELIVER CATCH AND BUY SUPPLIES.

Description	Estimated monthly expenses (pesos)
Gasoline for car	\$3,600
Ice	\$2,800
Bait	\$2,000
Medical	\$500
Groceries	\$7,000
Motor service	\$400
Motor repairs	\$2,000
Car service	\$1,000
Car repairs	\$2,700
Bribes/quota	\$1,000
Total monthly expenses per boat	\$23,000
Total annual expenses per boat	\$276,000

C. ESTIMATED MONTHLY AND ANNUAL REVENUES GENERATED BY FISHERIES IN SAN JUANIQUITO.

Total Annual Revenues per boat	\$322,748.83
Total Monthly Revenues per boat	\$26,895.74
Total Annual Revenues for the fleet	\$2,581,990.65
Total Monthly Revenues for the fleet	\$215,165.89



SEAFOOD DISTRIBUTION NETWORK

Traditionally, seafood has been bought and sold through a mixture of informal (i.e. no contracts or written agreements) and formal relationships that have a significant impact of fisher's revenues. Most transactions are informal and done through a middleman, who may also provide loans so fishers can continue fishing in exchange for "in-kind" payment (i.e. fishers are forced to sell their product to him). This basically transfers all power to the middleman, leaving fishers in a vulnerable position with no negotiating power.

Another important factor to consider is that San Juaniquito's fishers are competing against other fishers from Loreto, who have better equipment and can deliver better quality product (Figure 6). San Juaniquito's fishers sell their product to four brokers in Loreto: P. Higuera, La Bodeguita, Playas de Tijuana and the Cooperativa Álvarez. The remoteness of this community and lack of efficient refrigeration infrastructure results in the product's value quickly decreasing, which in turns makes it difficult for fishers to find a buyer.

Even with the seafood distribution network being predominantly informal, it is surprisingly stable. Business relationships have remained for many years, albeit with ups and downs that reflect periods of strain and periods of positive feedback. Dealing with a single buyer is preferred by fishers as it simplifies logistics and minimizes costs, but they are aware of the risk this has and how it reduces their resiliency and independence. Fishers are also aware of their need to find a way to improve equipment and other infrastructure so that their product maintains quality and can then be competitive against others.

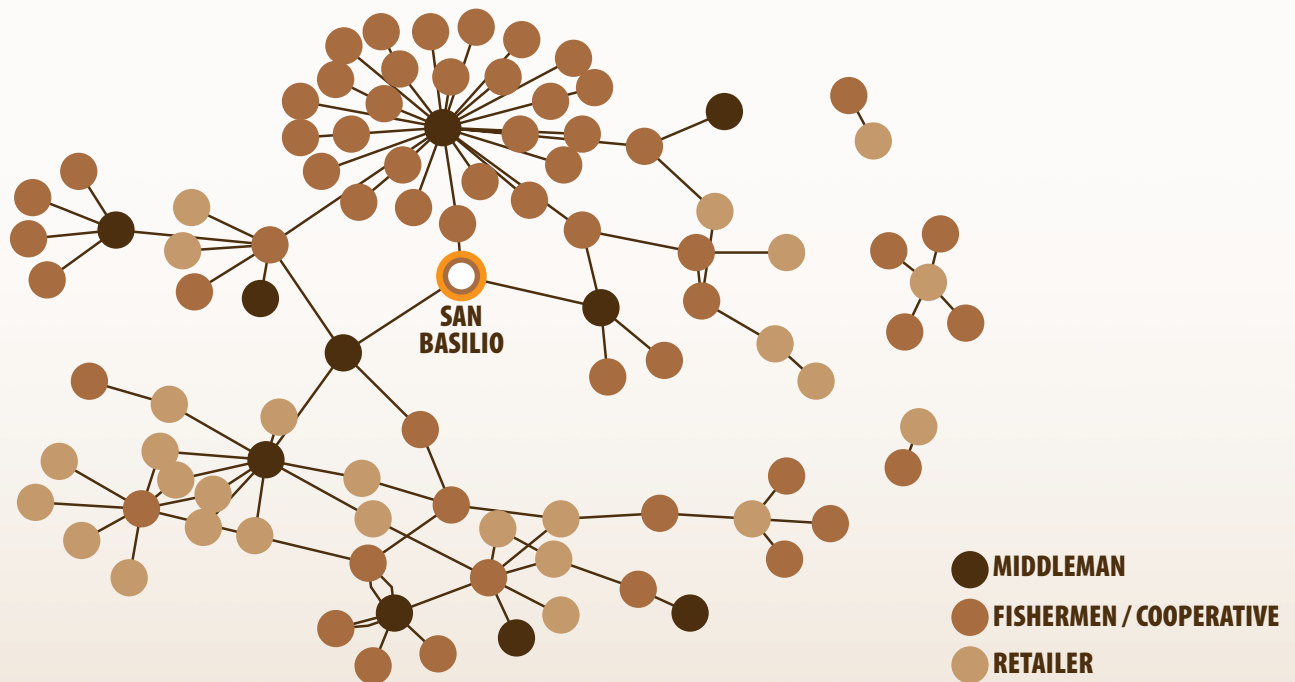


Figure 6. Representation of the seafood distribution network in Loreto. San Basilio fishers are represented with orange circle.



BUILDING A COLLABORATIVE RELATIONSHIP

Each family unit participating in fishing operates somewhat independently from others. They make decisions based on personal needs and preference but seek advice from others when needed. Sometimes, collaborative agreements among several fishers take place to increase benefits, distribute responsibilities, or share costs and sometimes people decide to work independent from others. Relationships among fishers are always changing in response to outside stressors like resource availability, market status, economic hardships and family issues, but a collaborative spirit seems to always prevail. This dynamic is not uncommon for communities that rely so heavily on one activity (in this case, fishing) and are in remote areas⁷.

The research team has maintained constant communication with fishers to foster collaboration and trust, as well as to establish an open communication among participating groups. We have presented and discussed research progress through formal and informal meetings. Informal settings allow us to engage in rich conversations with individuals and their families, sometimes leading to a more open dialogue that includes information that people may not feel comfortable sharing with a larger group of people. Formal presentations are necessary to present findings and new information, but also to engage in discussions where individuals can express their thoughts, worries, ideas and provide feedback so that a collective understanding of the status of fisheries and conservation opportunities can be built. These exchanges not only help community members improve their understanding of what is happening in the ocean and therefore their fisheries, but also helps scientists learn from them and improve our interpretation of the data and analysis results.



LOOKING TO THE FUTURE

Throughout these past two years, we have discussed issues related to fisheries and conservation in the San Basilio region (Table II). They have expressed interest in addressing unsustainable fishing practices and incorporating aspects of seafood trade and administration which have been left to third parties but could potentially help them become more efficient fishermen. This interest is the result of a changing environment, both ecologically and socially speaking. Overfishing and climate change are impacting reef productivity, illegal fishing affects marine ecosystems' health and threatens locals' safety, and even the community's relationship with the San Basilio Group has been changing.

Another driver behind the community's interest in diversifying their income sources is that, as a growing community, they need better infrastructure and services. While fishing is high on their priority list, families are interested in exploring activities that help complement their income and diversify their livelihoods. Only 27% of fishermen interviewed reported having their sons or daughters involved in fishing and, while this is a relatively young community (i.e. most of the families include grade-school children), a few people recognize that fishing is a tough way of life. For example, a couple of people mentioned sport-fishing and diving as areas of interest; another group expressed interest in terrestrial ecotourism and conservation (hiking, estuary restoration, beach cleanups). Sea turtle monitoring was mentioned during the discussion as an alternative for women and children.

Like many rural, and remote, communities along the Baja California Peninsula, San Juaniquito lacks basic infrastructure and services that are necessary to improve living conditions for this small group of families. Successful conservation programs and resource management depend on active participation and buy-in from resource users and from those affected by any restrictive measures that need to be put into place. When conservation/management goals are prioritized over a community's wellbeing, the rate of success for these plans declines. Addressing the community's needs will enable them to provide adequate services to tourists and visitors, which in turn will help build the foundation for their livelihoods.

⁷ Rosen, N. et al. (2022). *Beneficio colectivo sobre el beneficio individual: perspectivas clave de una cooperativa de pesca artesanal funcional*. In: *Comunidades con voz: el futuro de la pesca artesanal en Latinoamérica y el Caribe*. Lina María Saavedra-Díaz y María Claudia Díaz Granados Eds. Pp: 91-118.









Table II. Challenges, needs and opportunities for sustainable development in San Juaniquito and the San Basilio area. Information included in this table was collected by the GCMP and CBMC teams through interviews and conversations with community members while developing this project.

	 CATEGORY	 OPPORTUNITIES	 CHALLENGES	 POTENTIAL COLLABORATIONS
ALTERNATIVE LIVELIHOODS	SPORT-FISHING	<ul style="list-style-type: none"> • Since fishing is their expertise, this activity seems to be an easy transition. • Women can participate in administration and/or cooking duties. 	<ul style="list-style-type: none"> • Boats need to be upgraded • Fishing gear and equipment is needed. • Infrastructure for dining, fish processing, cooking, etc. would have to be built. • Service infrastructure* required. 	<ul style="list-style-type: none"> • Municipal and state governments • CONAPESCA • FONMAR
	DIVING AND SNORKELING	<ul style="list-style-type: none"> • This is a secluded and quiet spot where they can enjoy sandy beaches and tranquil waters. • Visitors already arriving by car (camper trailers are common) and small sail boats that anchor nearby. • Local reefs are healthy and there is plenty of marine life to enjoy. 	<ul style="list-style-type: none"> • Road conditions are not optimal. • Boats need to be upgraded. • There is no adequate infrastructure to accommodate business needs. • Electricity is needed to run compressors to fill the tanks. • Service infrastructure* required. 	<ul style="list-style-type: none"> • Dolphin Dive Center, David Castro
	HIKING AND OTHER LAND-BASED ACTIVITIES	<ul style="list-style-type: none"> • Hiking and exploring the estuaries • Visiting the nearby ranchos to learn about their operations. • Beach cleanups and coastal ecosystem restoration. 	<ul style="list-style-type: none"> • Collaboration opportunities with local/regional conservation groups. • Service infrastructure* required. 	<ul style="list-style-type: none"> • Nearby rancherías • NGOs: NOLs
	SEA TURTLE MONITORING AND CONSERVATION PROGRAM	<ul style="list-style-type: none"> • A young man and his family are looking for support to formalize a monitoring and conservation program to provide protection to the nests until hatchlings emerge. • A surveillance program to deter poaching is needed (job creation). 	<ul style="list-style-type: none"> • Official certification and recognition are required. • Rules are needed to control offroad vehicles on the beach (a very popular activity). • Required use of leashes on pets during nesting season (foreign tourists camping tend to allow their pets to roam free, not always supervised). 	<ul style="list-style-type: none"> • CONANP, Profepa • Research institutions: UABCS, CICIMAR • NGOs: Grupo Tortuguero de las Californias, EcoAlianza-CEMA, Wildcoast
	ACCESS TO WATER	<ul style="list-style-type: none"> • Water is taken from a nearby well. • Each house stores water in individual tanks; no running water. • Pump and pipeline for water transport is used by all. 	<ul style="list-style-type: none"> • Detailed study of aquifers/groundwater is needed. • Lack of electricity limits use of technology to extract and transport water. 	<ul style="list-style-type: none"> • Municipal and state governments. • CONAGUA • Research institutions: UABCS, CICESE, CICIMAR, UC-Davis (CEMA)
COMMUNITY DEVELOPMENT	SEWAGE	<ul style="list-style-type: none"> • There are environmentally friendly options for latrines (e.g. bio-toilets, dry latrines) which could minimize risk of diseases spreading. 	<ul style="list-style-type: none"> • There is no sewage system or infrastructure; outhouses and bathrooms use septic tanks. • No evaluation of septic tanks has been made; contamination by filtration is unknown. 	
	SOLID WASTE MANAGEMENT	<ul style="list-style-type: none"> • Lack of proper waste management is a priority for local families since they wish to eliminate/avoid sources of diseases. • Recycling could benefit some families. 	<ul style="list-style-type: none"> • The community does not have a landfill. • No waste separation. • Trash is dumped and burned. • All recycling needs to be transported to Loreto. 	<ul style="list-style-type: none"> • Municipal and state governments • COSCYT • Research institutions: UABCS • NGOs: Ponguinguola, EcoAlianza
	ACCESS TO ELECTRICITY	<ul style="list-style-type: none"> • Homes have a set of solar panels that vary in terms of capacity. • Every family owns at least a small generator to produce enough energy to run small household appliances. 	<ul style="list-style-type: none"> • Panels produce just enough electricity for daily necessities. • There is no plan to install infrastructure that could help connect the community to the state's electrical grid. • No large appliances are used. Families use iceboxes. 	





	 CATEGORY	 OPPORTUNITIES	 CHALLENGES	 POTENTIAL COLLABORATIONS
ACCESS & COMMUNICATION	ROAD MAINTENANCE	<ul style="list-style-type: none"> The new municipality administration has maintained the road enough to facilitate transit to and from Loreto. A well-maintained access road (doesn't have to be paved) is crucial. 	<ul style="list-style-type: none"> Access to San Juanquito requires a vehicle capable of handling tough off-road terrain. 	<ul style="list-style-type: none"> Municipal government (Desarrollo social) Secretaría de Comunicaciones y Transportes
	CELL PHONE RECEPTION	<ul style="list-style-type: none"> The most reliable source of communication is via radio signal 	<ul style="list-style-type: none"> There is no cell phone reception. Satellite signal is expensive. Radios require a generator to keep the batteries charged. 	
INFRASTRUCTURE AND TRAINING	COMMUNITY SPACES, AREAS FOR TOURISTS, GENERAL IMPROVEMENTS.	<ul style="list-style-type: none"> All infrastructure could be designed and built following sustainability standards and guaranteeing accessibility (Green community). A picnic area could be a nice space for tourists and community members to relax and have refreshments. A fisherman's wharf would allow fishers to process their catch. A nearby area with outdoor kitchen would allow women to cook and offer dining services. Space for parking is needed. 	<ul style="list-style-type: none"> Other than the school, there are no public spaces for the community and/or visitors. No public restrooms, stores or medical clinic. No dock or designated area for boats. 	<ul style="list-style-type: none"> Municipal government Secretaría de Turismo y Economía (SETUES) Sagarpa-Conapesca Private sector: Fundación Coppel
	TRAINING AND CAPACITY BUILDING	<ul style="list-style-type: none"> Younger community members have been exposed to opportunities for technical training or college courses, however consistent and formal training is lacking. 	<ul style="list-style-type: none"> All new ventures would require people to receive initial training. From business administration to customer service, these are abilities the community needs to acquire. 	

*Refers to basic infrastructure like restrooms, sinks, lighting.



