AN ENVIRONMENTAL IMPACT ASSESSMENT

for Responsible Small-scale Fisheries in the Upper Gulf of California and the Colorado River Delta Biosphere Reserve

cedo

MIA
MANIFESTACIÓN DE IMPACTO AMBIENTAL
para la pesca ribereña responsable en la Reserva de la Biosfera Alto Golfo de California y Delta del Río Colorado

A tool for planning and participatory ecosystem management

Achievements, challenges and lessons learned

CEDO 35 1980-2015

CONTENTS

Page

Prologue 3
What is the EIA and what is it for? 5
Importance of implementing an EIA for artisanal fisheries in the Upper Gulf of California 5
EIA implementation and CEDO's role 6
Participatory design 7
Transparency 8
Environmental Impact Assessment programs 12
- Onboard monitoring program 13
- Fisheries monitoring program 15
- Social participation program 18
- Training and awareness programs 20

Challenges and lessons learned 23
Next steps 25
Participants in the EIA 26
Acknowledgments 27
Credits 27

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PROLOGUE

Environmental impact assessments are being used on a global scale as an ecosystem-level planning tool to evaluate and mitigate environmental impacts. In the spring of 2010 conditions were in place to implement the first environmental impact assessment for artisanal fisheries in the Upper Gulf of California/Colorado River Delta Biosphere Reserve, Mexico: the government required fishermen to comply with the regulation requiring an impact study in protected areas; fishermen needed good advice; social sector organizations were interested in having an environmental impact assessment that was transparent and that contributed to conservation; and CEDO, the Intercultural Center for the Study of Deserts and Oceans, had the technical and logistical capacity to take on the implementation of such a project. It would set a precedent for Mexico, since to date, fishermen of the Upper Gulf of California are the only fishers who have had to comply with measures to mitigate the effects of artisanal fisheries on the ecosystem through an environmental impact assessment (EIA). Unlike all other fisheries and environmental regulations, with the EIA, it is the fishermen themselves who have the burden of proof, and must show compliance with regulations. Under this premise operational programs and implementation procedures were developed for the Upper Gulf EIA, focusing on building a culture of compliance, with co-management of small-scale fisheries and protection of the ecosystem.

For a time, the project made good progress, showing improvements in all aspects of implementation. But the socio-political climate was dynamic and various situations arose that distracted the attention and commitment of both fishermen and authorities. With the change in Mexico's presidency at the end of 2012, verification of compliance with EIA mitigation measures was relaxed. Illegal fishing for totoaba increased, spurred by demand for its swim bladder in the oriental market. The Mexican law regulating shrimp fishing (NOM-PESC_002-1993) was modified to eliminate the use of entangling nets by 2016. The process for setting, allocating and monitoring quotas in the corvina fishery was implemented and negotiations began for the temporary suspension of use of all gillnets and long-lines in the main habitat of the endemic and endangered vaquita porpoise and totoaba (croaker).

There are still many challenges before the EIA can provide all the results it is capable of, nontheless, this pioneering project has made significant progress:

- It represents the most intensive and extensive effort ever for training and raising awareness about caring for the environment and complying with regulations with the Upper Gulf fishing sector.
- For the first time, ever, fishermen filled out and turned in logbooks, accepting the responsibility of providing information about their daily fishing activities.

- Through this open and transparent process, fishermen participated in the creation of agreements about mitigation measures that should be implemented to reduce identified impacts and how to improve compliance. One example, is the contest that was held to involve fishermen in proposing alternative fishing techniques for finfish and shrimp, to compliment other government efforts.
- We conducted a monitoring program for four and a half years which provides baseline data on the amount, distribution and composition of incidental catch of nine artisanal fisheries in the Upper Gulf of California, showing that none exceed the ratio of 1:1 (targeted capture to incidental capture), and as such meet legal requirements as outlined in the General Law for Ecological Equilibrium and Environmental Protection in Natural Protected Areas, Article 81, Subsection F *(Reglamento de la Ley General del Equilibrio Ecológico y la Protección al Ambiente en Materia de Áreas Naturales Protegidas).*

Though there are still many challenges to overcome, this process of participatory development and implementation of the EIA in the Upper Gulf of California Biosphere Reserve is creating a new vision for how fishermen can take responsibility for management of their fisheries and the ecosystem.

Sergio Alejandro Pérez Valencia, Principal Investigator for the EIA

Peggy Turk Boyer, Executive Director of CEDO

WHAT IS THE EIA AND WHAT IS IT FOR?

In Mexico, the General Law of Ecological Equilibrium and Environmental Protection (LGEEPA) (1) states that in order to carry out economic activities within a natural protected area (ANP) an environmental impact assessment permit is required, which must be approved by the General Directorate of Environmental Impact and Risk Assessment (DGIRA), under the Secretariat of Environment and Natural Resources (SEMARNAT). The EIA requirement also applies where such activities could jeopardize the survival of one or more species with protected status, or where activities may cause damage to ecosystems. In the technical study known as the Environmental impact assessment (EIA), a person or entity analyzes and describes the environmental conditions prior to the implementation of a project or activity and reveals the potential impacts that its activities may generate, as well as how to avoid or mitigate them. EIA are generally used for new activities or developments, however, there are a few cases in which they have been applied in Mexico and elsewhere for traditional activities such as coastal fisheries.

IMPORTANCE OF IMPLEMENTING AN EIA FOR ARTISANAL FISHERIES IN THE UPPER GULF OF CALIFORNIA

The Upper Gulf of California and Colorado River Delta (Figure 1) is renowned as one of the world's important feeding, breeding and rearing areas for many species. Large populations of migratory birds use this area for resting and over wintering. The area is characterized by high productivity with unique habitats that support a wealth of species, and generate high fisheries production. Its marine waters are home to endemic and critically endangered species such as the vaquita porpoise (*Phocoena sinus*), the most endangered cetacean in the world (the primary threat is its bycatch in gillnet fisheries), and the totoaba (*Totoaba macdonaldi*), which has had a permanent fishing ban since the 1970s, caused by over-exploitation driven by market pressures for the highly valuable swim bladder and meat. Because of its ecological significance the area was declared a Natural Protected Area in 1993 under the category of Biosphere Reserve. By 2005 the plight of the vaquita worsened and led to the creation of a new refuge for the species, overlapping in part with the Upper Gulf Biosphere Reserve, and offering additional fisheries regulations for the protection of this species. The challenges currently facing the region highlight the need to mitigate the impacts of fishing on these key species and the entire ecosystem.

This is why, since 2009, coastal fishermen in the Upper Gulf of California and Colorado River Delta Biosphere Reserve's three primary communities (San Felipe, Baja California, and Golfo de Santa Clara and Puerto Peñasco, Sonora) have been required to develop and work under an Environmental impact assessment. With EIA authorization the coastal fisheries sector can continue to fish within the buffer zone of the Biosphere Reserve (Figure 1).

A properly designed and implemented EIA has the potential to significantly reduce illegal fishing, ensure access rights of fishers, and involve fishers in reducing their environmental impacts, reduce bycatch (especially of protected species like the vaquita and totoaba), and to help assess the effects of fishing on populations and communities. In this context, the Environmental impact assessment has become an important opportunity for ordering and planning a cooperative management system that is leading towards more responsible fisheries that encompass the ecosystem and biodiversity within the Upper Gulf Biosphere Reserve. This approach so far has not been explored in other marine protected areas of Mexico.

EIA IMPLEMENTATION AND CEDO'S ROLE

The first environmental impact assessments for small-scale fisheries in the Upper Gulf were done in 2009 (one for most fishermen from San Felipe, Baja California, who named a permit holder to represent them (4)), and another for fishermen from two communities of Sonora (Golfo de Santa Clara and Puerto Peñasco), who also had one permit holder representing them (4). Though these studies were deemed inadequate, DGIRA gave fishers temporary and conditional authorization to fish during the 2009-10 season. They were required to produce a new study and to progress on implementation of specific programs to generate information on fisheries. In 2010, the EIA fisher representatives (4) approached the Intercultural Center for the Study of Deserts and Oceans (CEDO), a known environmental organization working in the region, and requested assistance for creating programs to operate and monitor the established mitigation measures and to produce a new EIA. Both representatives agreed to work jointly with CEDO to develop a technically solid project, through a transparent and participatory process that would adhere to the law, and that would have realistic mitigation measures that were feasible to monitor and that would give measureable results on impact of their fishing activities. Thus, in late 2010 and 2011, four programs were initiated to comply with resolutions established in the 2009 EIA, and the CEDO team began design of a new EIA with participation of fishermen, that would insure transparency by inviting feedback from other interested organizations before it was officially submitted. Thus began the project known as the "Environmental impact assessment for Responsible Coastal Fisheries in the Upper Gulf of California and Colorado River Delta Biosphere Reserve", henceforth referred to as "EIA".

> "It has been an experience without match and historic at a national level, only in the Upper Gulf of California has an EIA been carried out and continued. We are pleased to publicly state that we are aware of the greatness of this project."

Ramón Franco Díaz,
Representative of the EIA for the Federación de Cooperativas Ribereñas Andrés Rubio Castro SPR de RL.

The new EIA developed by CEDO was authorized in December 2012. It was designed to address the environmental and fisheries impacts of 9 small-scale fisheries, targeting 27 species (Table 1) involving 906 boats and nearly 2,000 fishermen from three communities of the Upper Gulf. The study identified 14 priority impacts on the environment (Table 2), for which 12 specific mitigation measures (Table 3) were proposed to be implemented with four operational programs: 1) Onboard Monitoring, 2) Fisheries Monitoring, 3) Social Participation and 4) Training and Awareness (Figure 2). These programs were designed to give continuity to programs initiated in 2010, but were modified to incorporate lessons learned in the field and new requirements to strengthen implementation of the new EIA.

The project can be divided into two

The EIA focuses on mitigating the impact of 9 FISHERIES that cover 27 COMMERCIAL SPECIES in the Upper Gulf.

phases, based on the official DGIRA authorizations. The first phase operated from November 2009 to December 16, 2012 (2). The second phase covered the period from December 17, 2012 to December 16, 2014 (3). Future stages may be added to the project, with new approvals and/or extensions of existing approvals (Table 4).

Both fishermen and CEDO faced many challenges in efforts to fulfill the requirements of the EIA. On the other hand, it also was a great learning experience for both parties to implement such a complex and comprehensive project, to progress in generating information and knowledge about the project's fisheries, and to have fishers participate and change their attitudes and perceptions about conservation and fisheries management. Finally, through the implementation of these four programs, the concepts and principles of ecosystem–based fisheries management were operationalized, making this EIA process an innovative case study for using this tool and its ecosystem approach to make the transition to sustainable fishing.

[1]LGEEPA Article 28, Section XI and XII, and article 5, subsections S and T of the Regulation on Environmental Impact Assessment (REIA).
[2]Promovente: legal representative of an Environmental Impact Assessment.
[3]Resolutions MIA 2009-2011 S.G.P.A.-DGIRA.-DG.-6766.09. and S.G.P.A.-DGIRA.-DG.-6767.09.
[4]Resolutions MIA 2012-2014 S.G.P.A./D.G.I.R.A./D.G./9532 and S.G.P.A./D.G.I.R.A./D.G./9533.

PARTICIPATORY DESIGN

To encourage the participation of fishermen in the development of the new EIA, in the spring of 2011 workshops were held in San Felipe, El Golfo de Santa Clara and Puerto Peñasco to identify the impacts of fisheries and to propose mitigation measures to counteract these impacts. The workshops used a participatory approach to incorporate fishermen's knowledge into a matrix of interactions between fishing activities and environmental factors (biotic and abiotic) for each of the fisheries covered by the project. Listed impacts were then characterized using seven criteria: 1) magnitude, 2) extension, 3) duration, 4) synergy, 5) accumulation, 6) controversy, and 7) mitigation. The magnitude of the effects were then evaluated using indices of intensity and significance for each impact.

With participation of fishermen the most significant impacts (those with high and very high magnitude) were evaluated using four criteria: 1) possibility of compliance, 2) benefit for the species, 3) benefit for the environment, and 4) profit for the fishing community, resulting in the selection of twelve mitigation measures (Table 3). These results were subsequently validated by fishermen through another series of workshops.

THE PROJECT involved 906 pangas (457 - Golfo de Santa Clara; 136 - Puerto Peñasco; 313 - San Felipe), *some organized under cooperatives and others as permit holders, Figure 5.*

About 2,000 fishermen operate these boats with a total of 1,792 fishing permits (924 - Golfo de Santa Clara; 273 - Puerto Peñasco; 595 - San Felipe, *Figure 6).*

The development of the EIA was done through a participatory process, based on **FISHERMEN'S OWN PROPOSALS.**

TRANSPARENCY

In order to generate confidence that the EIA would be developed with the best available information, would comply with the law, and would include realistic and adaptive mitigation proposals, a "Technical-Legal Observatory" was formed (with support from the World Wildlife Fund-Alliance Carlos Slim Foundation and Pronatura Mexico), that invited the participation of academic and fisheries technicians and a group of civil society organizations with the needed expertise. The Observatory accompanied us throughout much of the process, made comments and issued specific recommendations (including feedback on impact identification and selection of mitigation measures) before the EIA was officially submitted to the appropriate authorities for evaluation. This process was carried out with the additional goal of creating an example that could be replicated elsewhere in the country (https://observatoriomia.wordpress.com).

In a further commitment to transparency, both EIA projects were voluntarily opened to public comment during the environmental impact assessment process.

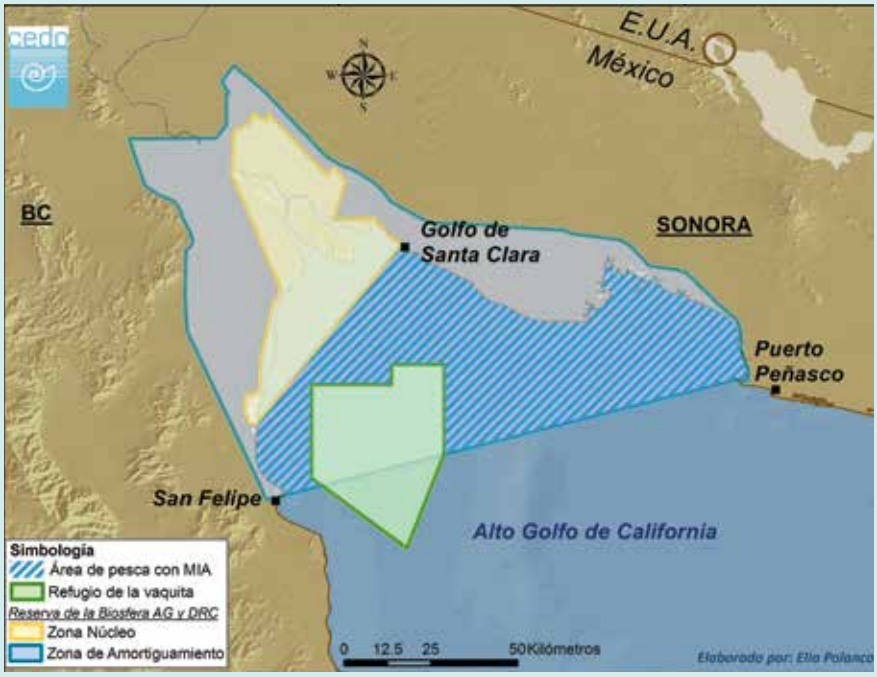


Figure 1. Upper Gulf of California and Colorado River Delta Biosphere Reserve and Vaquita Refuge: zones and communities that are part of the study.

Figure 2. Programs designed to assure implementation and compliance with mitigation measures, as required in the terms and conditions of the EIA.

> “I think one of the most valuable aspects of the Legal Technical Observatory was that it brought together all stakeholders, even with opposing views, to make recommendations to the process for establishing an EIA for fishing activities. It was a major effort of inclusion and transparency that resulted in a more stable EIA - so I am very pleased to have been part of it.”

Alejandra Salazar Dreja,
Director of Environmental Policy,
Pronatura México, A.C.

Table 1. Fisheries and species included within the EIA.

FISHERY	SPECIES	SCIENTIFIC NAME
Blue shrimp with entangling nets	Blue shrimp	*Litopenaeus stylirostris*
Gulf corvina with entangling (gillnets)	Gulf corvina	*Cynoscion othonopterus*
Gulf croaker with gillnets	Gulf croaker	*Micropogonias megalops*
Mackerel with gillnets	Mackerel	*Scomberomorus concolor* *Scomberomorus sierra*
Blue crab with traps	Blue crab	*Callinectes bellicosus*
Elasmobranchs with gillnets	Pacific sharpnose sharks Smoothhound sharks Rays Guitarfish	*Rhizoprinodon longurio* *Mustelus californicus* *Mustelus lunulatus* *Mustelus henlei* *Daysatis dipterura* *Gymnura marmorata* *Myliobatis californica* *Myliobatis longirostris* *Rhinobatos productus*
Finfish with gillnets	Flounder Mullet Corvinas Snapper	*Paralichthys aestuarius* *Mugil cephalus* *Mugil curema* *Cynoscion parvipinnis* *Cynoscion xanthulus* *Cynoscion reticulatus* *Hoplopargus guentherii*
Mollusks by Hooka diving	Black murex snail Swimming clam Octopus	*Hexaplex nigritus* *Argopecten ventricosus* *Octopus bimaculatus*
Finfish with long-line	Gulf coney Goldspotted sand bass	*Epinephelus acanthistius* *Paralabrax auroguttatus*

Table 2. Summary of main environmental impacts identified by the EIA and their magnitude.

	IMPACTS	MAGNITUDE
1	Overfishing of Gulf corvina	High
2	Overfishing of Gulf croaker	High
3	Overfishing of mackerel	High
4	Overfishing of blue crab	High
5	Overfishing of elasmobranchs (sharks & rays)	High
6	Overfishing of finfish by gill nets	High
7	Overfishing of mollusks	High
8	Overfishing of finfish by trawls	High
9	Incidental catch	High
10	Incidental catch of vaquita	High
11	Incidental catch of totoaba	High
12	Incidental catch of sea turtles	High
13	Incidental catch of white sharks	Very high
14	Nets, traps and trawls abandoned at sea	High

Fishermen compliance with the project is DIRECTLY RELATED to the level of requirement by the authority.

Table 3. Mitigation measures of EIA 2012-2014, impacts on the environment addressed by the operational programs that were implemented, and the level of compliance achieved. (PMA = Onboard Monitoring Program, PMP = Fisheries Monitoring Program, PPS = Social Participation Program, PCC = Training and Awareness Program).

MITIGATION MEASURES	MEASURING TYPE	IMPACTS	PMA	PMP	PPS	PCC	**LEVEL OF COMPLIANCE
MM-1 Train fishermen in good fishing practices	Voluntary	1 to 14				X	
MM-2. Implement a spatial and temporal plan to reduce fishing effort, and fishing in biodiversity hotspots.	Voluntary	1 to 14	X	X	X	X	
MM-3. Collect fishing information in a systematic and rigorous way using onboard observations to be used by the competent authorities to establish fisheries reference points for setting fishing limits needed for environmental protection.	Legal provision	1 to 14	X				
MM-4. Fishermen record their daily fishing operations in logbooks.	Legal provision	9, 10, 11, 12, 13		X		X	
MM-5. Respect the Vaquita Refuge within the Upper Gulf of California and Colorado River Delta Biosphere Reserve, and other zoning.	Legal provision	9, 10, 11, 12, 13	X	X	X	X	
MM-6. Respect the part of the Vaquita Refuge that lies outside the Reserve.	Voluntary	9, 10, 11, 12, 13	X	X	X	X	
MM-7. Find alternative gear for shrimping that is credible and accepted by the coastal fisheries sector to substitute entangling nets in the short, medium and long term, and that eliminate vaquita bycatch.	Voluntary	9, 10, 11, 12, 13			X	X	
MM-8. Repopulate the population of Gulf corvina by releasing larvae obtained through artificial insemination using eviscerated gonads collected during the fishing season.	Voluntary	1		X	X		
MM-9. Do not fish during the peak days of reproduction for Gulf corvina, during each tide cycle, as determined by scientific data.	Legal provision	1			X	X	
MM-10. Adjust catch volumes of Gulf corvina to match the limits defined by the authorities.	Voluntary	1, 9			X	X	
MM-11. Build blue crab traps with one side of mesh uncoated with PVC so that they corrode quickly if left in the field.	Voluntary	4, 9, 14		X	X	X	
MM-12 Suspend catching of black murex snail in all areas from May 15 to June 15 to permit the release of young snails.	Voluntary	7			X	X	

***Voluntary:** this refers to the said mitigation measures that were proposed and validated by the fishers through participation in the workshops, nevertheless, with their authorization in the resolution of the EIA, their compliance becomes obligatory.

****Level of compliance:** High, Medium, Insufficient information to determine level of compliance.

Table 4. Important events in the EIA process from 2009-2012.

NOVEMBER 2009	Coastal fishermen get their first conditional authorization on an Environmental impact assessment according to the S.G.P.A.-DGIRA.-DG.-operative 6766.09. and S.G.P.A.-DGIRA.-DG.-6767.09.
MAY 2010	The coastal fisheries in the Upper Gulf of California and the Intercultural Center for the Study of Deserts and Oceans, A.C. sign an agreement to: 1) facilitate and document compliance with mitigation measures, and enforce the terms and conditions of the EIA, and 2) develop a new EIA.
NOVEMBER 2010	A series of extensions are obtained for complying with the resolutions to fulfill mitigation measures as well as for the terms and conditions.
OCTOBER 2011	A new project is presented to the General Directorate of Environmental Impact and Risk Assessment (DGIRA) for evaluation. During the nine months that followed, DGIRA requested additional information which was sent in a timely and proper form.
SEPTEMBER 2012	Authorization of the environmental impact assessment is denied, primarily because of low compliance for the mitigation measures set out in the previous study S.G.P.A.-DGIRA. DG.-6766.09 and S.G.P.A.-DGIRA.-DG.-6767.09.
DECEMBER 2012	A new project, independent of the previous study, is submitted with supplementary information. On 17 December 2012 the project is authorized by the S.G.P.A./D.G.I.R.A./D.G./9532 and S.G.P.A./D.G.I.R.A./D.G./9533 operatives.
DECEMBER 2014	End of the term of operation of S.G.P.A./D.G.I.R.A./D.G./9532 and S.G.P.A./D.G.I.R.A./D.G./9533.

The Technical-Legal Observatory accompanied CEDO in the process of developing the EIA to assure **THE CORRECT GENERATION OF MITIGATION MEASURES** that respond to the environmental impacts of the fisheries and to create a **REPLICABLE EXAMPLE** for the country.

ENVIRONMENTAL IMPACT ASSESSMENT PROGRAMS

Through the development of these four EIA programs, an unprecedented ecosystem-based fisheries management system was implemented in Mexico. The programs responded directly to authorized mitigation measures and other requirements of the EIA, but they really should be part of any fishery or protected area management system. In the context of the Reserve and its fisheries, this was the first attempt to systematize and involve fishermen in these kinds of programs and considering this, the results are impressive.

It's important to mention that the operation and implementation of these programs was primarily the financial responsibility of the fishermen, though additional funds were obtained from other foundations and government agencies, as well as matching contributions by CEDO. To guarantee success in the future, we recommend that government grants be considered as the primary source of funding, with a structure that requires matching contributions from fisherman and civil society organizations, not the reverse. Results from the implementation of the EIA from 2013 to 2014 follow.

ONBOARD MONITORING PROGRAM

MITIGATION MEASURES ADDRESSED

MM-2, MM-3, MM-5, MM-6

In this program, CEDO-trained monitors accompanied fishermen on their fishing trips and collecting detailed catch information on target species and bycatch. Data was recorded in logbooks (bitácoras) in the field and later transferred to a database.

The program's main objective was to characterize the fisheries in the Upper Gulf of California and the fishing techniques used, as well as to quantify the impact of fisheries on the ecosystem.

The technical information gathered in this program will be used to establish base line reference points on fisheries and environmental indicators for the use and benefit of fishermen.

Specific Objectives

1. Collect fishing information: Catch of target and bycatch species, composition of the bycatch, weight structure of both target and bycatch species, fishing effort, characteristics of the fishing methods used, and geographic location of the catch.
2. Quantify changes in impacts of fishing over time for different species, biodiversity and ecosystem processes.
   Describe the spatial-temporal distribution of fishing efforts and the different types of fishing methods used.
3. Observe if fishermen comply with no fishing zones, such as the Vaquita Refuge.

Main Achievements

- At least 996 onboard and onshore observation days covering nine fisheries were recorded by monitors (Table 5). Monitors worked from November to May, the most intense fishing period of the year due to higher volume of catch species with higher value.
- Information obtained by onboard monitors was incorporated into a database that was internally validated.
- This information made it possible to make a preliminary determination that none of the nine fisheries in the project produced greater than 1:1 proportion of target to bycatch species. Figure 3 shows data from the three primary fisheries.
- The data shows that in all net fisheries, the top bycatch component was corvina, followed by Gulf croaker and mackerel. The top bycatch component in fisheries using traps was the pink murex snail (Figure 4).
- The most commonly captured protected species were the totoaba, seahorses and gorgonians.
- No vaquita bycatch was recorded during the onboard monitoring period.
- A monitoring protocol was developed for standardizing procedures and reducing errors, making it possible to replicate the program in other regions.

Main Challenges

- Cash flow and the overall funding level of the project impacted the ability to gather information on level of fishermen compliance with no fishing zones, such as the Vaquita Refuge (MM-5 and MM-6). Low funding also limited the number of onboard monitors that could be employed, the ability to use equipment such as data loggers, which in turn affected the ability to implement spatial temporal measures for compliance of mitigation measure MM-2 (Table 3).

Preliminary analyses suggest NONE of the 9 fisheries of the EIA pass the 1:1 ratio of targeted to incidental catch.

> “I think that with the support of fishermen you can, to say it this way, take an xray of the status and quantity of species and see how we are impacting them and take actions while there is time. Also the EIA is of great help for the communities and responsible fishermen, as it helps you value the resources.”

Javier Barroso,
Winner of the Alternative Gear Contest
from Golfo de Santa Clara, Son.

Table 5. Number of fishing trips by community and fishery, as documented in onboard monitoring logbooks implemented from 2010-2014.

TYPE OF FISHERY	TOTAL
Blue shrimp with entangling net	429
Gulf corvina with gillnet	217
Sierra/mackerel with gillnet	59
Gulf croaker with gillnet	102
Blue crab with trap	81
Sharks and rays with gillnet	2
Finfish with gillnet	53
Molluscs (diving gear)	47
Finfish with long-line	6
Total	**996**

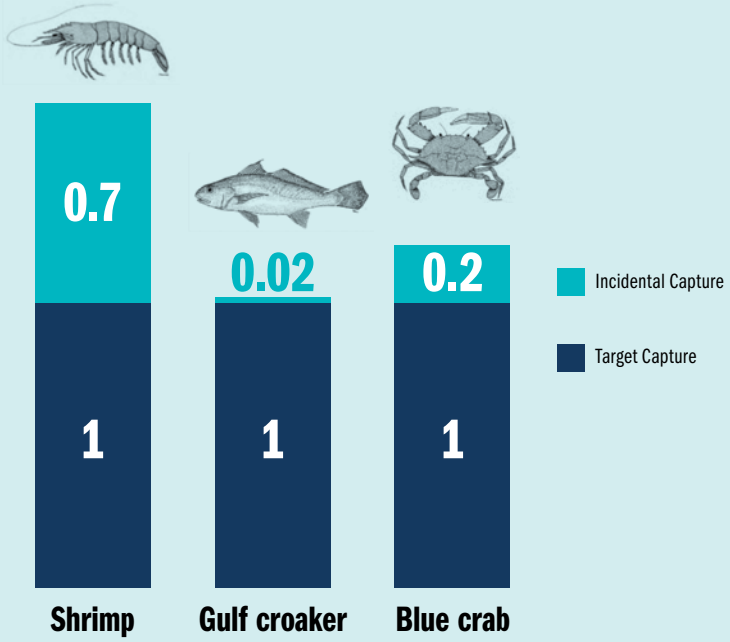


Figure 3. Proportion of incidental capture in relation to the targeted capture in shrimp, Gulf drum and blue crab fisheries, according to data taken during onboard monitoring of the EIA (2010 to 2014).

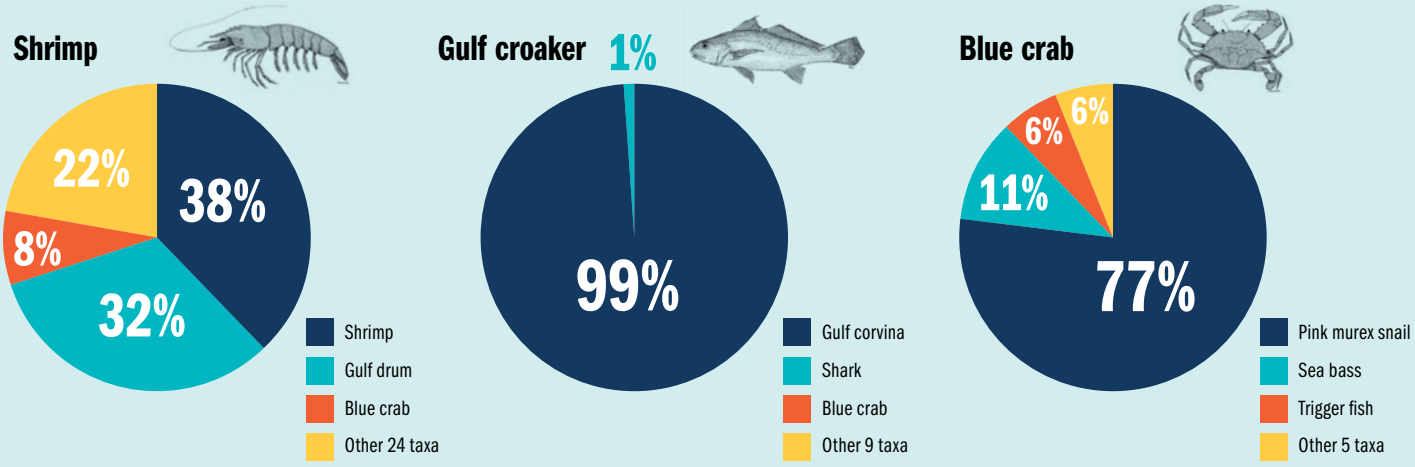


Figure 4. Composition of incidental capture of shrimp, Gulf drum, and blue crab fisheries, according to data from onboard monitoring of the EIA (2010 to 2014).

FISHERIES MONITORING PROGRAM

MITIGATION MEASURES ADDRESSED

MM-2, MM-4, MM-5, MM-6, MM-8, MM-11

Unlike the onboard monitoring program, fishermen were in charge of recording their own data from their daily captures in special field logbooks (bitácoras). They had to record the data and deliver the logbooks periodically to CEDO staff, whose primary function was to gather, organize and create a database with the information.

Field logbooks were assigned to every boat; each logbook had a unique QR code, associated with the boat's identification information, which could be read or scanned using a smartphone. The read out from the scan directed the authorities to a website with basic information including the logbook holder's authorization to be in the fishing area and the degree of their fulfillment of required mitigation measures.

Specific Objectives

1. Document level of compliance of boats, cooperatives and communities with mitigation measures, and record fishing periods in logbooks (MM-4, Table 3).
2. Establish a mechanism using QR codes to distinguish between illegal and EIA authorized boats fishing within the reserve.
3. Establish self-recording and co-responsibility processes for fishermen for generating information about their fishing areas, capture composition and other data needed for fisheries management.

Main Achievements

- Design of a plastic fishing logbook that was easy to use and sturdy for field use.
- Design and implementation of a process for collecting fishermen's logbooks, and gathering, organizing and creation a database with the information generated.
- Implementation of a mechanism (QR codes on fishing logbooks scanned by smartphone) that could identify fishing boats registered in the EIA and their level of compliance (participation in training, payment of EIA fees, and others).
- Two workshops were conducted to promote using the QR platform by the appropriate authorities and to facilitate inspection and surveillance actions with participation of PROFEPA, CONAPESCA, CONANP and SEMAR in Puerto Peñasco, Sonora (8 participants) and in San Felipe, Baja California (15 participants).
- Arrangements were made between CONAPESCA and INAPESCA to adopt the EIA's fishing logbooks as the only "official" type of logbook for the Upper Gulf Reserve. This arrangement was well accepted, but was sidetracked with other changes in fisheries in the region, such as implementation of a quota system for Gulf corvina, publication of the NOM-PESC-002 for shrimp, and adoption of an agreement for a temporary closure for gillnets.
- Creation of a validated database, with the number of fishing trips recorded in logbooks delivered by the boats, cooperatives and communities.
- Collection of 2,020 logbooks with records of 25,636 fishing days in 2013 and 2014 (Table 16).
  In 2013 more logbooks were collected (1,112) and more fishing days (16,630) were recorded than in 2014.
- In 2014, 3% of cooperatives or permit holders earned a "complete" score for their compliance with logbook requirements (Table 7). Representatives of a total of 78 boats committed to filling out logbooks responsibly, initiating a self-recording process that increased our knowledge of the fisheries in the region.
- Although obtaining accurate and real data in fishermen's logbooks is a great challenge, fishermen did increase their daily logbook recording of fishing and no-fishing days in acceptable detail (Figure 7).

Main Challenges

- The logbooks could have been the tool for controlling access to the Reserve for fishermen without EIAs, as it was a legally binding instrument, but it lacked adequate surveillance both inshore and offshore. Whenever the authorities demanded the logbooks, however, fishermen responded well.

2,020 LOGBOOKS were collected and **25,636 FISHING DAYS** were registered.

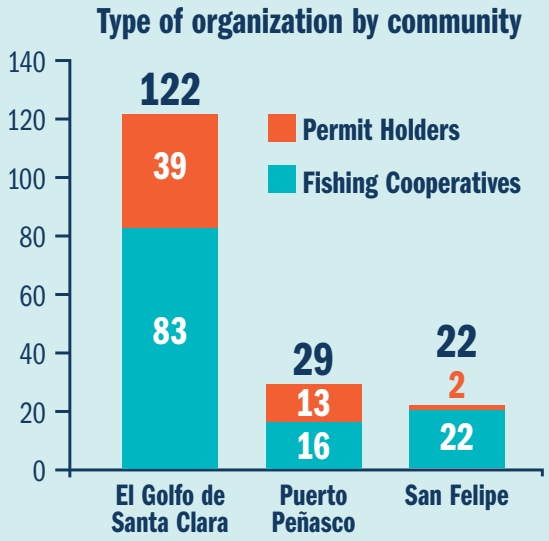


Figure 5. Number of fishing cooperatives and permit holders enrolled in the environmental impact assessment program of the Upper Gulf Reserve, Mexico (2013-2014) by community.

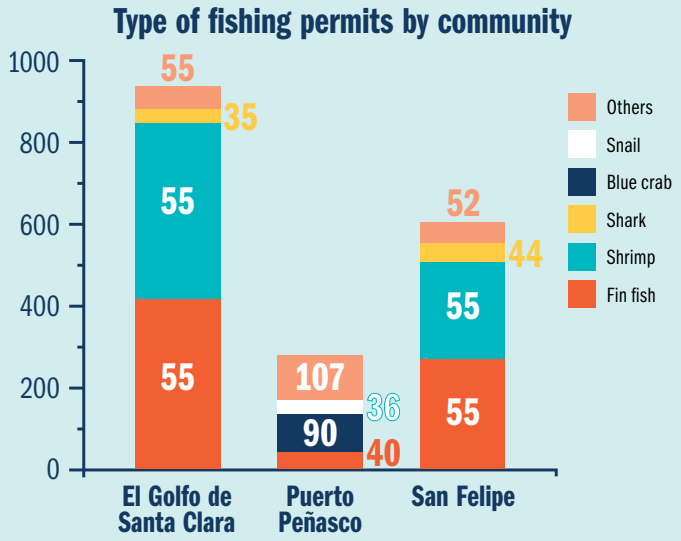


Figure 6. Number and kinds of permits held by fishermen enrolled in the environmental impact study (2013 -2014) from the three communities of the Upper Gulf Reserve, Mexico.

Table 6. General indicators of compliance with filling out and returning fishing logbooks by community during 2013 and 2014 implementation of the EIA.

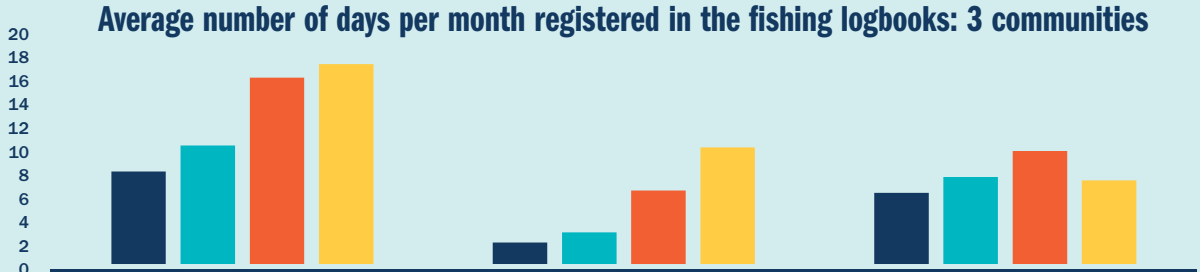
INDICATOR	2013			2014		
	San Felipe	El Golfo de Santa Clara	Puerto Peñasco	San Felipe	El Golfo de Santa Clara	Puerto Peñasco
% of cooperatives/permit holders that returned their logbooks	77	56	28	73	57	38
% of pangas that returned their logbooks	58	30.3	16	45	51	18
Number of logbooks filled out by fishers	368	690	54	321	522	65
Total # fishing trips registered	2,556	13,285	539	1,765	6,503	988
Average # fishing trips registered	9	21	11	7	15	16

Table 7. Percentage of cooperatives and permit holders that filled out and returned fishing logbooks by categories of compliance, community and year in the Upper Gulf of California in 2013 and 2014.

PERCENTAGE OF COOPERATIVES OR PERMIT HOLDERS						
Level of Compliance	El Golfo de Santa Clara		Puerto Peñasco		San Felipe	
	2013	2014	2013	2014	2013	2014
Complete	2.4	0	0	3	0	0
High	8.9	7	0	0	5	0
Medium	24.2	23	10	10	14	32
Low	20.2	26	17	24	59	41
Nulo	43.5	43	72	62	23	27

Table 8. Percentage of boats that filled out and returned logbooks by categories of compliance, community and year in the Upper Gulf of California in 2013 and 2014.

PERCENTAGE OF BOATS						
Level of Compliance	El Golfo de Santa Clara		Puerto Peñasco		San Felipe	
	2013	2014	2013	2014	2013	2014
Complete	8.6	0	1	7	0	11
High	7	10	1	0	0	0
Medium	28.1	23	9	2	15	17
Low	11.2	17	5	10	43	16
Nulo	45.2	49	84	82	42	55



	TOTAL DAYS	DAYS OF NO FISHING	FISHING DAYS
2011	8.2	1.9	6.3
2012	10.5	2.8	7.7
2013	16.5	6.5	10
2014	17.7	10.32	7.4

Figure 7. Tendency in the number of days per month registered in fishing logbooks by fishermen in 2011 (n=50), 2012 (n=17), 2013 (n=60 and 2014 (n=111) in the three communities of the Upper Gulf of California. *Total fishing days: represents the sum of registered fishing days and no fishing days.

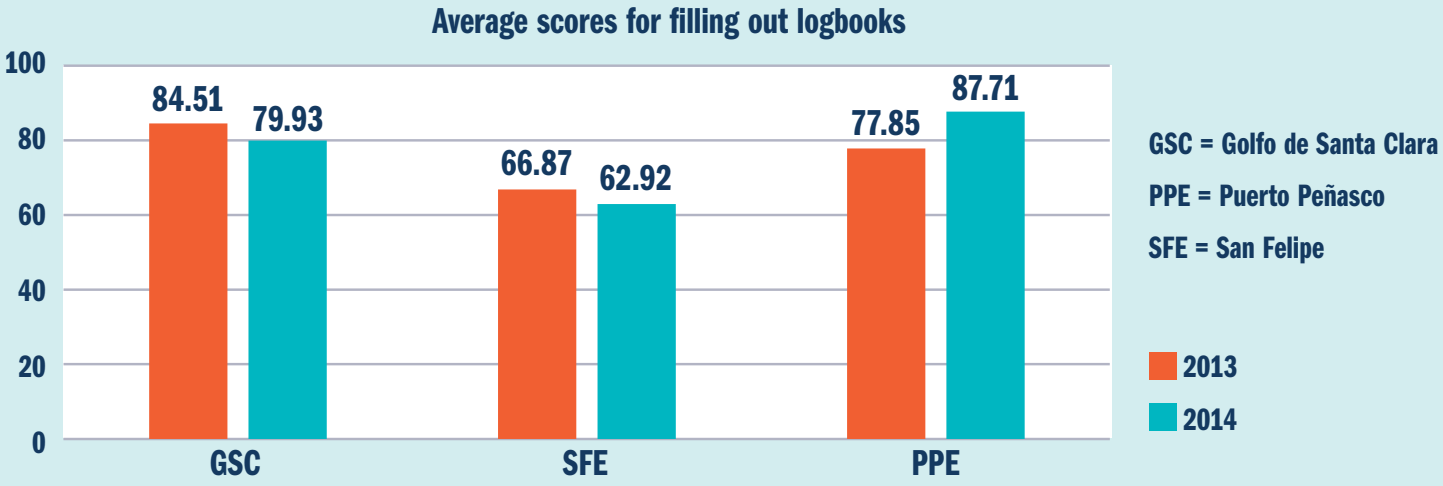


Figure 8. The grades for filling out fishing logbooks (scores between 0 and 100) in the communities of the Upper Gulf of California during 2013 (n=80 and 2014 (n=90). * GSC: Golfo de Santa Clara, SFE: San Felipe, PPE: Puerto Peñasco.

SOCIAL PARTICIPATION PROGRAM

MITIGATION MEASURES ADDRESSED

MM-2, MM-5, MM-6, MM-7, MM-8, MM-9, MM-10, MM-11, MM-12

The social participation program was designed to empower fishermen involved in the EIA process for co-management of the region's ecosystems. This program was responsible for developing, managing and validating the processes for complying with the project's mitigation measures.

Specific Objectives

1. Formalize fishermen councils in each community in the Upper Gulf, with operational rules and mechanisms to motivate fishermen to participate in evaluating conditions of the EIA and make decisions about internal sanctions for non-compliance.
2. To promote and document the processes to encourage compliance with the EIA mitigation measures. (Table 3).

Important approaches were made with authorities to HELP EIA FISHERMEN and to promote compliance with the mitigation measures.

Main Achievements

- Three community councils with five fishermen each were formed: in the case of El Golfo de Santa Clara the council included women.
- In 2013 and 2014, 20 council meetings were held to develop processes. The councils decided to address the vaquita bycatch problem and the need for alternative nets (MM-7, Table 3) through a "Contest of Alternative Fishing Gear for Shrimp and Fishes". The contest generated at least 10 new fishing methods that met with fishermen approval. A permit to test the winning fishing method is being sought and if approved will allow testing of this fishing method for the 2015/16 shrimp season.
- An agreement was reached and approved to avoid fishing during reproductive peaks of the Gulf corvina during every tide in 2014 (MM-9, Table 3). This agreement was reported at a meeting about inspection and surveillance in the Gulf corvina fishery with authorities from CONAPESCA, CONANP and PROFEPA.
- The councils agreed to a voluntary ban on black murex snail during its reproductive peak from June 1st to 15th of 2014 both within and outside of the Reserve (MM-12, Table 3). This process triggered a number of additional achievements and events:
  - > Fishermen agreed to not fish pink murex snail, in addition to the closure for black murex fishery.
  - > Black murex snail fishermen who were not part of the EIA, voluntarily joined the no-fishing proposal.
  - > Buyers in the snail market supported the initiative by committing to not buy black and pink murex snails from June 1st to 10th of 2014.
  - • An unprecedented meeting was held with fisheries authorities (CONAPESCA, PGR, Puerto Peñasco Government officials, CONANP, PROFEPA and SEMAR), fishermen, black murex snail buyers and CEDO at Puerto Peñasco. Surveillance and enforcement issues were addressed and the following agreements were established:
    - Black murex snail fishermen from Puerto Peñasco asked CONAPESCA to create an official closed season for this species.
    - PROFEPA committed to carry out surveillance in the Reserve.

- Fishermen with blue crab permits received training from CONANP on how to apply for PROCODES funds to build traps with one side without the PVC reinforced netting, as required by the EIA (MM-11, Table 3). Two cooperatives received funding and 560 ecological blue crab traps were built for the 2014 fishery season. If these traps are lost, the unreinforced side will decompose and reduce unwanted bycatch.
- A six member Community Surveillance Committee was created at Puerto Peñasco. The committee was recognized and trained by PROFEPA with a primary focus on reducing access to the Reserve by fishermen not participating in the EIA.
- Working with CONANP it was established that Reserve fishermen had to prove their compliance with the EIA program in order to be eligible for funds from the PACE Vaquita (5) program.

Main Challenges

- Councils needed more training to empower them to follow up on agreements and improve work plans.

(5)EL PACE Vaquita: Action Program for the Protection of the Vaquita Species) is a public policy tool that promotes the conservation of the vaquita marina and its habitat.

TRAINING AND AWARENESS PROGRAM

MITIGATION MEASURES ADDRESSED

MM-1, MM-2, MM-4, MM-5, MM-6, MM-7, MM-9, MM-10, MM-11, MM-12

> "To educate a community in all aspects (fisheries, social and economic) is the best way to make people committed to their fellow beings and to the future of the world, and with these lessons in how to practice sustainable fisheries and live together with the environment, we can create a future for both parts."

Carlos Tirado Pineda,
Representative of the EIA in Sonora.

Prior to the beginning of each fishing season, workshops, a communication campaign and educational materials were given to fishermen to promote actions outlined in the EIA, such as specific mitigation measures for that fishery and reinforcing the need to fill out logbooks. The program also tried to sensitize and raise fishermen's awareness about the importance of the marine resources of the region and how their meaningful participation in improving fishing practices could reduce negative environmental impacts.

Indicators to measure participation and compliance were developed and used to offer positive incentives to the most responsible fishermen to motivate their continued compliance. Changes in knowledge and perceptions of fishermen were also evaluated.

Fishermen that complied with the EIA were given PUBLIC RECOGNITION and participated in EXCHANGE EXPERIENCES with other fishermen in the country.

Specific Objectives

1. To increase knowledge and awareness of fishermen from the Upper Gulf Reserve about the importance and benefits of following the regulations for marine resource management and the specific requirements of the EIA for reducing negative environmental impacts.
2. Provide the tools and information necessary to fishermen so they could understand and comply with mitigation measures and the terms and conditions of the EIA.
   Train fishermen in the appropriate use of logbooks.
3. Create a positive incentive system to support responsible fishing.

Main Achievements

- At least 154 training and awareness workshops were carried out in 2013 and 2014 for artisanal fishermen of the region. At least one person from 791 of the 906 boats registered in the project (87.3%) participated in at least one of these workshops.
- Educational and explanatory materials were developed to support the project: one flyer; a manual on good fishing practices; three bilingual identification guides of bycatch species (mammals, marine turtles, birds and fishes); two tide calendars with information on fisheries and protected species of the region; and various videos and radio spots.
  Compliance indicators were developed for monitoring of the fisheries logbook program, increasing knowledge and EIA participation.
- Fishing logbook indicators showed an increase in quantity and quality of the information obtained and compiled by fishermen.
  An annual award ceremony in each community gave public recognition to the most responsible fishermen participating in the EIA. Other positive incentives included participation of some of the award winners in an exchange experience with fishermen from Vizcaíno Biosphere Reserve and in an exchange workshop with over 100 fishermen in La

791 OF 906 PANGAS registered in the EIA
PARTICIAPTED in training and awareness workshops.

Paz, BCS, called "From Fisherman to Fisherman."

- Fishermen identified as the most responsible participants in the EIA have expressed interest in continuing to use this tool.

Main Challenges

- Impromptu events and meetings occurred for other important fisheries related activities during this period, which impacted attendance at the scheduled workshops.

*http://www.youtube.com/watch?v=-Ja6V13WkM7g
https://www.youtube.com/watch?v=u3OSo-ExAUqc
https://www.youtube.com/watch?v=fxYy_HhNWSg

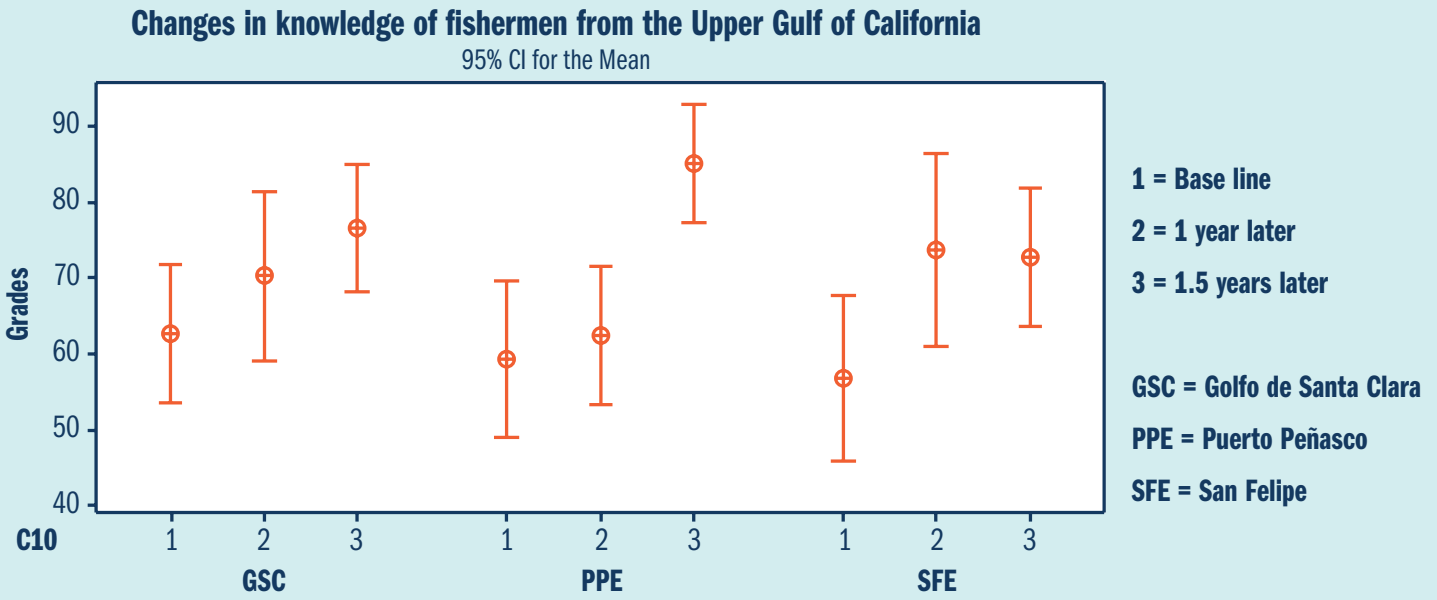


Figure 9. Increase in knowledge of fishermen who are part of the EIA of the Upper Gulf of California and their progress with the Training and Awareness Program. The results are shown by community. Numbers 1, 2, and 3 represent the scores of fishermen in responses to questionnaires that were applied three different times: 1) Before beginning the Program (n=224), 2) After one year of implementation (n=74) and 3) After one and a half years of execution (n=84) when the last training workshops were given.

Table 9. General benefits of good fishing practices promoted with fishermen involved in the EIA.

Favors reproduction of species	Protects other species and the ecosystem
Favors birth and growth of species	Protects other protected species
Maintains sufficient organisms in the sea to maintain populations	Permits juvenile organisms to mature and reproduce
Protects marine mammals	Maintains equipment in good condition
Maintains a clean ocean	Maintains good profit for fishermen

CHALLENGES AND LESSONS LEARNED

The environmental impact assessment is an ecosystem-based planning and management tool that has the potential to significantly reduce the impacts of fishing on the Upper Gulf of California ecosystem, provided fishermen continue to be empowered by the project and there is efficient inspection and surveillance.

The prevailing social and political context in the Upper Gulf when the EIA was first implemented presented various challenges for the project to take hold, as demonstrated by the following events:

- Federal government changes and political campaigns in 2012.
- Changes in the shrimp law (NOM-PESC-002-1993), announcing adoption of the RS-INP-MEX prototype net in July 2013, and the phasing out of gillnets for shrimp fishing.
- In 2011, quotas were established for the first time for Gulf corvina fishery.
- The illegal catch and sale of the endangered and endemic totoaba intensified beginning in 2012.
- A negotiation process for establishing a temporary closure in a larger refuge area to protect the vaquita was initiated with fishermen in September 2014 and ended in April 2015.

All the above diminished the priority placed on the EIA by both fishermen and authorities. Participation in the EIA, however, strengthened fishermen commitment to negotiate solutions for some of these situations. Important aspects of each of the issues mentioned could have been completely or partially resolved by reinforcing compliance with the EIA.

For example, if the EIA had been effectively implemented and enforced as was required by the authorities, it would have helped reduce illegal exploitation of totoaba populations and the rapid decline of the vaquita population observed in the past three years (Figure 8). At the beginning of the project DGIRA developed scorecards for each of the conditions fishermen had to comply and they met with fishermen to provide feedback, which had a very positive impact on fishermen. Similarly, for a short time (2014 shrimp season), when PROFEPA was conducting surveillance and enforcement for the EIA logbooks in the field, it helped control illegal fishing in the Reserve and increased fishermen's registration of their fishing activities in the logbook and participation in complying with the EIA.

Control of access to the Reserve by illegal fishermen was one of the most important expectations of fishermen participating in the EIA, but it did not have this result. Entry of fishermen for illegal fishing of totoaba was the main reason for the rapid decline in the population of the vaquita, not to mention the totoaba. This situation contributed to a general apathy among fishermen to participate in activities required by the EIA.

The project would not only have benefited from more follow-up from authorities, it would also have benefited from a more intense socialization process at the beginning in collaboration with the authorities. Despite efforts to inform fishermen about the EIA within the Committee to Evaluate and Follow-up on the Program for Protection of Vaquita (Orgáno de Evaluación y Seguimiento del Programa de Protección de la

> With the EIA we are caring for the biodiversity of the ecosystem and for the entire productive system. Within the Reserve we have to care for more because here there is so much product and if we begin to fish without caring, we are going to finish with it all... but we have to make the authorities value what we are doing... they need to remove from the Reserve all of those who do not comply with the impact statement...

Jesús Emigdio Zambrano,
Fisherman from Puerto Peñasco, Sonora.

Vaquita - OES), most of the fishermen had no knowledge of this new regulation, nor clear understanding of its significance. This proved to be a real impediment to jump starting the project, especially during the planning stage. People did not understand what doing an EIA meant, and they tended to confuse CEDO's role as facilitator of the process with that of the authorities.

Implementing mitigation measures involving large numbers of people was another challenge: some people complied with the measures, others did not. In the end, if overall compliance did not meet the authorities' expectations, there could have been consequences that would have affected everyone, including those who did meet the expected goals. This generates a sense of injustice. On the other hand, despite the efforts of groups of fishermen, such as black snail fishermen, who managed to unite and work together to meet the voluntary season closure established in the EIA (MM-12), the absence of effective inspection and enforcement in the area meant that their efforts were in vain, as poachers or fishers without an EIA were fishing within the Reserve with no consequences.

Another challenge that complicated the project was having sufficient finances available at the moment they were needed for implementing the project. The costs for doing an EIA for coastal fishermen is relatively high and given that these costs should be covered by the different people involved in the project (906 registered boats), the collection of the money was complicated. Since the programs being implemented were new and the region lacks an adequate system of fisheries and ecosystem management, paying for the development of a comprehensive monitoring system was an unrealistic responsibility for fishermen. It is recommended that implementation of regional EIAs that include monitoring systems should be co-financed by the government (CONAPESCA and CONANP), fishermen and civil society. It is important for the fisheries sector to take responsibility and, as in this case, work with a civil society organization to help find funding from other sectors. It is too much responsibility for the small-scale fishermen to do all of this alone, but ultimately the responsibility should lie with the fishermen.

The coastal fisheries sector is accustomed to receiving subsidies that allow them to enjoy the privilege of exploiting resources of national priority, rather than assuming the costs themselves. This project, however, implied the need for a complete change in fishermen's perception, and was an important step towards their assuming co-responsibility for the use of resources.

Ultimately, since the success of the EIA depends on fishermen's behavior as they carry out their activities within the Reserve, it is important to ensure that they have access to information and understand the importance of implementing the actions specified in the EIA, for the benefit of the ecosystem and consequently, for their own benefit. In turn, it is necessary to establish and document participation and self-regulation mechanisms, which ensure open, inclusive, transparent and clear rules of operation (the simpler the better) for making legitimate decisions. All this is necessary because such governance schemes go beyond what is legally established.

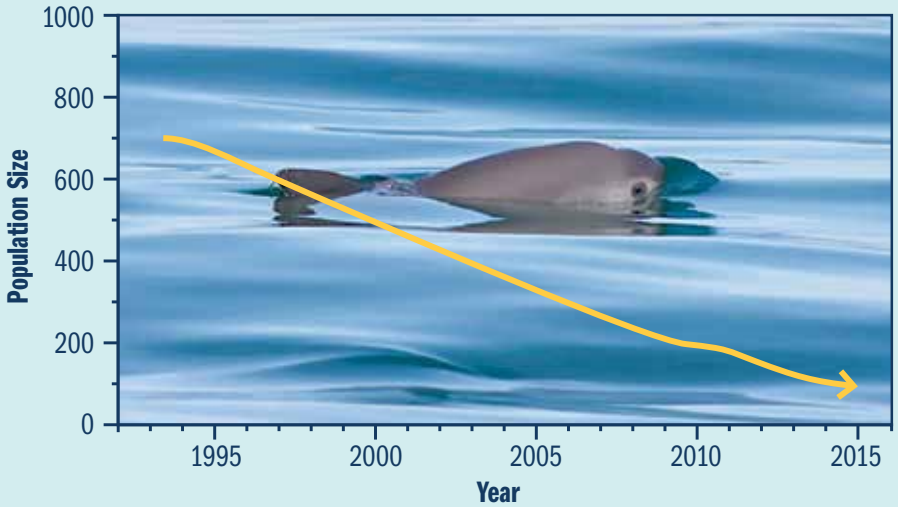
Overall, the effectiveness of the EIA can be viewed from two perspectives. From a strictly legal point of view, there is still much room for improvement in terms of compliance with regulations, terms and conditions and mitigation measures. As for vaquita and totoaba, the EIA process developed a system to control access and fishing effort, however it was not

monitored nor enforced, and thus had no effect on reducing impacts to these populations. Nonetheless there were other actions that were implemented that can reduce negative impacts on these species. Social participation programs and training have increased awareness among fishermen on the need for ecosystem management and have gotten them involved in promoting solutions to these problems.

From another perspective, since May 2010 progress has been made in participation and implementation of actions for conservation and sustainable use of fishery resources within the Upper Gulf Reserve, which were not taking place before this project began. This project has been valuable, in and of itself, for being the first effort in Mexico to mitigate the effects of coastal fisheries on the ecosystem in marine protected areas. Also, through the EIA, procedures and formats have been developed and lessons have been learned that can be replicated in other protected areas of Mexico.

NEXT STEPS

The current sociopolitical context complicates the reinforcement of compliance with the provisions of an environmental impact assessment. At CEDO we are systematizing protocols and documenting the lessons learned on how to implement more efficient mitigation measures. Analysis of the data from four and a half years of collection of both onboard monitoring and other methods enables CEDO to share information and experiences with other groups when it is necessary for them to comply with environmental impact assessments in other marine protected areas in Mexico.



Projection of the decline in the vaquita population shown in the report of the 5th meeting of the International Committee for the Recuperation of Vaquita (CIRVA-5) in 2014 (modified). The small change in the curve in 2010 was based on the understanding that there had been a reduction in fishing effort; but this did not occur, due to the increase in effort that the illegal totoaba fishery sparked. *(Photo: Thomas Jefferson)*

PARTICIPANTS IN THE EIA

Peggy Turk Boyer
Sergio Alejandro Pérez Valencia
Elia Polanco Mizquez
Paloma Valdivia
Felipe Barrera
Verónica Solis
Leonor López
Efraín Wong
Mayra García
Christian Chávez
Agustín Miranda
Pablo Avitia
Diego Cervantes
Alejandro Velázquez
Melissa Mayorga
Caroline Downton
René David Loaiza
Abigail López Maldonado
Miguel Escobedo
Alejandro Rodríguez
Guimel Muñoz
Carlos Hernández
Mario Onan
César Guerrero
Verónica Castañeda
Verónica Íñiguez
Hitandeui Tovar
Ángeles Sánchez
Andrea Cuéllar
David Buitrago

> "....and if they look to the past and were to begin again,
> and they find those who have formed a place
> that some good day will march forward,
> perhaps it will be said
> that these were grand travelers that passed by here..."
>
> **Fernando Delgadillo**

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Mexico Office

Apartado Postal #53, Edif. Agustín Cortés
Fraccionamiento Las Conchas
Puerto Peñasco, Sonora
(638) 382-0113/5

Tucson Office

4560 E. Broadway, Suite 220
Tucson, Arizona 85711
(520) 320-5473