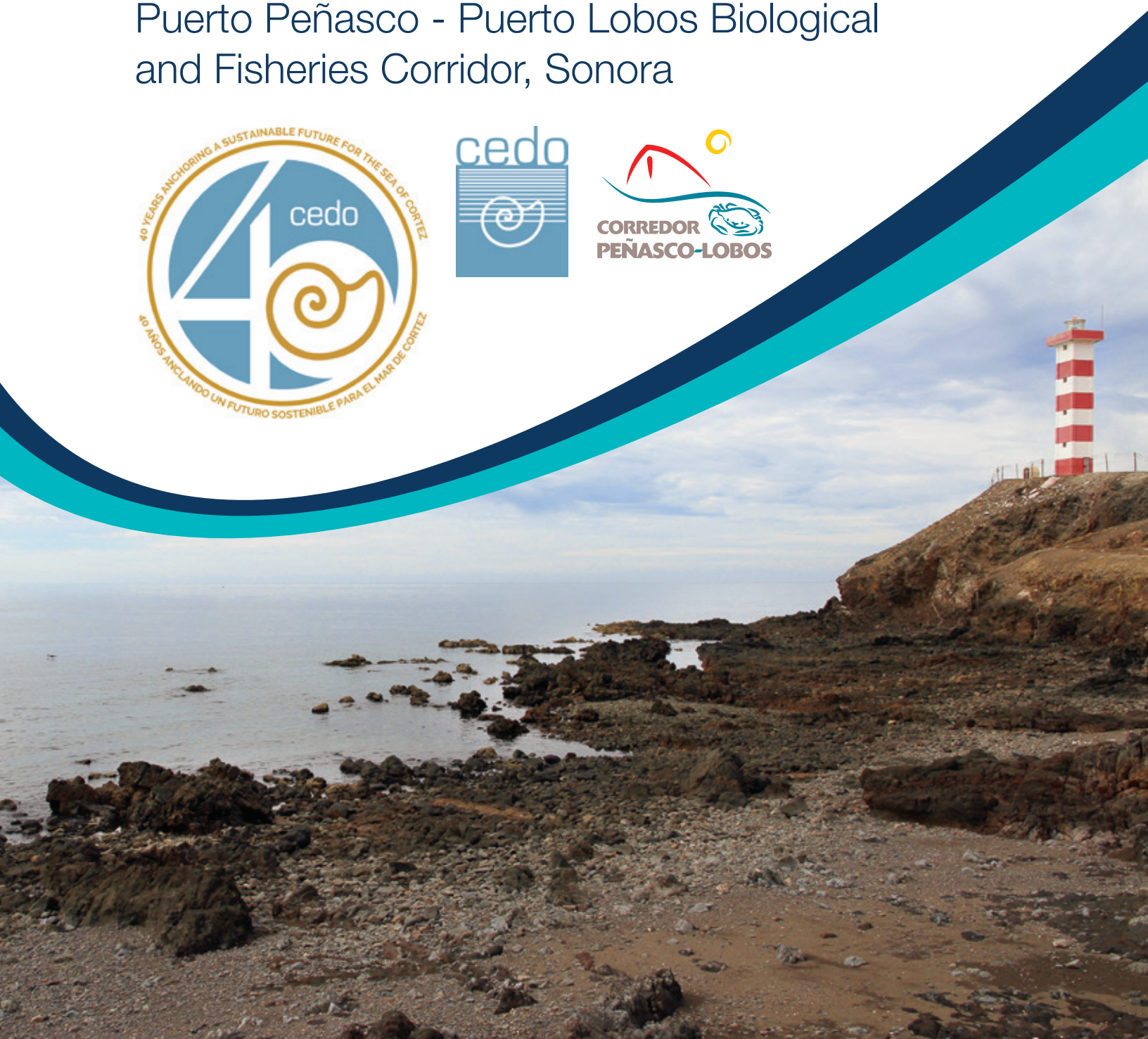
A New Path Forward for Ecosystem & Fisheries Management in Mexico:

Coastal-Marine Spatial Planning and Integrated Fisheries Management in the Puerto Peñasco - Puerto Lobos Biological and Fisheries Corridor, Sonora



Bottlenose dolphins *(Tursiops truncatus)*

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Contents

This report represents a significant milestone in CEDO's work and celebrates the close relationships that have been established with the communities of the Upper Gulf of California. I congratulate Peggy Turk Boyer, Executive Director Emeritus and Founder of the organization, for her leadership in achieving these results. In the coming years, the CEDO staff and I look forward to building upon this solid foundation to continue to promote meaningful environmental stewardship and community development in the critically important fishing sector of the Gulf of California.

Nélida Barajas Acosta
Executive Director

Preface and Acknowledgements

Peggy J. Turk Boyer
Executive Director Emeritus, CEDO Intercultural

In 2015, the Intercultural Center for the Study of Deserts and Oceans (CEDO) began to promote Coastal - Marine Spatial Planning (CMSP) as a solution to the declining health of the marine and coastal ecosystems of the Northern Gulf of California and to the problems faced by small-scale fishermen and other natural resource users. CEDO's first application of the CMSP framework began along Mexico's Sonoran coast in a highly productive "Biological and Fisheries Corridor", a unique ecosystem characterized by its rich and interconnected biological and socioeconomic diversity. This Corridor encompasses six fishing communities that benefit from a wide variety of commercial species and other ecosystem services.

CEDO's combination of vision, leadership, knowledge, experience, and 40 years of steadfast commitment have been essential for bringing people together around this innovative and comprehensive solution to the region's complex problems. With a shared vision and key support from Mexico's National Commission of Aquaculture and Fisheries (CONAPESCA), the active participation of different stakeholders, especially fishermen, and the integration of vast amounts of scientific data and traditional knowledge, we collectively produced a sound and comprehensive plan for Integrated Management of Coastal Fisheries in the Puerto Peñasco-Puerto Lobos Corridor. In the summer of 2018, after four years of hard work, a detailed technical proposal was formally submitted to CONAPESCA, forwarding a bottom-up management system that promises real solutions to urgent challenges faced by small-scale fishermen and their communities. The proposal places socioeconomic development of local communities at the forefront, seeking to ensure productivity of important commercial species, the primary source of livelihood in the region, while maintaining clear conservation outcomes for habitats, key species and ecological processes.

This comprehensive approach would not have been possible without the financial support and vision of: CONAPESCA, the Blue Solutions Initiative of the German Corporation for International Cooperation on behalf of the German Federal Ministry for the Environment, Building and Nuclear Safety ((GIZ- BMUB), the David and Lucile Packard Foundation, The Nature Conservancy, the Televisa Foundation, the Mexican Fund for the Conservation of Nature, the Alliance between World Wildlife Fund and Carlos Slim Foundation, the Environmental Defense Fund, Walton Family Foundation and SuMar "Voces por la Naturaleza". Through multi-year investments these funders made it possible to work at the scale needed to achieve significant and wide-reaching results. Only through such efforts that are built from the bottom-up, fostering stewardship and collaboration and the use of tools such as CMSP, can we hope to build the united front required for addressing the complex problems facing this and other regions around the world. Further financial commitments will be needed to proceed with implementation of this plan and engaging other stakeholders who share the use of this ecosystem.

With such inclusive and comprehensive programs we are reshaping the social fabric around the use of our oceans, setting important precedents for Mexican public policy, while also acheiving global sustainable development objectives, as promoted by the United Nations for oceans around the world. You too can help us realize these goals that address the economic needs of underserved communities in the Gulf of California and beyond, by supporting our work for engaging local stakeholders as stewards of the planet and ecosystems on which we all depend.

Coastal - Marine Spatial Planning:
A Solution for Mexico's Seas & Coastal Communities

Throughout the world, the Coastal - Marine Spatial Planning (CMSP) framework is being widely promoted as a solution to the growing conflicts arising around the shared use of marine and coastal areas and resources.

CMSP brings together all stakeholders in a defined geographic area to plan for the sustainable use of the shared space and resources, balancing diverse economic interests with the protection of productive habitats and biodiversity, to achieve integrated management for an area (Ehler & Fanny, 2009). CMSP has demonstrated success as an ecosystem-based management tool that can benefit vulnerable ecosystems and the diverse stakeholders that depend on them.

In the northeastern Gulf of California, Sonora, Mexico, CEDO has pioneered a participatory CMSP process to meet the immediate needs of coastal communities. Unlike many CMSP processes which are driven by large development projects and strong economic interests, this program has given priority to defining the spatial use and rights of traditional local users, such as coastal fishermen and oyster farmers. Since small-scale fishing is the mainstay of the local economy, focus was given first to spatial planning for the primary artisanal fisheries selected by the region's six coastal communities. By fostering a bottom-up process, engaging communities and building capacity for collective action, local voices have reached the highest levels of government with sound proposals for resource management.

Coastal-Marine Spatial Planning is being promoted worldwide as an ecosystem-based management tool that can benefit vulnerable ecosystems and the diverse stakeholders that depend on them.

This CMSP program contrasts with the top-down, conservation-driven management approach implemented in the adjacent Upper Gulf of California and Colorado River Delta Biosphere Reserve, where the endemic vaquita porpoise *(Phocoena sinus)* and the giant croaker "totoaba" *(Totoaba macdonaldi)*, are endangered with extinction. Regulations and measures used to protect these species have often been in direct conflict with fishermen's economic interests and social well-being. As fishing has been restricted in the Reserve, fishermen have flocked into adjacent regions to exploit resources, generating conflict with local users, and compounding existing territorial disputes between fishing communities and other stakeholder groups.

Using CMSP in the adjacent Peñasco-Lobos Corridor we sought a different approach that would engage local communities as co-responsible parties in resolving conflicts around the use of shared space for their primary economic activity. By defining and clarifying fishing rights and spatial use, the small-scale fishermen in the Sonora Corridor have already demonstrated their willingness to work together and to become stewards of this ecosystem. They have taken important steps to maximize fisheries recruitment, while also protecting key habitats.

As has been noted with the implementation of CMSP in other parts of the world, the process functions best when diverse groups of actors come together with similar levels of organization, capacity and vision to produce an integrated plan. With this program small-scale fishers have organized and articulated their vision for integrated management and ordering of their primary economic activity. Fisheries authorities will need to act on their proposals to give them legal validity. Moving forward CEDO will continue to create forums that engage other economic interests, so that tourism, sport-fishing, mining, and agricultural sectors can join the conversation around the collective use of the Corridor ecosystem to achieve shared objectives. While many management instruments may operate at the same time, other practitioners of CMSP have found one of the biggest challenges for implementing CMSP lies in defining an overarching authority that integrates, aligns and enforces a multi-sector zoning vision.

The Puerto Peñasco - Puerto Lobos Biological and Fisheries Corridor
– A Special Management Area for Responsible Fishing in Mexico

The sociopolitical and biophysical interconnections between the habitats, species and human communities from Puerto Peñasco to Puerto Lobos, in the Northern Gulf of California, Sonora, help define an integrated and unique corridor ecosystem. The western boundary for this Biological and Fisheries Corridor was determined by the fishing zones of its six communities, the limits of existing management areas, such as the fisheries exclusion zones for the vaquita porpoise, and other biophysical characteristics (Morzaria-Luna *et al.,* 2019, in review). Punta Borrascosa and Puerto Lobos (Figure 1), the northern and southern limits of the Corridor, roughly represent the north-south extension of the seasonally reversing current system that distributes larvae year-round throughout the area, connecting species and habitats (Soria *et al*., 2012, Turk-Boyer *et al*., 2014).

The Corridor is a very biodiverse ecological region that embodies a range of habitats, from wetlands, sandy and muddy bottoms, pelagic waters, riparian zones, intertidal and subtidal rocky reefs, to the rich San Jorge Island archipelago – one of the Gulf of California's Island Protected Areas for Flora and Fauna managed by the National Commission of Protected Areas (CONANP). Nearly one fourth of the Corridor's area overlaps with the Upper Gulf of California/Colorado River Delta Biosphere Reserve, which includes the vast wetland system of Adair's Bay north of Puerto Peñasco. Adair's Bay and the San Jorge Bay wetland complex to the south are both recognized by the Ramsar Convention on Wetlands of International Importance.

This diversity of interconnected habitats supports a high diversity of species, many exploited by the region's coastal fishermen. The Corridor produces about 1,800 metric tons of catch per year, with the harvest of at least 75 commercial species in sixteen distinct fisheries (data from the Corridor's Community Monitoring Program, 2016-17).

Its economic importance, ecosystem characteristics and sociopolitical boundaries, all justify the Corridor as a distinct management unit. The six communities of the region (Puerto Peñasco, Bahía San Jorge, Punta Jagüey, Santo Tomás, Desemboque de Caborca, Puerto Lobos) agreed to use this area during their process to define spatially explicit management tools for their primary fisheries. They submitted a proposal to officially designate the Corridor as an Area of Responsible Fishing for local communities, that is curently being considered by CONAPESCA.

Scientific studies on species distribution, trophic ecology (food webs), and connectivity (larval dispersal) help define the Puerto Peñasco-Puerto Lobos Corridor as an integrated ecosystem and offers an opportunity to promote a unique management area.

Figure 1. The Puerto Peñasco - Puerto Lobos Biological and Fisheries Corridor, Northern Gulf of California, Sonora, Mexico, covers the marine and coastal zone from Punta Borrascoso south to Puerto Lobos, Sonora. The Corridor area incorporates the primary fishing zones of six coastal communities, existing management areas, and marine and coastal habitats (modified from Morzaria-Luna *et al.,* 2019, in review).

Puerto Peñasco to Puerto Lobos Corridor Communities

The six communities encompassed by the Corridor lie in the two Sonoran municipalities of Puerto Peñasco and Caborca. These communities share the same fisheries jurisdiction and central office at Puerto Peñasco. Fishing permits issued to fishermen from these communities generally cover the entire geographic area of the Corridor.

Small-scale fishing is the principal economic activity within the Corridor with about 2,000 active fishermen.

Fishing is the backbone of the economy for these coastal communities, with around 2,000 small-scale fishermen operating in the Corridor, and more than 60,000 total inhabitants. Puerto Peñasco is the largest of these communities and has the most diverse economy, with active industrial and recreational fishing fleets and an important tourism industry. In some of the smaller communities fishing livelihoods are supplemented by terrestrial mining for gold and other minerals, agriculture, and growing tourism activity (Table 1).

Extensive commercial relationships, friendships, and kinships create strong ties among the people of the Corridor. But despite their many interconnections, each community has its own unique socioeconomic character, observed in their level of organization, the diversity of fisheries exploited, and the other economic occupations they pursue (Table 1). The smaller communities are marginalized from basic social services, such as schools and medical facilities. Some communities are far removed from the coast, requiring traveling considerable distances by car to get to their fishing landing sites. The supplies needed for work (like gasoline and fishing gear) are also relatively expensive, where available. Fishermen lack information on how to improve their socioeconomic situation, and there has been little government support available to them. Many fishermen, for example, do not know how to acquire a fishing permit, which is the primary legal tool required to access fisheries.

Commercial relationships, friendships, and kinships create strong ties between the people living in the Corridor communities.

Altogether, these factors reduce the resilience of these communities, making them highly vulnerable to sociopolitical, economic, and environmental changes. Prior to this program, no process or structural framework existed to bring these communities together to solve their shared problems. By enhancing social connectivity, the program seeks to address a wide range of challenges, from overfishing, competition over resources, impacts of climate change, to providing alternative economic opportunities to fishing and educational opportunities for young people.

Table 1. Description of the six fishing communities of the Puerto Peñasco-Puerto Lobos Biological and Fisheries Corridor, Sonora, Mexico. Communities are shown from north to south. See map on p. 5.

Corridor communities	Population size	Fishing organizations	Number of small-scale fishing boats	Primary fishing gear	Other economic activities
Puerto Peñasco	62,177**	37 Cooperatives 3 Unions 1 Federation 2 Non-profit organizations	409	Hookah, gillnets, longline, pole, traps	Aquaculture Commerce Tourism
Bahía San Jorge (Ejido Campodónico)	325*	1 Cooperative	66	Gillnets, traps	Agriculture Aquaculture Mining
Punta Jagüey (Ejido 15 de septiembre)	393*	4 Cooperatives	57	Gillnets, pots, traps	Agriculture Mining
Santo Tomás (Ejido Álvaro Obregón)	707*	4 Cooperatives	36	Gillnets, longline, traps	Agriculture Mining
Desemboque de Caborca	733*	14 Cooperatives 2 Federations	170	Hookah, gillnets, longline, pole, traps	Agriculture Tourism
Puerto Lobos	121*	4 Cooperatives	56	Hookah, gillnets, longline, cane, pots, traps	Tourism

Data from INEGI *2010 and **2015, respectively

Challenges for Establishing Sustainable Coastal Fisheries

Fishing is fundamental to the economy of the region. Three fleets exploit the Corridor's abundant resources: the small-scale fishing fleet, and industrial and recreational fleets. The industrial, or large-scale fishing effort from the Corridor, is based out of Puerto Peñasco, with more than 100 boats that trawl for shrimp and several species of finfish. Additional industrial boats from the Guaymas area and south also venture into the Corridor area. Sport fishing, which is most developed at Puerto Peñasco and emerging at Puerto Lobos, is carried out by service providers using a range of vessel types, some owned by locals and others by foreigners.

Before the start of this program, more than 50% of artisanal fishing in the Corridor was carried out without the required permits, which makes local fishermen vulnerable and unable to defend their traditional use of coastal and marine resources.

Almost 800 small skiffs with outboard motors, called "pangas", engage in coastal, small-scale fishing throughout the Corridor (Table 1). This "artisanal" sector exploits a wide variety of species and uses various gear types and methods including traps, hookah, long-line, nets, and hook and line. Any individual fisherman will likely require several species-specific permits to sustain their various fishing activities throughout the year. Finfish and elasmobranchs (sharks and rays) each require separate permits, and most invertebrate species (snail, octopus, crab) require separate permits as well. Before the start of this program, more than 50% of artisanal fishing in the Corridor was carried out without the required permits, especially in the five smaller communities in the municipality of Caborca where there is no official fisheries office.

There are many challenges for fishermen to access permits. The process to obtain them is expensive and complicated and to be successful often requires having the right political connections. Many fishermen do not have documents proving ownership of their boats and engines, which is a basic permit requirement. The lack of permits leaves traditional unpermitted fishermen vulnerable to "poachers" from other regions who enter their traditional fishing grounds to exploit their resources. A fisherman without clear legal rights cannot denounce another's questionable acitivities. This scenario became all too common as gillnet fishing restrictions in the adjacent Biosphere Reserve to the north increased in order to save the vaquita porpoise and the totoaba, causing many fishermen to venture south into the Corridor where netting is allowed. Overfishing has become a serious problem, and conflicts are on the rise among individual fishermen, fishing communities, and between fishermen and other sectors, such as the growing tourism industry. Without permits, fishermen are also unable to defend their traditional launching sites on local beaches, which are being acquired by coastal developers.

Lack of information about fisheries and fishing effort has made it difficult for government authorities to propose effective management tools. Add to this, the lack of enforcement of existing fisheries regulations and insufficient resources for surveillance, and we begin to understand that the fisheries system is dysfunctional. Fishermen know they cannot rely on the government alone to solve their growing problems. In the first phase of our program, we worked with the Corridor's small-scale fishermen to identify the most pressing challenges they faced, and we laid out a plan for establishing realistic, community-based solutions.

Governance:
Transparent, Inclusive, and Informed Participation of a Multi-Sector Team

A transparent governance structure and a real commitment to the process are often cited as two of the most important enabling conditions for the successful implementation of CMSP. In the isolated communities of the Corridor, however, traditional users lacked the organization and institutional structure to spur collective action and were presented with few opportunities for interaction with scientists, management experts or government authorities.

Therefore from 2015 to 2019, CEDO forwarded a governance system to guarantee the equitable participation of all the stakeholders needed to solve fisheries-related problems. The governance model that emerged consists of four interacting management groups, collectively known as the Integrated Management Group (Figure 2):

- **The Intercommunity Fishers Group (IFG)**, is made up of small-scale fishermen and fisherwomen, elected through a transparent voting process as representatives of their communities. The IFG is the primary decision-making body involved in the design and proposal of management solutions. They are responsible for ensuring that their communities are informed and consulted during the process.

- **The Technical Group (TG)** is comprised of researchers and specialists in fisheries management, marine conservation and social participation. Their role is to provide technical feedback on the proposals offered by the IFG, elaborating and modifying as needed until consensus is reached on the management tools to be used.

- **The Core or Nuclear Group (CG)** consists of government authorities from all levels with jurisdiction over fisheries issues. This group analyzes the legal viability of the proposals and is responsible for facilitating their formalization, and ultimately for implementing them and any enforcement processes.

- **The Base Group (BG)** is represented by staff from CEDO, a local non-government organization with 40 years of experience working in the region. CEDO has led development of the Corridor Project and together with the National Commission of Aquaculture and Fisheries (CONAPESCA) and the National Fisheries Institute (INAPESCA) the GB facilitates meetings, maintains communications and has kept the process moving forward.

“For me the Corridor project is the opportunity, it is the possibility that fishermen were waiting for. The purpose, I think, of this project is that all fishermen have the same opportunities and the same possibilities of accessing the same resources, the same projects, the same subsidies. For me in broad terms, this is the Corredor ... sustainable fishing, orderly and with the same opportunities for all fishermen.”

Ernesto Alonso Gastélum, Intercommunity Fishers Group at Puerto Peñasco

Initially six people were elected democratically from each community to make up the Intercommunity Fisher Group (IFG). During this process an effort was made to assure representation of fishermen experienced in each of the fisheries exploited by that community and to include traditional fishermen. The IFG developed a set of bylaws to regulate the fair and equitable participation of their communities in the management of the Corridor. By the end of 2016 all agreed to give greater representation to the two larger communities, increasing the total number of official representatives to 45, including 12 representatives for Puerto Peñasco and 9 from Desemboque.

To ensure active and informed participation of the fishing communities a rigorous capacity building program was designed to cover a range of topics. Some themes were geared towards strengthening the IFG’s capacity for collective action (leadership, communications, negotiations), while others were more technical, providing information needed for making good management decisions (marine ecology, fisheries management tools, rights-based management). Field exchanges with distant fishing communities enhanced these programs by sharing the perspectives and experiences of other fishermen also involved in managing their resources. Some trainings were also offered to the communities at large. Community bulletin boards, posters, videos, radio programs and other tools formed part of a strategic communication campaign aimed at informing and involving Corridor communities.

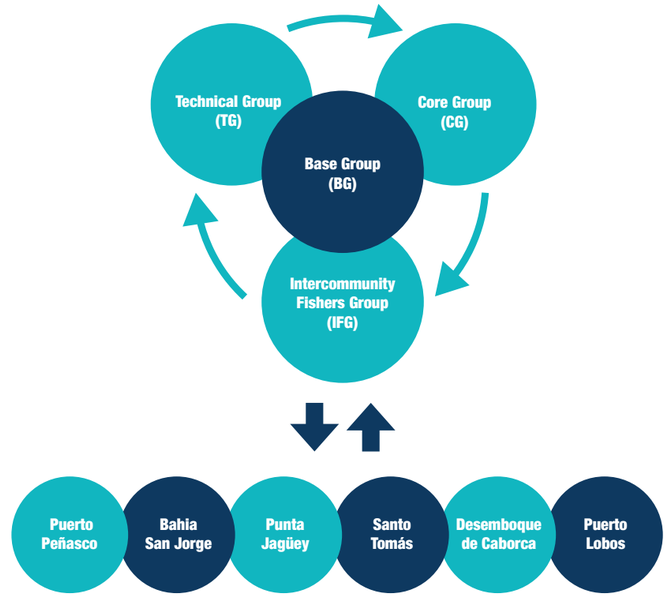


Figure 2. The CMSP process in the Puerto Peñasco - Puerto Lobos Biological and Fisheries Corridor has a governance model with four management groups that include fishermen, scientists, experts and authorities that collaborate in an Integrated Management Group to design, adapt and implement management actions. CG: Core Group, TG: Technical Group, IFG: Intercommunity Fishers Group, and BG: Base Group.

As a result of this process, IFG fishermen now take an active role as spokespersons for the Corridor program and its goals within their communities and beyond. They give radio interviews and represent the Corridor in forums with fishermen throughout Mexico and with authorities. They have helped organize beach clean-ups and are sharing their perspective and knowledge with local students, becoming role models of environmental stewardship. What is more, fishermen have actively participated in monitoring their resources to generate the information required for management.

In all 66 training sessions were held with fishermen and communities with almost 1,000 participants and almost 250 workshops and meetings were conducted for developing and validating a comprehensive management proposal for the Corridor (Table 2). Including all the management groups these sessions had almost 3500 participants. We at CEDO firmly believe that the active and meaningful participation of local communities is the foundation for achieving strong and sustainable ecosystem management. Through this program local fishermen have organized and are now empowered to be co-managers of their resources in continued collaboration with scientific experts and government.

Table 2. Meetings, workshops and training sessions carried out from 2015 to mid 2019 to engage management groups in the CMSP process for the Puerto Penasco – Puerto Lobos Biological and Fisheries Corridor.

*Management groups	No. Meetings/ Participants		No. Trainings/ Participants	
CG	48	344	n/a	n/a
TG	19	144	n/a	n/a
IFG	47	436	20	211
COM	116	2011	46	747
2 or more groups	11	419	n/a	n/a
Total:	**241**	**3354**	**66**	**958**

*Management groups: CG: Core Group, TG: Technical Group, IFG: Intercommunity Fishers Group, COM: Corridor Communities.

The shape and function of the Integrated Management Group that brings all these actors together will likely evolve as specific management instruments are formally adopted. Formalization of the relationship and specific roles of each of the management groups will help strengthen and sustain the operations needed for implementation of the program.

“I am very pleased to have had the chance to participate in this project because it is using very innovative tools, with a lot of information, very detailed analyses, very well defined maps, bathymetries ... it is taking advantage of all the technology that is available ... This is a process for which it is well worth scientists and authorities making the effort to agree on, for the benefit of fishermen.”

Dr. Patricia Fuentes Mata, INAPESCA – Technical Group and Core Group

Generating Information: Integrating Traditional Knowledge into a Contemporary Scientific Framework

The scientific underpinnings of this program derive from robust data collected on the region’s small-scale fisheries. Apart from the scientific literature, data on the Corridor ecosystem was gleaned from years of collaborative research with fishermen in both biological and fisheries-based monitoring, and from other in-depth field studies conducted by CEDO and others as part of two ecosystem-based management research initiatives: PANGAS, Small-scale Fishing in the Northern Gulf of California: Environment and Society (Munguia-Vega *et. al.,* 2015) and Atlantis, an end to end ecosystem model for the Northern Gulf of Califoria (Ainsworth *et al.,* 2011). Building on firsthand information, integrating traditional and experiential knowledge, and validating results with local fishermen were key steps in this process, allowing for the integration of both fine-scale data and the generation of a high level of confidence in the data among communities and all parties involved.

This CMSP is based on robust scientific information that integrates and validates fishermen’s traditional knowledge.

Cabo Pulmo, BCS members of GIR, CEDO and Niparajá. Photo - Efraín Wong

More than 200,000 geo-referenced datapoints form the baseline for the spatial and temporal components of this integrated management process, and for the analysis of management tools like species-specific quotas, fisheries refuges, and community management areas. For example, by using input from fishermen and scientists in the modeling program ZONATION (Moilanen et al. 2004), we were able to prioritize areas for establishing unique fisheries refuge zones with highly specific goals for 11 priority species. The resulting network of 26 refuges was then tested to assure that a series of key biophysical principles were followed, that would maximize successful larval dispersal and recruitment of fisheries populations, as well as give adequate protection for essential habitats. Refuges for specific species and habitats were replicated throughout the Corridor’s four main zones to support connectivity and protect against large scale perturbations and the effects of climate change, following guidelines established for the Gulf of California (Munguia-Vega *et al*., 2018).

In each of the Corridor’s six communities, local, shore-based monitors continue to register all the artisanal fishing activity in the Corridor - information that would otherwise be unavailable and that is a pre-requisite for regularizing and managing the fishing effort. CEDO has committed to taking the baseline data for fisheries and biodiversity and to monitor other indicators established by consensus of the management team. These indicators are the vocabulary that will be used to evaluate the impact of management actions in achieving governance, socioeconomic, biological and fisheries goals and adapting these as needed.

In summary, the robust science and the active involvement that CEDO has fostered ensures that the information and buy-in required for effective management is available to all, not least of all to government authorities and decision makers.

A Comprehensive Proposal for Integrated Management and Regularization of Small-Scale Fisheries in the Corridor

One of the most important achievements of the Corridor Program to date has been the production of a technically sound and legally viable management proposal that has been validated by all six communities. This comprehensive management proposal calls for the use of instruments that address the problems of open access, missing permits, overfishing, and lack of enforcement for the artisanal fisheries resources in the Corridor, while also strengthening property rights and forwarding stewardship. Four primary tools were selected and analyzed to address these issues: (1) regularization of permits, (2) designation of locally managed marine areas, (3) establishment of a network of fisheries refuge zones, and (4) establishment of catch quotas for select species. Altogether this suite of tools aims to sustain the ongoing productivity of 11 priority commercial species, carefully selected by the communities and experts for their socioeconomic and ecological importance. In the summer of 2018, with consensus of the entire Integrated Management Group, a formal proposal outlining details on how to legally and logistically apply these tools was submitted to CONAPESCA with a request for its formalization. Following the precise guidelines specified by Mexican law (NOM-049-SAG/PESC-2014) a separate, detailed proposal for establishing a network of fisheries refuge zones was submitted at the same time.

Establishment of fisheries refuge zones will benefit the successful reproduction and recruitment of the priority species by protecting habitats associated with key life-history stages and safeguarding critical ecological processes (Table 3). For each of the 26 refuges the proposal details location, size, target species and management objectives, as well as activities permitted. The proposed network includes: 9 totally protected permanent refuges, 9 partial permanent refuges, and 8 partial seasonal refuges (Figure 3). As a network they maintain ecological connectivity between key habitats, protecting 15.6% of the rocky reefs, 19.5% of the wetlands, 100% of the mangroves, 66% of the zones where rhodoliths occur and 4% of sandy habitats, which are the most abundant in the Corridor area.

Fishers who harvest blue crab and black and pink murex snail, agreed to promote exclusive areas for local management of these resources, which can be specified through permits. In combination with fisheries refuges and catch quotas to be established by CONAPESCA and INAPESCA, when all of these tools are implemented we would expect a 10% overall reduction in biomass removed from fishing, enhanced species recruitment, reduced conflicts between users and most importantly increased buy-in from Corridor communities for supporting management of their areas.

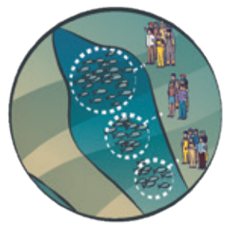
The Corridor Program also includes key elements for reducing vulnerability of coastal communities to the impacts of climate change. These objectives all align with the worldwide goals set forth in the 2011-2020 Strategic Plan for Biodiversity at the Aichi Convention and Sustainable Development Goals 2015-2030.

We at CEDO believe that a strong, sustainable economy can and should co-exist with our most ambitious conservation goals, and while the management proposal has great potential in terms of safeguarding biodiversity and habitats, its ultimate purpose is to strengthen user rights, achieve food security and increase economic benefits for fishermen and the entire production chain.

Integrated Management Tools proposed for small-scale fishing in the Puerto Peñasco to Puerto Lobos Corridor, Sonora.

1 REGULARIZATION OF FISHING EFFORT

- Compiled complete list of legal and unregistered boats, permits, and spatial and temporal pattern of fishing effort, including illegal and unreported catch volumes
- Community Management Committees identified traditional local users
- Facilitated a process for registration of boats
- Proposed transparent, inclusive process for permitting unregulated fishing



2 LOCALLY MANAGED AREAS FOR RIGHTS BASED MANAGEMENT

- Defined the Corridor as a Special Management Area for Responsible Fishing for six communities
- Communities defined exclusive local areas for managing benthic species (blue crab, pink and black murex snail)

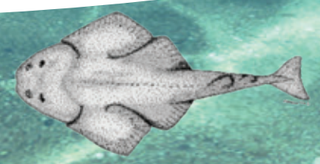
3 FISHERIES REFUGE ZONES (FRZ)

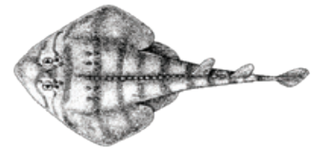
- Reached agreement with 75% of fishermen in six communities for establishing a network of fisheries refuge zones in the Corridor.
- Submitted formal proposal to CONAPESCA for 26 fisheries refuges covering a total of 64,301.5 hectares or 4.4% of the total area of the Corridor.
- Proposed refuges enhance recruitment for 11 fisheries species (Table 3).
- Proposed refuges offer protection for critical habitats: 15.6% of rocky reefs, 19.5% of wetlands, 66% of the zones where rhodoliths occur, 100% of mangroves; 4% of sandy habitat.

4 CATCH SHARES

- Analyzed and shared data on management, catch volume and size distribution of nine species to prioritize setting quotas with INAPESCA
- INAPESCA agreed to define locally managed fishing areas and catch limits for benthic species

The following eleven species were considered priority for fishermen and the technical group for their economic and ecological importance and were thus selected for management in the Puerto Peñasco – Puerto Lobos Biological and Fisheries Corridor.

Common name English/Spanish	Scientific name	
Black murex snail/ Caracol chino negro	*Hexaplex nigritus*	
Pink murex snail/ Caracol chino rosa	*Hexaplex erythrostomus*	
Blue swimming crab/ Jaiba	*Callinectes bellicosus*	
Brown smooth-hound shark/ Tiburón tripa	*Mustelus henlei*	
Pacific angel shark/ Angelito	*Squatina californica*	

Shovelnose guitarfish/ Guitarra	*Pseudobatos productus*	
Banded guitarfish/ Cholo	*Zapteryx exasperata*	
Gulf coney/ Baqueta	*Hyporthodus acanthistius*	
Goldspotted sandbass/ Extranjero	*Paralabrax auroguttatus*	
Gulf croaker/ Chano norteño	*Micropogonias megalops*	
Flatfish/ Lenguados	*Families Paralichthydae/ Pleuronectidae*	

The network of fisheries zones proposed for the Corridor will maintain ecological connectivity between key habitats, protecting 15.6% of the rocky reefs, 19.5% of the wetlands, 100% of the mangroves, 66% of rhodolith beds and 4% of sandy habitats.

Table 3. Types of Fisheries Refuge Zones (FRZ) proposed for each priority species at the Puerto Peñasco to Puerto Lobos Corridor, Sonora.

Priority species	Totally Protected Permanent Refuges	Partial Permanent Refuges	Partial Seasonal Refuges	Total FRZ
Black murex snail	5	5	7	17
Pink murex snail	6	3	6	15
Blue swimming crab	3	3	6	12
Brown smooth-hound shark	2	4	3	9
Pacific angel shark	2	4	2	8
Shovelnose guitarfish	2	4	6	12
Banded guitarfish	1	3	6	10
Gulf coney	3	4	3	10
Goldspotted sandbass	3	5	3	11
Gulf croaker	1	4	2	7
Flatfish	6	8	9	23

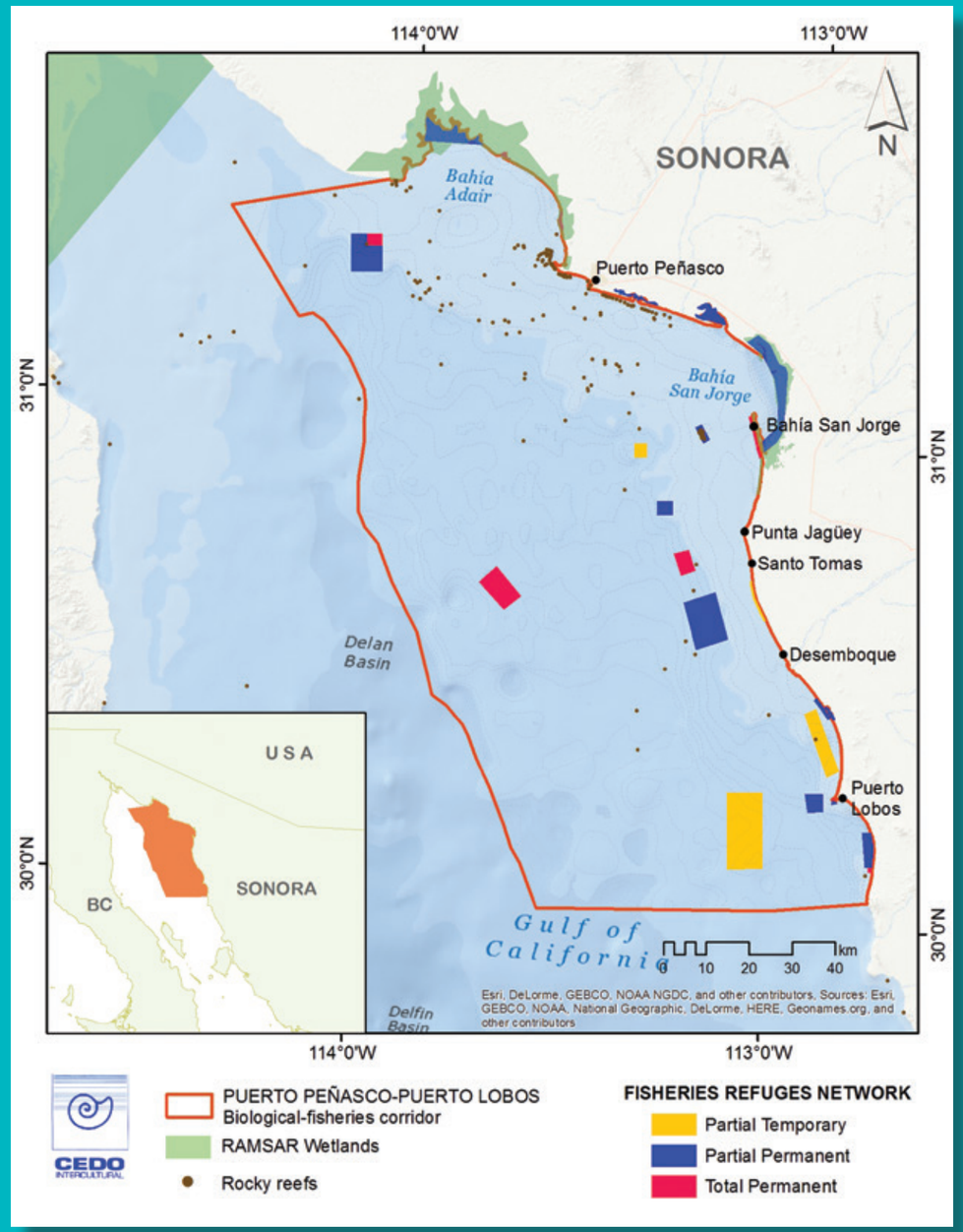


Figure 3. Network of Fisheries Refuge Zones proposed for the Puerto Peñasco – Puerto Lobos Biological and Fisheries Corridor, Sonora, Mexico by fishing communities. The 26 refuges have specific goals for recovering the fishing stocks of eleven priority species and essential habitats in the Corridor and ensure the connectivity between them.

What's Next? Opportunities & Challenges

The communities of the Corridor have shown great initiative with this program, but in order to reap the full benefits of their work they will require the continued commitment of the relevant government authorities, especially CONAPESCA and INAPESCA. All parties understand the value of the integrated solution that has been forwarded here, and the unique opportunity it offers for ordering fisheries in an important ecosystem in Mexico. While the government organizes to take the next steps, communities are strengthening their voice and capacity to influence public policy by legally incorporating their intercommunity group and by voluntarily implementing management actions.

Once the program is formally implemented authorities will also benefit from their increased capacity to manage the region's natural resources with the support of local stakeholders. We expect that new opportunities will emerge and that the channel of open communication between communities and the government will continue to grow for effective co-management of resources. This will add value to fisheries and other economic activities, and will benefit the local, regional and national economy.

Market interest in sustainable fisheries is growing around the world and the Corridor fisheries are receiving attention as a potential source. One organized cooperative has already successfully registered a formal Fisheries Improvement Project (FIP) making a public commitment to follow international sustainability standards for management of their blue crab trap fishery in collaboration with a green market in Tucson, Arizona. As the Corridor program is implemented in full, other fishermen and fisheries are preparing to access these new opportunities with potential to give added value to their production.

Most importantly, this program has fostered a re-weaving of the social fabric in the coastal communities of the Corridor, creating a new social structure to sustain an ongoing process of inter-community and inter-sector collaboration and commitment around fisheries. Diverse actors now can come together with fishermen in a constructive forum to find common ground in forwarding and designing a more hopeful future for the shared Corridor ecosystem. We strongly believe that Coastal and Marine Spatial Planning, as exemplified by CEDO's unique approach, should be replicated with natural resource dependent communities throughout Mexico and beyond. Furthermore, CEDO is willing and able to scale our experience; and is already promoting similar processes in two other communities within the Upper Gulf of California and Colorado River Delta Biosphere Reserve.

The next steps for the Corridor's CMSP Program are to:

- Strengthen structure and operations of the Integrated Management Group, defining roles and commitments of all parties.
- Integrate other groups such as wetland users, sport-fishermen and other tourism service providers into a Multi-sector Group to plan and manage spatial use of all economic interests in the Corridor space.
- Address climate change impacts and adaptations with a Multi-Sector Corridor Management Group.
- Develop a permanent program to monitor fisheries, biological, socioeconomic, governance and climate change indicators.
- Continue connecting fishermen and fisheries committed to international standards for sustainability with market-based incentives.
- Communicate lessons learned and results of the process to advance the science of marine-coastal management.
- Replicate the process in other areas using a reliable and transparent governance structure.

This project has had a broad impact on six communities of Sonora. We estimate that 2,324 people benefited directly from this work, with 144 women and 2,180 fishermen. Indirectly almost 13,000 people have benefitted, with equal numbers of men and women.

Participating Staff

We thank CEDO staff and associates who laid the foundation and worked on the design and development of this trans-disciplinary project.

Peggy J. Turk Boyer

(*in alphabetical order)*
Alan Berman Ruíz
Tonatiuh Carrillo Lammens
Christian Chávez Rodríguez
Gabriela Cruz Piñón
Caroline Downton Hoffmann
Socorro González Barajas
René Loaiza Villanueva
Eleazar López Gallegos
Leonor López Herrera
Hem Nalini Morzaria-Luna
Valeria Peña Mendoza
David Petatán Ramírez
Elia I. Polanco Mizquez
Victor Ricárdez García
Ángeles Sánchez Cruz
Verónica Solis Gracia
José Alejandro Rodríguez Valencia
Paloma A. Valdivia Jiménez
Efraín Wong López-Cuéllar
Silvia Yee

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To foster vibrant communities and resilient ecosystems in the Northern Gulf of California and other ecoregions by integrating people, knowledge and solutions.

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