A fisheries Pride campaign was implemented in the mangrove-lagoon system in La Encrucijada Biosphere Reserve, to promote sustainable fishing of snook. The goal was to maintain the median catch per unit effort of snook in terms of kg/fisherman/day. Snook is an economic important fisheries species in the area, and the fishermen depend on it for their livelihood. CPUE data came from daily individual landings data from the fisheries cooperatives. The 2011 baseline data included 1,081 records, ranging from a low of 0.1 to a maximum of 81.8 kg/fisherman/day, with a median of 3.9. By the end of the campaign CPUE was measured again and the median was 4.8 kg/fisherman/day. Further exploration of the distribution of CPUE indicated that three quarters of the fishermen catch less than 6 kg/day. The importance of fishermen recording their daily catch data was essential to calculate the CUEP. It is also important to maintain a close relationship of trust with the fishermen to be able to have access to their data. In presenting the results to fishermen, their reaction was of great interest from observing their production data presented in graphs, something they have seen before done with other fisheries.

Exploitation of the armored catfish (Pterygoplichthys spp) as a strategy for the control of this invasive species on Natural Protected Areas, a case study from the Terminos Lagoon in Campeche

El área de protección de flora y fauna Laguna de Términos ofrece múltiples hábitat que son utilizados por una comunidad de peces diversa y abundante, sin embargo recientemente se ha reportado la presencia y proliferación alarmante de especies exóticas introducidas como la tilapia y el pez Diablo. El objetivo de este trabajo es desarrollar un protocolo de aprovechamiento del pez Diablo en zonas altamente invadidas. A partir de recopilación bibliográfica, estadísticas pesqueras, muestreos prospectivos y entrevistas con pescadores, realizados con el respaldo financiero de la Comisión Nacional de Áreas Naturales Protegidas (CONANP), se determinaron parámetros poblacionales a partir del análisis de tallas, contenidos estomacales, sexo y fase de madurez gonádica. Se realizó un análisis bromatológico para determinar la calidad de la carne para su consumo humano y se evaluaron las alternativas de producción de harina de pescado, fertilizantes y otros subproductos artesanales. Se describen algunos aspectos relevantes de la biología del recurso y se proponen alternativas de aprovechamiento con un respaldo económico. El pez Diablo es un recurso pesquero emergente que debe ser aprovechado activamente tanto para coadyuvar en la economía de los pescadores de la región como para mitigar el alto potencial invasivo del recurso.
Mercury in biota from estuarine areas under varying human pressure

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Mercury (Hg) is the most dangerous trace element present in the edible parts of fishes and invertebrates. With the aim of having a general view on Hg occurrence in commercially exploited biota (fish and invertebrates) from selected estuarine systems of Mexico, we compiled information related to Hg levels in fish (elasmobranchs and teleosts), shrimps, clams, mussels and oysters from impacted estuarine areas and other coastal ecosystems in the Pacific Ocean and the Gulf of Mexico. Levels of Hg in the Asiatic clam Corbicula fluminea (a freshwater species) were relatively low (<0.32 µg g⁻¹) in comparison to individuals collected in moderate or severely impacted sites. In the case of marine mollusks (Crassostrea cortezensis and Mytilus strigata) Hg concentrations were comparable to those from low or moderately contaminated sites. In shrimps, Hg values were low (<0.72 µg g⁻¹) and consistently higher in hepatopancreas tissue than in muscle. Rays had lower Hg levels (<0.4 µg g⁻¹ wet weight) than sharks (<2.0 µg g⁻¹ wet weight). Teleost fish have been studied more thoroughly than other groups; Hg levels in muscle tissue varied by two orders of magnitude (from 0.02 to 1.58 µg g⁻¹ dry weight). Among studied organisms, fish are known as the main pathway of Hg entrance to humans. It is necessary to generate information of the rates of consumption of fish, especially of predator species. Considering legal limits of Hg and methyl Hg (1.0 and 0.5 µg g⁻¹ wet weight, respectively) in edible portion of fish in Mexico, at present there is risk to the human population for the consumption of the scalloped hammerhead shark Sphyrna lewini.

Establishing Management Strategies for Coastal Lagoons Using Nutrient Carrying Capacity

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Coastal lagoons are considered one of the most important ecosystems on the planet because they provide the necessary conditions for the biological cycle of a large number of species. However, in recent years, water quality in these systems has deteriorated because of population growth and human activities, which has led to increased inputs of organic matter and nutrients such as nitrogen and phosphorus. In order to determine the nutrient carrying capacity of coastal lagoons in tropical areas, a study was carried out at the estuarine system of Boca de Camichín, Nayarit using a model developed by the International Land Ocean Interactions in the Coastal Zone This work was conducted during three climatic seasons (hot-dry, rainy and cold-dry) between April 2008 and February 2009. Results obtained show that the system is clearly heterotrophic, which is caused by considerable production of organic matter. High productivity is maintained due to hydrodynamic movement, the penetration of sea water through a deep channel as well as the influence of a large river (San Pedro River). In all of the studied seasons, mass balances indicate that different concentrations of phosphate (19 to 90 tP/month) and nitrogen (90 to 162 tN/month) accumulate in the interior of the estuary. These results show that the Boca de Camichín system may be very close to its carrying capacity; therefore potential human activities that generate new organic matter that are discharged to Boca de Camichín lagoon should be controlled. Our results also show that it is essential to determine the nutrient carrying capacity of these types of systems in order to take proper management actions that ensure resource sustainability.
Trophic Relationships within a Subtropical Estuarine Food Web from Southeast Gulf of California through Analysis of Stable Isotopes of Carbon and Nitrogen

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We identified the sources of carbon supporting an estuarine food web in the Southeast Gulf of California. The trophic food web in the Estero de Urias Lagoon (EUL) was studied through the carbon and nitrogen isotopes in the potential food sources (plankton, macroalgae, plants) and organisms including filter-feeding mollusks, crustaceans, fishes and seabirds. The isotopic composition of sediment suspended organic matter (SSOM) and suspended particulate organic matter (SPOM) showed that there are diverse organic matter sources in EUL. The greater inputs of mangrove to detritus were reflected in their similar δ13C values with respect to SSOM and SPOM. The δ13C data suggest a direct transfer of C from SSOM and zooplankton to filter-feeders organisms and to a lesser degree from SPOM and phytoplankton. The isotopic composition of the different groups of organisms showed the complexity of the food web. However, there was a continuous gradient of 15N-enrichment from SSOM and SPOM to seabird with intermediate values for filter-feeders and crustaceans. The δ15N values in the EUL food web were consistent with 5 trophic levels. Fishes were strongly dependent on macrobenthos- and pelagic-derived nutrition. Cormorants occupied the highest trophic level and its major diet contributors were fishes. The studied food web was not segregated by time because isotopic trends were similar between dry and wet seasons.

Changes in the Hydrological Regime of Coastal Lagoons Affect Mangroves and Small Scale Fisheries: the Case of the Mangrove-Estuarine Complex of Marismas Nacionales (Pacific Coast of Mexico)

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The estuarine system of Marismas Nacionales (Pacific coast of Mexico) is a Biosphere Reserve that is considered to be the most extensive mangrove region in the American Pacific, and an important region for artisanal fisheries since prehispanic times. Significant hydrological changes occurred in this region after 1976 when an artificial channel was constructed to connect the sea to the main body of the estuary. The channel was originally built to be 40 m wide by 2 m deep, but erosion of the sand barrier (consequence of strong ebb currents) caused the formation of a channel that is presently more than 700 m wide and 20 m deep. The consequent hydrological shift caused the mortality of more than 15,000 ha of mangroves; more than 33% of the mangroves were affected by 1999, and it is considered that the process of deterioration is still happening. On the other hand the opening of the artificial channel improved the shrimp and finfish fisheries in the region: the number of fishing communities increased, as did the shrimp and fish landings, and large populations of pershell (Atrina maura) settled in the region. Several publications state the importance of mangrove as a key habitat for sustainable fisheries, but environmental conditions in some mangrove areas can be extremely difficult for the survival of fishes, crustaceans and mollusks (i.e. due to oxygen depletion). Thus, it seems that the role of mangroves is more related to the support of fisheries in surrounding habitats such as tidal channels, intertidal sand banks, seasonal flood plains, coastal lagoons and adjacent marine areas than “in situ” mangroves. This chapter describes the mangrove deterioration process in the region and proposes the hypothesis that mangroves combined with freshwater inputs, tidal channels and coastal lagoons with tidal influence and seasonal flood-plains are required for a mangrove forest to be considered an adequate fish habitat, and therefore an important
fishing region. Riverine, fringe and overwash mangrove forests are more beneficial to fisheries than basin and dwarf mangroves that play different ecological functions other than supporting fisheries

Water Quality Effects on Fish Larvae in a Tropical Coastal Lagoon of the Gulf of Mexico

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Human settlements and industrial activities located along rivers and coastal lagoon margins have led to the discharge of untreated waste effluents into proximate waters, a situation that has affected the biota, fisheries and man himself. Many examples of this phenomenon exist throughout the world, including along the coast of Mexico. This study analyzed the physicochemical water quality parameters of a coastal lagoon in the northwest Gulf of Mexico during four sampling seasons in 2009 and 2010 that included dry, rainy and north-wind seasons; results were compared to conditions of the lagoon in 1983. Anthropogenic discharges along rivers and lagoons in the study area were correlated with slight increases in ammonium, total nitrogen and phosphorus starting 30 years ago, with concentrations remaining stable during this time period. Intermittent decreases in these nutrients occurred during heavy rains. Residence time of these nutrients varied from 19–40 days and depended on the depth of the lagoon. Results suggest that water quality does not differ greatly between historic and present times, suggesting that these fluvial-lagoon systems do not currently require environmental management. However, controlling urban discharge, as the human population increases will be necessary to minimize the impact of anthropogenic discharges.

Managing Artisanal Fisheries in Estuarine Systems through the use of Fishing Zones in the SE Gulf of California

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Artisanal fisheries in the estuarine systems of Mexico are poorly regulated due to fishery complexity and the lack of information on the biology of exploited species, their habitat and fishing methods. Due to these unknowns and to utilize existing catch data (i.e., landing date, catch and landing site, catch per species, and price), this chapter proposes the use of zones as management units to understand fishing processes by region, and to identify possible spatiotemporal changes of the marine communities along the coast of Sinaloa (SE Gulf of California). A total of 97 species, primarily teleost fishes (n = 80), composed the artisanal catch within 6 defined zones; the shrimp fishery was also important in all the zones. The importance of other fisheries differed according to zone, but in general, swimming crabs were most economically important in the North and demersal fishes were most important in the South. Three categories of target species were classified: high economic value and high abundance seasonal species; low abundance and high value resident species; and high abundance and low value resident species. Zonation will allow the identification of catch trends, which can be used for management; however, there still remains essential information that is needed for better management.
Ecosystem-based Fisheries Management of a Biological Corridor along the Northern Sonora Coastline (NE Gulf of California)

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The coastline of Northern Sonora is dominated by hypersaline estuaries and vast rocky intertidal zones that are intermittently covered by the extreme tides characteristic of the Northern Gulf of California. Research on the spatial-temporal distribution of flora and fauna in wetland, sandy muddy bottoms, the pelagic zone, subtidal rocky reefs and an offshore island offer an in depth characterization of the region's habitats and allow the definition of a unique biological Corridor for the coastal zone between Punta Borrasco and Puerto Lobos, Sonora. Trophic studies and coupled oceanographic-biological models validated by larval dispersal and population genetic studies on commercial species highlight the connectivity between marine and coastal habitats and support the Corridor as a distinct management unit, especially for fisheries. Patterns of human use along the coast (fisheries, tourism and coastal development) have been documented and currently stake-holders in six communities are engaged in fisheries monitoring and management. The wealth of information available on this Corridor supports an ecosystem-based approach for fisheries management. The traditional hurdles to successful implementation of ecosystem-based fisheries management can be overcome for the coastal fisheries of the Peñasco Corridor by defining essential habitats for important target species, identifying trophic interactions, involving fishers and coastal communities in spatial planning and decision-making, and creating a positive incentive system.

Wetland Conservation in Northern Sonora, Mexico: Legal Tools and Active Communities

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During the global economic boom of the last decade (2000s), the shoreline of northern Sonora became one of the most rapidly growing coastal areas in Mexico, second only to the Caribbean. Many high impact development projects were proposed for the estuaries near Puerto Peñasco between Bahia Adair and Bahia San Jorge. Because of the recognized value of these wetlands, a multi-layered suite of legal and management instruments were applied to guarantee long-term protection of these essential habitats. Natural Protected Areas, Federal Zone Concessions and Ramsar Site Designations have been implemented to protect different wetland sites in northern Sonora, Mexico. Development projects are required to present Environmental Impact Studies for approval, and need vigilance to assure maintenance of coastal integrity. These different instruments are being brought to life in a biological corridor near Puerto Peñasco, Sonora by active participation of local communities and civil society organizations. The coastal inhabitants of these wetlands have united in processes to zone their use, develop low impact economic activities (resource monitoring, ecotourism and handcrafts), and participate in training and education programs, which also involves the youth. A Ramsar wetland network was formed to link wetland users with each other. Environmental contests and campaigns have engaged the region’s youth in working with their communities to solve environmental problems. Fishermen are participating in management initiatives for individual species and a vision for ecosystem-
based management is growing. The impact of these pro-grams points to an emerging wetland conservation ethic that may prove as important for long-term protection as the other instruments used. We present this process as a model for social participation in management of natural resources that can be used with a variety of user groups and legal tools.

Fisheries in the Santa Rosalia Region, Gulf of California, Mexico

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The approach to fisheries planning and management programs must consider the operation types of the fleets that exploit different fisheries resources in a given region. Consistent with this approach, we initiated an analysis of the small-scale fisheries that take place in the Central Western region of the Gulf of California, between the ports of Santa Rosalía and Mulegé. The analysis performed shows that from 1999 to 2010 the average annual catch was 28,132 Metric Tons (t) (max. 37,000, min. 17,000). Of this, giant squid fishing contributed 95%. However, this decreased in 2009 and 2010 to 16,000 t, almost half of 2008’s catch, causing changes in the structure of the regional fisheries. The lowest catch, occurring in 1998 (80 t), was related to the El Niño phenomenon, and had serious consequences on the regional economy. Other fisheries of interest include Pacific crevalle jack, chub mackerel, leopard grouper, sharks and octopus, each with its own fishing techniques. This paper discusses the capture trends that may reflect changes in fish availability or in the market, and that facilitate discussion regarding the interaction among different fisheries.

Common names and Keys for fish species of interest in the Mexican Pacific Fisheries

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Catch records by species for the purpose of fisheries monitoring is a matter of particular importance, since the statistics translate into trends of production, and are used to construct performance indicators. The problems associated with the database collection (i.e. catch by species, by geographic region and fishing season) primarily relate to the identification of species, their scientific names, and how those names correspond to their related common names. To contribute to the improvement of the quality of catch data by species, a list of common and scientific names and keys was prepared for 924 marine and brackish waters fish species of interest to the Mexican Pacific fisheries. The main objective is to facilitate the identification of these fish species by providing their common names, which are accompanied with pictures, diagrams, and additional general information. The species list is a dictionary of common and corresponding scientific names.

An interdisciplinary approach to study Small-scale fisheries in lagoon estuarine complexes in the Gulf of California

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There is a lack of information for Mexico’s small-scale fisheries (SSF). In the Gulf of California Marine Program we established an interdisciplinary approach to study SSF in lagoon-estuarine complexes (LECs). Our long-term goal is the collection of interdisciplinary data (official landings, fisher’s socioeconomics, fisher’s local ecological knowledge and historical ecology) in LECs. Marismas Nacionales (MN) was our pilot study site. Preliminary results show a “vicious circle” existent in the social-ecological system (SES) of fishing towns, where the high value of shrimp and unsustainable fishery practices, have altered the SES. Fishers were aware of the ecological benefits mangroves provide to improve their livelihoods, environmental damage, reduced catches, and of unsustainable fishing practices. For example pork meal employed to fish shrimp, illegal mesh nets and cyanide are widespread. Historical records show MN top predators are decimated. We aim to expand this research into other LECs, for which we currently have a 9-year dataset of SSF landings. By institutional collaboration we hope to achieve this interdisciplinary goal and disseminate the information through DataMARES open-source platform. This information can promote studies that help lightening actions, which need to be implemented regionally to break “vicious circles” between maintaining the socio-economic benefits and increasing environmental degradation.

Fisheries biology of the freshwater prawn Macrobrachium acanthurus in the Palizada River, Campeche (Southern Gulf of Mexico)

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The fishing activities of the genus Macrobrachium shrimp are an important component of society and culture of fishing communities of Rio de Palizada, Campeche. In order to have an adequate scientific basis for fisheries resource management research on the abundance, breeding seasons, distribution, fishing gear and the socio-economic situation of fishermen were performed. The results show us that: a) the abundance of M. acanthurus given in catch per unit effort presented the highest values were found from July to February, b) the breeding season was from September to October, c) an average size of female ovulation 99.1 mm and size range 40 -131 mm, d) there is a migration of ovigerous females towards downstream e) the sale price was $ 30 to $ 80 y Pígua fishermen in the area are poor and without alternative employment. In conclusion, it is necessary to identify sustainable alternatives to fishing and management of the fishery, such as to enable sustainable management of the resource, these possible options to ensure continuity and productivity of the species in the long term.

Finfish species catalogue from Tamaulipas (Northern gulf of Mexico)

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The catalog includes information systematically fish species that make up the coastal commercial catch, taxonomic identification, height, weight, distribution, habitat, fishing gear and methods, economic importance, capture, timing and regional distribution. For its realization, monitoring were made in 2010 and 2011 in the zones directly on download to the arrival of the boats, is conducted interviews with fishermen fishing related. Species were identified at the level of regional common name and later in the laboratory with a specimen of each species was identified taxonomically supported with shooting spot. Each species was recorded the total length, fork length, standard length, total weight, gutted weight. Identified 73 species were integrated into 31 families of which 68% were commercial, 29% non-commercial and 3% of fishing. The most abundant family was Lutjanidae representing 51%, the red
snapper *Lutjanus campechanus* the most representative. An important and fundamental part was the taxonomic identification of the species and the generation of information, since the multi-species nature of this activity requires systematic information that contributes to better resource utilization while expanding their knowledge.

**From no management to ecosystem-based management**

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Ecosystem-based management (EBM) has been distinguished from traditional management—based on single species and single sectors—because it recognizes the connectivity between the different elements of the ecosystems including humans and their activities. This approach must be place-based and requires the coordination between the stakeholders that participate and manage the human activities that impact marine ecosystems. Although guidelines for EBM implementation are available, there is a bridge between theory and practice. This project represents the first multi-stakeholder collaboration for EBM implementation in Mexico. We prove that EBM can be implemented in sites with poor management and poor data. We used Puerto Libertad small-scale fisheries as a case study. Our project involved the characterization of the system, the definition of shared objectives and indicators, as well as the elaboration and implementation of a management proposal, which included a committee of fisheries and aquaculture; a no take area; an individual quota system for clam fisheries; and a mariculture project. After two years of implementation, we conclude that essential ingredients for EBM implementation are: the development of shared objectives, cooperation among stakeholders, incorporation of traditional knowledge and science, and the professionalization of fishermen to participate in decision-making processes.

**Fisheries governance examples from Northwestern Mexico: New stakeholders with new roles**

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Fisheries management currently claims for fisheries governance (FG), with a more balanced scheme, which proposes to share the power among government, civil society and economics. The FG includes all the stakeholders involved in the decision making process and the rules that regulates their roles and interactions. The aim of this study was to identify how the FG structure is currently performing in the swimming crab and sardine fisheries in the Gulf of California. A legal analysis showed that both fisheries were performing under the same regulatory framework that draws a network structure with power asymmetries. A stakeholder mapping recognized that sectors other than government and fishermen are also involved in the management process. Through interviews we found that the decision making role is mainly played by the federal government, however, in the sardine fishery the technical and
productive sectors revealed important participation; furthermore, the scientific academy seems to be missing the opportunity to participate and the NGOs are playing not only the environmental defense role but also supporting the fisheries management. In conclusion both fisheries have a network structure that includes all the stakeholders known in the Fishing Act, even though some of them are not playing their stated roles.

Building a responsible fishery: The on-going story of Barra’s fishermen

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Fisheries are a source of income and livelihood for millions of people around the world. This is the case of the Barras de Piaxtla community in Sinaloa, Mexico. Located within the Meseta de Cacaxtla Natural Protected Area, this fishing community is working towards building a responsible fishery together with the help of the government and academia. We have enhanced good fishing practices and environmental awareness in the community through environmental education activities. We are working on strengthening the organization of the cooperative through several coaching strategies, planning and skill-developing sessions, and promoting fishermen to exchange experiences with other fishermen in previously identified successful cooperatives. Barra’s fishermen now understand the impacts of their activities on ecosystems and work towards a responsible management of their fishery. So far we have trained 6 environmental educators implementing the environmental education manual we designed for them. Based on perception surveys with the fishermen and several workshops, he helped them identify key needs in their organization as a cooperative and designed a step-by-step strategy in order to achieve their goal. This is an on-going conservation aimed story we hope becomes a successful replicable one across Latin American fisheries.

Interactions between shrimp and catarina scallop fisheries in Magdalena Bay, Baja California Sur, Mexico.

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To provide information of measures implementation for fisheries management in the ecosystem context, the operating fleet dynamics of shrimp and catarina clam in the region of Bahia Magdalena-Almejas was analyzed, considering impacts of overlapping areas and fishing seasons. Maps demarcating fishing areas and physiographic features of the lagoon complex, fishing gear used and spatial and temporal distribution of catches were made. The results validated by a study of local knowledge allow us to understand how fleets operate during periods of interaction between these fisheries the perceptions and tactic preferences of producers during these events. Economic units have permits to exploit multiple resources and must decide in the medium term in which fishing gear to invest, and in the short term in which fishery and area to participate. The impacts of direct interactions are reduced by users trading strategies, who to choose more than one open season, use the abundance of the resource as the main criterion (65%) followed by the price of the product on the beach (15%). Spatial interactions show distribution problems and fleets congestion with a trend that worsen over time.

Mapping from coastal fishing fleet operating results and local knowledge

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In the ecosystem-based management of fisheries is important to identify the differences in the strategies of spatial and temporal utilization of resources. His determination is related to the dynamics of fleet operation and requires
seasonal catch data and fishing area of the target species. In Mexico, arrival notices include these data, which were used to develop the mapping of catarina scallop and shrimp fisheries in the region of Magdalena-Almejas Bay, Baja California Sur. With production data, capture value and number of arrival notification of each species, we estimated a relative importance index, and which was related with additional fishing spots to define areas through a geographic information system. In such a definition were also considered features of the environment (habitat) and limitations of using nets for shrimp and clam diving. The maps obtained were validated with a study of local knowledge in 29 surveys conducted to leading producers in the region, fisheries interaction information was also obtained, as well as preferences and tactics of producers responding to the abundance of the resource, the price of the product landed and transportation distance to the fishing grounds.

**Marine Area of Responsible Fishing, a path toward small scale fisheries co-management in Costa Rica? Perspectives from Golfo Dulce**

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This chapter analyses participatory management processes of small scale fisheries in two Pacific embayments of Costa Rica, a centralized state of Central America where fisheries management is traditionally “top-down”, data deficient, and poorly suited to local biological and socio-economic conditions. We provide an historical overview of coastal activities governance and fisheries national context, and describe different participative approaches to small-scale fishery management. The Marine Area of Responsible Fishing (Área Marina de Pesca Responsable, or AMPR), created in 2008, is a management tool developed by the Costa Rican government to effectively involve fishers organizations in small-scale fisheries management. In this paper, we compare participative management initiatives associated with AMPRs in the Golfo Dulce and Golfo de Nicoya (Palito and Tarcoles), and Marine Protected Areas (MPAs) in Cahuita and Marino Ballena National Parks. Based on our analysis, we recommend ten measures to improve the small-scale fisheries co-management process. Among these, five recommendations stand out: (1) increase the participation of artisanal fishers in the development of collective choice rules; (2) allocate costs and benefits of management measures among artisanal fishers; (3) improve local leadership; (4) improve understanding and transparency of the management process; and (5) formalize and implement strategic fisheries management plans.

**Exploring fishing effects on cortes geoduck (Panopea globosa) populations from the upper Gulf of California.**

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Geoduck fishery starts in 2007 in the upper Gulf of California. Management has been done through permits that authorize fishing in defined polygons and establish a yearly total quota for each identified bed (based on unbiased density estimations and total area of clam’s beds). After five years of intense exploitation, it’s necessary to explore how fishing has affected the once virgin beds. An analysis of variance (ANOVA) it’s been used to find differences on average shell length, average live weight, average age, and total live weight-shell length relationship, from geoducks sampled at the begging of the fishery, compared with geoducks sampled five years later. Data was obtained from fishery independent monitoring and fishery dependent monitoring in Puerto Peñasco and San Felipe. Clams were measure and weighted alive. Geoduck were aged by counting growth rings after cutting shells transversally trough the umbo. Average age was estimated using the von Bertalanffy model. An allometric growth model was be used to describe the relationship between total live-weight and shell-length. If differences are found, and based on the fact that geoduck natural mortality is low at large ages, we could conjecture that fishing is causing the differences
Use of an environmental impact study for increasing compliance in Mexico’s marine protected areas: A bottom-up social process in the Upper Gulf of California Biosphere Reserve

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In Mexico all commercial fishing inside Marine Protected Areas needs an Environmental Impact Assessment (EIA). To date, only fishermen from the Upper Gulf of California and Colorado River Delta Biosphere Reserve have been asked to cover this requirement. Since 2010 a bottom-up social process has been conducted for implementing mitigation measures to reduce the fishing impact of nine small-scale fisheries on the ecosystem. A total of 905 fishing boats from the three main fishing communities of the region are involved in the EIA. The EIA provides an opportunity to improve the level of compliance with fishing and environmental regulations, as well as with voluntary mitigation measures, because it puts the burden of proof on the fishermen. To empower fishermen, an onboard monitoring program and a fisheries monitoring program have been implemented to provide essential information. An education and training program gives fishermen the knowledge and incentives to be active participants. A social participation program has created decision-making bodies in each community that serve as a forum for fishermen to express their opinions and propose solutions for improving self-compliance. The EIA is a pioneer project that will set an example for other marine protected areas in Mexico.

Assessing the effects of fishing mortality on the Pacific sierra population (Scomberomorus sierra) from the Southern Gulf of California, Mexico

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The Pacific sierra is one of the most important fisheries resources in the Gulf of California. It is mainly captured with gillnets and is relevant because of its social importance as a seasonal fishery. A demographic analysis was carried out incorporating biological data on fecundity, length of first maturity, longevity, sexual ratio and natural mortality, using previously reported data from literature with the aim of obtaining parameters such as: the finite rate of population increase (lambda); the net reproductive rate (R0) and others that indicate the rebound potential of the population. Simultaneously, a Beverton-Holt’s yield-per-recruit model was developed to assess the population in fishing terms. The first run of the demographic model in non-exploitation conditions (only M), yielded that lambda = 1.70, which indicates that the population is able to increase 70% each year. However, simulating different exploitation schemes varying the fishing mortality (F) and the age of first capture (Epc), we concluded that the population is highly productive and supports fishing mortality values of even 1.0 (maximum evaluated) when captured from 4 year-olds (43 cm of Lf) without compromising its stability. The results obtained in this study could be mainly useful to determine the optimal length for first capture.

Extent and implications of IUU catch in Mexico’s marine fisheries

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Around the world it is well recognized that not all fisheries catches are reported or recorded properly by either government or non-government agencies; Mexico is no exception. These unreported catches can be illegal, of unregulated species, or simply not monitored due to logistical barriers. We know that it is time for a fundamental change in strategy away from expansion of fishing effort and toward ecological and economic sustainability, and an important step is to provide a more comprehensive quantitative analysis of Mexico’s fisheries catches. Results suggest that from 1950-2010, total catches were nearly twice as high as previous reports, with an average annual catch of 1.5 million tonnes (t) compared to 796 thousand t in official statistics. In the last year of available data, 2010, official and total estimated catches were 1.5 million and 2.2 million t, respectively. This study does not single out a responsible party for poor data quality, but is a call to many sectors of society to help overcome these conditions, and increase and sustain the benefits from Mexico’s marine fisheries.