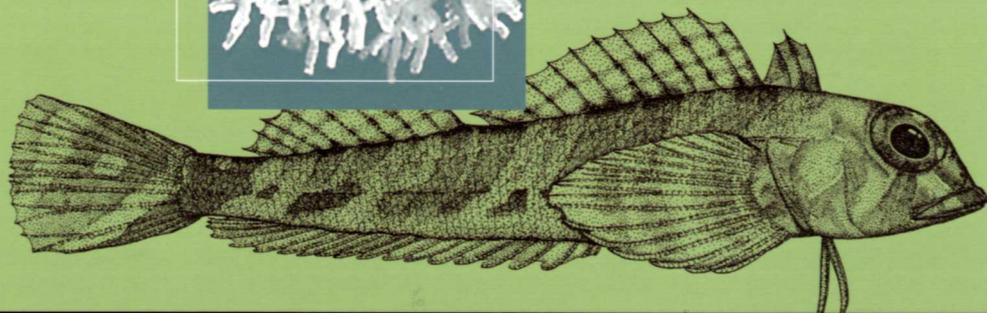
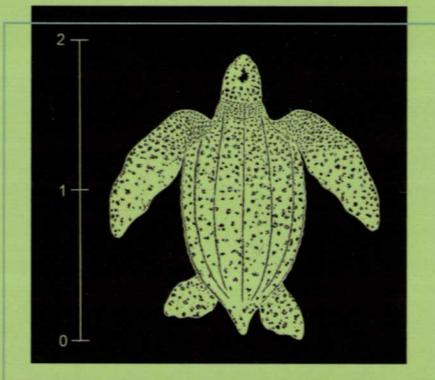
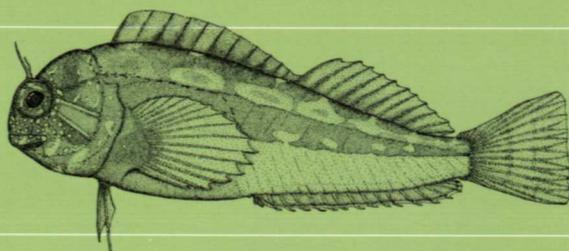
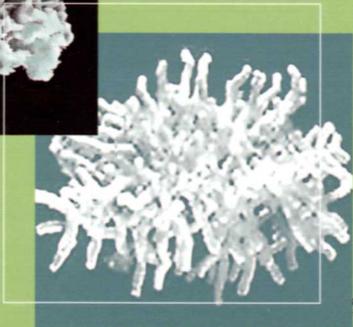


Arizona-Sonora Desert Museum Studies in Natural History



# THE GULF OF CALIFORNIA

BIODIVERSITY AND CONSERVATION

Edited by Richard C. Brusca

Foreword by Rodrigo A. Medellín

**The Gulf of California  
Biodiversity and Conservation**

Edited by  
Richard C. Brusca

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## CHAPTER 11

# Ecological Conservation in the Gulf of California

MARÍA DE LOS ÁNGELES CARVAJAL,  
ALEJANDRO ROBLES, AND EXEQUIEL EZCURRA

### Summary

**W**ith an immense biological richness and high marine productivity, the Gulf of California (*Mar de Cortés*, Sea of Cortez) is both a large marine ecosystem of high global conservation priority and a region that faces growing threats—mostly as a result of overfishing and significant degradation of coastal habitats—with 39 marine species listed in the International Union for the Conservation of Nature (IUCN) Red List.

The Gulf coastline is a sparsely populated and comparatively affluent region of Mexico. In recent decades, new economic opportunities and depletion of natural resources have led the economy away from its traditional reliance on agriculture and fisheries, shifting it toward tourism and manufacturing. Rapid economic growth has brought accelerated immigration with growing pressures on the environment. The implications of these socioeconomic changes for biodiversity conservation are significant.

In addressing the growing challenges in the region, the conservation movement has relied on three fundamental approaches: (1) research data from the scientific community, (2) ecosystem conservation through the establishment of protected areas, and (3) building capacity for conservation at local and regional levels. Conservation efforts began in the 1950s and early 1960s, when the Upper Gulf and Isla Rasa were officially declared protected sanctuaries for the reproduction of fisheries and seabirds, respectively.

Rapid progress was achieved in the 1990s when conservation organizations began working closely with academic and governmental institutions to better manage protected areas in the region. As a result of these efforts there are now ten terrestrial and thirteen terrestrial and marine protected areas in the Gulf that cover, in total, more than 9 million hectares. The National Commission for Protected Natural Areas (CONANP; see

**TABLE 11.1.** Acronyms used in this chapter.

ALCOSTA	<i>Alianza para la Sustentabilidad del Noroeste Costero Mexicano</i> , an alliance of several environmental organizations promoting coastal conservation
CES	<i>Centro Ecológico de Sonora</i> , a research center in Sonora
CIDESON	<i>Centro de Investigación y Desarrollo de los Recursos Naturales de Sonora</i> , a research center in Sonora
CIRVA	International Committee for the Recovery of the Vaquita
CONANP	<i>Comisión Nacional de Áreas Naturales Protegidas</i> , Mexico's National Commission for Protected Natural Areas
FONATUR	<i>Fondo Nacional de Fomento al Turismo</i> , Mexico's National Fund for the Promotion of Tourism
GEF	Global Environmental Facility, an international funding organization created as a result of the Rio Summit (UNCED)
INE	<i>Instituto Nacional de Ecología</i> , Mexico's National Institute of Ecology
IUCN	International Union for the Conservation of Nature
MAB	UNESCO's Man and the Biosphere Program
NAFTA	North American Free Trade Agreement
NGO	Nongovernmental organization
NOS	<i>Noroeste Sustentable</i> (Sustainable Northwest), a Mexican conservation initiative
PROFEPA	<i>Procuraduría Federal de Protección al Ambiente</i> , Mexico's Environmental Attorney General
SAGARPA	<i>Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación</i> , Mexico's Ministry of Agriculture
SDNHM	San Diego Natural History Museum
SEDUE	<i>Secretaría de Desarrollo Urbano y Ecología</i> , Mexico's first Environmental Ministry (1983–1992)
SEMARNAP	<i>Secretaría de Medio Ambiente, Recursos Naturales y Pesca</i> ; Mexico's Ministry of the Environment (1994–2000)
UNAM	<i>Universidad Nacional Autónoma de México</i> , Mexico's National University
UNCED	United Nations Conference on Environment and Development (also known as the Rio Summit)
UNESCO	United Nations Educational, Scientific, and Cultural Organization

table 11.1 for a summary list of acronyms) was created during that time. Also, professional staff was hired and assigned to protected areas, advisory groups were established, management plans were developed, legislation was updated, and the budgets for managing protected areas rose significantly. Yet in spite of increased legal protection, problems have continued to grow in many areas. This highlights the importance of finding alternative modes

of conservation, especially by learning from the many grassroots and regional success stories of conservation objectives achieved by means that are different from, but complementary to, those of federal reserves.

For conservation initiatives to succeed in the Gulf of California, they must be able to win the hearts and minds of local people, lead toward generation of alternative livelihoods, and increase local community capacity for stewardship of resources.

## Introduction

The Gulf of California is a large, semi-enclosed sea covering approximately 260,000 square kilometers. It contains some outstanding natural features such as deep ocean basins with hydrothermal vents in its central and lower portions, expansive tides in its upper reaches, over a hundred large islands, myriad islets and offshore rocks, and strong upwellings of cold, nutrient-rich waters that make it extraordinarily productive. In the surrounding coastal deserts, rainfall and terrestrial productivity are tightly coupled to oceanographic variations (Polis et al. 1997; Velarde and Ezcurra 2002). The great diversity of topographic and bathymetric features has produced a variety of habitats for marine life and island species (Case and Cody 1983; Robles and Carvajal 2001; Case et al. 2002). The Gulf is a sort of “marine peninsula,” isolated from the rest of the Pacific by the 1,500 km of land of Baja California. Habitat heterogeneity, geographic isolation, endemism, and rarity have been driving forces of evolution in the fragmented coastal lagoons and wetlands as well as in the oceanic islands, reefs, underwater seamounts, and other areas of the Gulf (color plate 7A).

Fragmentation also yielded unique human cultures. Separated from the rest of Mesoamerica, the Cochimí Indians of Baja California developed one of the most incredible prehistoric assemblages of cave paintings in the world. Later, during the Spanish colonial period, Jesuit fathers established a system of missions in Baja California that evolved in complete independence from the harsh rules of the mainland conquistadores. Other coastal indigenous nations—such as the Seri, the Yaqui, and the Cucapá—also developed unique lifestyles as fishers and sailors, with cultures finely adapted to their coastal resources (Felger and Moser 1985; Bowen 2000; Bahre and Bourillón 2002; Nabhan 2002).

Biologically, the Gulf of California is one of the most productive and diverse seas in the world (Alvarez-Borrego 1983, 2002; Brusca 2004a; Brusca and Bryner 2004; Brusca et al. 2005; Lluch-Cota et al. 2007). Its high biodiversity levels, biological productivity, and 857 endemic species of fish, seabirds, marine mammals, and macroinvertebrates give it one of the highest coastal ecosystem conservation priorities on the planet. Unfortunately, it also faces growing threats that result mostly from overfishing and degradation of the coastal habitats: 39 of its marine species are listed in the IUCN Red List as threatened or vulnerable (Thomson and Eger 1966; Brusca 1980; Thomson et al. 2000; Thomson and Gilligan 2002; Brusca 2004a; Brusca and Bryner 2004; Carvajal et al. 2004; Brusca et al. 2005; Findley et al. in press).

This vast natural wealth is not only of biological and conservation interest; it also yields some 30–60 percent of the national catch of Mexican fisheries and provides the socioeconomic sustenance of the inhabitants of the region, who have developed systems of natural resource access, use, and appropriation that often put the long-term sustainability of the resources in peril. The most important threats to biodiversity are driven by the growth of economic activities in the region that have caused the deterioration of coastal marine ecosystems due to decreasing freshwater flows, pollution by agrochemicals and urban waste, sedimentation, overfishing, and the use of inappropriate fishing technologies such as bottom trawling and gill nets. Critical habitat of mangrove forests is being lost at an annual rate of 9 percent from sedimentation, eutrophication, and changes in water flows caused by the construction of shrimp ponds, marinas, inland channels, and deforestation (color plate 8B). Invasion of exotic plant and animal species is putting at risk the native and endemic species of the Gulf's islands and the Sonora and Baja California desert regions (Carvajal et al. 2004).

In the 1930s, outboard motors and gill nets came into use in the Gulf, permanently transforming the once-abundant regional fisheries. The highly prized totoaba—an endemic fish—saw significant population declines (Cisneros-Mata et al. 1995a, 1997; Román-Rodríguez and Hammann 1997), while inshore fishing efforts began to have a strong impact on estuaries and lagoons. In 1933, the shrimp fishing industry introduced the use of bottom-trawling gear on soft seabeds, devices that have since been sweeping the seabed clean on a regular basis. Everything in the path of the

trawling dragnet (fish, octopus, conch, sponges, starfish, etc.) is harvested, and the by-catch, if judged to be of lesser economic value, is returned dead to the sea. As the twentieth century progressed, the shrimp fishery became the most important economic activity in the fishing industry. In 1997 the five states of the Gulf of California produced 57,000 tons of shrimp (approximately 70 percent of the Mexican national shrimp production) while destroying the Gulf's soft seabeds and wiping out hundreds of thousands of tons of by-catch. The use of bottom trawlers had become one of the greatest threats to marine biodiversity in the Gulf (García-Caudillo et al. 2000).

Today, the Gulf region represents a large and still sparsely populated area of Mexico, with human densities only a third of the national average. It is also a relatively wealthy region of the country: the per capita income of Baja California and the State of Sonora is 22 percent higher than the national average (Ezcurra 2003; Carvajal et al. 2004). The region produces around 70 percent of the value of national fisheries, and 40 percent of the national agricultural production is harvested in its high-technology irrigated fields. In recent decades, however, depletion of natural resources and new macroeconomic opportunities have led to major shifts in the economic structure, leading the economy away from its traditional base on the primary sector—particularly agriculture, fisheries, and mining—and toward export-oriented manufacturing/industry and services such as tourism.

## **Regional Environmental Challenges**

The rapid growth of the regional economy has brought a large demographic increase from immigration and ensuing pressures on its natural resources. Open-access, extractive use of natural resources seems to have reached a limit in the region, and rapid development of the manufacturing and services sectors is putting an additional strain on natural resources. The implications of this economic change for biodiversity conservation are significant. Decision makers have an important opportunity to reduce the pressure on natural resources in the region by supporting a reorientation of the economy away from primary-sector activities associated with overexploitation of natural resources and by promoting the establishment of a sustainable industry of low-impact, environmentally minded tourism. In this section we discuss some of the major regional environmental chal-

lenges brought about by agriculture, industrial and small-scale fisheries, and massive tourism in the environmentally sensitive areas of the Gulf of California.

## Fisheries

With 39 species listed on IUCN's Red List, it seems clear that ecological degradation has already taken a major toll on the Gulf's biodiversity. The endemic vaquita porpoise (*Phocoena sinus*) is already near extinction, the fate of the totoaba (*Totoaba macdonaldi*) is questionable, and populations of five species of sea turtles have all but disappeared from the Gulf. The International Committee for the Recovery of the Vaquita (CIRVA) estimated the current vaquita population in the range of 268–464 for 2004, as compared with a previous estimate of 567 vaquitas for 1997. The new estimate took into consideration an annual growth rate of 4 percent and the loss of 39 to 78 individuals per year (D'Agrosa et al. 2000), which make the vaquita the most endangered marine cetacean in the world. More recent work suggested that the vaquita population might be as low as 150 (Jaramillo-Legorreta et al. 2007).

Overharvesting of the fishing stocks has become a strongly limiting factor for the success of the regional fisheries. Twenty years ago, there was a positive correlation between catch and effort in most of the regional fisheries—the more days the fleets fished, the higher the catch they achieved. Now that correlation is largely gone: the total landings in most fisheries are largely independent of the (generally excessive) fishing efforts, and the catch per unit effort has decreased severely for many species. In short, the fishers of the Gulf are often overharvesting, and in some cases even depleting, their stocks (Sala et al. 2004; Velarde et al. 2004). Additionally, there is clear evidence that coastal food webs in the Gulf of California have been “fished down” during the last thirty years (i.e., fisheries have shifted from large, long-lived species belonging to high trophic levels to small, short-lived species from lower trophic levels) and that the individual fish length for landings has decreased significantly (by about 45 cm) in only twenty years (Sala et al. 2004).

In some fisheries, the tragedy of common-access resources is hitting the Gulf hard. For example, thirty years ago, the shrimp-trawling fleet

in the Gulf consisted of about 700 boats, each of which captured about 50 tons of shrimp per season. Today, the fleet is almost 1,500 boats but the annual catch scarcely surpasses 10 tons per boat. In spite of governmental transfers of about \$30 million (U.S.) each year—provided in the form of discounted fuel prices—many boats of the fleet are facing economic collapse. Decrease in catch per unit effort combined with low wholesale prices for farmed shrimp led, in the early 2000s, to many shrimp trawlers going out of business or switching largely to nonshrimp target species.

The situation is also discouraging from an environmental standpoint, especially regarding the shrimp trawlers. The bottom trawlers exterminate some 200 thousand tons of by-catch every year for a meager annual catch of some 30 thousand tons of shrimp. The dragnets destroy some 30–60 thousand square kilometers of sea bottom (García-Caudillo et al. 2000), much of which lies within the Upper Gulf Biosphere Reserve, and the boats emit collectively some 30–40 thousand tons of greenhouse gases due to the cheap fuel that keeps their inefficient business going. Seabeds have been so depleted in some areas that local artisanal fishers in places such as Loreto Bay and Bahía de los Ángeles have been demanding the establishment of no-take zones and marine protected areas. In open conflict with the local communities, the larger fleets want no protected areas and demand permits to trawl inside federal reserves—such as the Upper Gulf Biosphere Reserve—to increase their scanty earnings. In the Gulf, conflict between sectors and between particular interests has increasingly become the rule.

However, not all stories of common resource use in the Gulf of California are despairing tales of unsustainability and collapse. There are also many success stories, and learning from them is fundamental for future conservation efforts. For example, local artisanal fishers have started to work with local researchers in the Gulf to understand the phenomenon of spawning aggregations so that they can identify and protect reproductive areas. As a result of pressures from these local resource users, the Bay of Loreto is now a marine park (*Diario Oficial* 1996a), and the fishers of Bahía de Los Ángeles are supporting the creation of a similar marine protected area. In San Ignacio Lagoon, fishers from a previously unsustainable fishery have organized to preserve the environment and train their people in basic natural history to organize whale-watching tours.

The abalone and lobster cooperatives of the Pacific coast of Baja

provide yet another example of long-term sustainable use. With no support from the federal government, these fisheries have established strict rules for resource extraction and have developed their own law enforcement system. Many cooperatives generate their own electricity, run their own canneries, and finance their own schools. More than forty years after their establishment, their productivity is still high and their resources seem to be used in a sustained manner.

Not only small communities and conservationists are critical of some of the region's unsustainable modes of development: a growing number of entrepreneurs and business people are also becoming committed supporters of the environmental cause. As a result of increasing environmental concerns, a cluster of committed business leaders have organized an action and opinion group called grupo NOS (for *Noroeste Sustentable*, or Sustainable Northwest) to promote the appropriate use of resources in the Gulf region. Even large fishing fleets can maintain sustainable landings when their leaders and operators work in cooperation. In contrast with the continuing crises of the shrimp bottom-trawling fleet, the sardine fishery has proven capable of controlling its own fishing effort and—after a past collapse—is now healthy and productive (Cisneros-Mata 1995b, 1996; Lluch-Belda et al. 1986). In short, although the Gulf of California is under extreme overfishing pressures in many parts and has seen the consequent collapse of some of its resources, it also harbors a number of successful and encouraging experiences of communities that are trying to keep their resources healthy and productive now and in the future.

### Coastal Tourism and Recreational Activities

The magnificent landscapes and the amazing density of marine wildlife make the Gulf of California a superb place for visitors. The first tourists coming into the Gulf in the first half of the twentieth century were driven by the extraordinary catches of sport fish. Nautical tourism developed later, partly driven by the success of sport fishing and partly by the beauty of the area. Soon the idea of connecting the region through a series of marinas with the states of California, Oregon, and Washington in the United States became a vision for developers. During President Vicente Fox's administration this idea materialized in the form of a regional project, the *Escalera Náutica*, or Nautical Stairway, whose goal was greatly increas-

ing boat tourism in the Gulf. The project was developed by the National Fund for the Promotion of Tourism (FONATUR, a federally funded development agency).

Following its announcement in 2001 and in the years that followed, the Escalera Náutica became one of the most debated projects in the region. On the one hand, the project tried to generate a shift in the regional economy from unsustainable fisheries and water-intensive agriculture toward the services sector in the form of boat tourism. Given the irrefutable evidence that the economy's primary sector has reached its limits in the Gulf (and in some cases is even facing collapse), this shift seems like a desirable move in principle. On the other hand, experiences in Mexico with resource-intensive, unsustainable tourism (and its sequel of failed and abandoned projects, dredged mangrove swamps, and exhausted aquifers) have left a deep scar of mistrust in local groups and communities. Thus, the Escalera project presented a dilemma for conservation groups: it signified a positive shift in the local economy by moving it away from consumptive resource use, but it failed to assure the ecological sustainability of the project and opened the door for environmentally disruptive development. For regional conservation groups, the big challenge in the Gulf of California is to promote environmentally sustainable tourism while ensuring the preservation of the natural beauty and biodiversity of the region—the very attributes that initially triggered tourism in the region.

ALCOSTA (Alianza para la Sustentabilidad del Noroeste Costero Mexicano), an alliance of several environmental organizations), was born in the wake of the Escalera Náutica project. Together with other players, ALCOSTA brought a voice of concern into the development plan. The group spearheaded critical efforts to reduce the environmental impacts of the project and to reform the initiative by making it more accommodating to issues of environmental conservation. As a consequence of these efforts, FONATUR was compelled to prepare a regional Environmental Impact Statement and public hearings were held about the initiative—the first hearings ever held in Mexico about a development project of regional dimensions. ALCOSTA developed a critical analysis of the project and presented it to the federal authorities during the hearing. All the environmental conditions proposed by ALCOSTA for the authorization of the project were taken into account in the final resolution. Additionally, the discussions drove President Fox to designate the Gulf of California as a

joint priority for tourism development and for conservation. As a result, the Ordenamiento Ecológico Marino (Marine Habitat Use Plan) program was initiated together with a promise to enlarge the protected areas in the Gulf islands to include surrounding waters.

The governments of states surrounding the Gulf have adopted aggressive plans to promote tourism by creating infrastructure. In their vision, tourism is an opportunity to create much-needed jobs and to foster economic development, thereby compensating for job losses in other sectors and perhaps also easing the growing demands for subsidies by farmers and fishers. The crisis of the primary sector makes tourism an increasingly attractive alternative for regional governments. This, in turn, will demand growing attention from conservation groups to address the issue on a regional scale.

### Freshwater Resources

Water is a vital development resource in desert regions such as the Baja California peninsula and the State of Sonora. However, the rapid growth of activities such as agriculture, industry, tourism, and urban development (and its associated demographic growth) have placed increasing pressure on regional water resources during the last decades, not only from higher demand but also from the increase in pollutants that results from unplanned economic growth and from growing pressures on the deficient sanitary infrastructure and limited water treatment facilities. Thus, the rapid expansion of the more successful sectors of the regional economy has been mostly done at the expense of depleting underground aquifers, disrupting watershed flows, and destroying the natural wetlands around large urban conglomerates.

At the end of the nineteenth century, all regional rivers still ran free into the Gulf waters. In the early decades of the twentieth century, major agricultural developments were established in the lower basins and deltas of the Fuerte, Mayo, and Yaqui Rivers of Sinaloa and Sonora and also in the Colorado River valley along the Mexico-U.S. border, giving birth to the fast growth of settlements along the coastal plains and permanently modifying the ecological landscapes and the services that the deltas provided.

A good illustration of this dynamic is the Colorado River, which until the 1930s was the largest river flowing into the Gulf of California and

included a vast delta covering 300 km<sup>2</sup> of wetlands (Sykes 1937; Fradkin 1984; Ezcurra et al. 1988; Felger 2000; Brusca and Bryner 2004). The development of steamboat traffic on the Colorado River during the nineteenth century, from the Gulf into the Yuma trail, was made possible partly because of the dense cottonwood forests on the river banks, which were intensely logged for charcoal. The devastation of these forests brought the first significant environmental impacts on the delta, which were merely a prelude to the devastation that the estuary would later see. In 1905, major infrastructure projects that diverted the waters of the Colorado gave birth to the Imperial and Mexicali agricultural valleys. In the early 1940s, the Hoover Dam and the International Water Treaty signed between the United States and Mexico brought about the irremediable demise of the great delta. In the same manner and in the same decade, dams and channel works were initiated along the Fuerte, Mayo, and Yaqui Rivers as part of a regional project for agricultural development that brought a dramatic reduction in the supply of freshwater to downstream ecosystems and thus led to degradation of the riparian corridors, estuaries, wetlands, and coastal lagoons (Robles et al. 1999). Economically, all these irrigation projects were extremely successful during their first decades. At present, however, the once-fertile soils of these man-made agricultural valleys are showing clear signs of exhaustion. Soil salinization and decreasing profit margins have forced farmers to abandon many fields, leaving behind a substantial ecological footprint of salinized and vegetation-denuded coastal plains and thus further compounding problems in the already heavily affected areas.

The decline of water and soil resources for agriculture has encouraged a reorientation toward high-value horticultural crops that provide better returns. The outlook also seems to be improving for restoration of the once-lush coastal wetlands: the abandonment of lands because of salinization, together with changes on the Mexican Law of National Waters (Ley de Aguas Nacionales), has created the possibility of buying water rights to restore the deltas.

### The Need for Effective Conservation

If effective conservation in the region is to be achieved, then a strategy that addresses these critical regional environmental challenges must be developed. Such a strategy should allow for the protection of endangered

species, spawning aggregation areas, and endangered ecosystems such as seamounts, coastal lagoons, coral reefs, estuaries, and marine mammal habitats (Sala et al. 2002). Expansion or establishment of protected areas is an approach that can be taken to ensure long-lasting conservation efforts, but alternative approaches are also needed. In order to be effective, any successful conservation effort will require the support of the local communities and regional stakeholders. If conservation initiatives are not able to win the hearts and minds of local people by generating alternative livelihoods, then future efforts are not likely to succeed.

The degradation of coastal wetlands is one of the Gulf's most serious threats. With little consideration given to the ecological services they provide, mangrove forests are being cut for the development of aquaculture (mostly shrimp farms) and tourism projects. Moreover, coastal wetlands in general are threatened by consumptive water use upstream and by the pollution of rivers and waterways. Because water is a mobile resource, the protection and the restoration of coastal wetlands demands comprehensive large-scale plans addressing both upstream and downstream habitats. The ecological services provided by estuaries and lagoons are critical for the survival of the Gulf of California fisheries and for the health of the large marine ecosystem as a whole. Comprehensive plans for effective protection of coastal wetlands, halting mangrove deforestation, and maintaining the ecological services of coastal lagoons and estuaries must be developed and implemented for the long-term survival of the entire Gulf.

### **A Brief History of Conservation Efforts**

Possibly the first efforts to protect the ecosystems of the Gulf of California started in 1951 with the publication of Lewis Wayne Walker's popular paper on the seabirds of Isla Rasa in the *National Geographic* magazine. Walker was then a researcher at the San Diego Natural History Museum and later became associate director of the Arizona-Sonora Desert Museum. He was knowledgeable about the natural history of the region and possessed firsthand field experience in Baja California and on the islands of the Gulf, especially Isla Rasa. Walker wrote many popular articles on the natural history of the region and through these publications popularized the plight of Rasa (Walker 1951, 1965).

In the early 1950s the Audubon Society donated \$5,000 for the preservation of Rasa. This started Walker's research on the island, which was later also supported by a grant from the Belvedere Scientific Fund from San Francisco. Part of this financial support reached Dr. Bernardo Villa's laboratory at the Institute of Biology in the National University of Mexico (Universidad Nacional Autónoma de México, or UNAM). The funds were used to maintain a biologist and a field station on the island. The work at Rasa was later supported by donations from the Roy Chapman Andrews Fund to the Arizona-Sonora Desert Museum.

The results of these investigations soon reached the Direction of Forestry and Wildlife in the Mexican federal government, which in the late 1950s was headed by Dr. Enrique Beltrán, an eminent Mexican conservationist. Beltrán's own interest in the issue—and the public notoriety that Isla Rasa had achieved through popular publications and the field trips of many biologists—helped to prepare the way for the first federal decree protecting the insular ecosystems of the Gulf of California: in 1964, the official governmental federal register (*Diario Oficial de la Federación*) published a decree declaring Isla Rasa a nature reserve and a refuge of migratory birds (*Diario Oficial* 1964).

In 1973, a natural history expedition was organized, using a chartered Catalina flying boat to traverse the Gulf and visit small, remote islands. The group included George Lindsay, then director of the California Academy of Sciences; Charles Lindbergh, the legendary aviator; Joseph Wood Krutch, a celebrated American nature writer; and Kenneth Bechtel, a philanthropist from San Francisco. Lindbergh had become a committed conservationist and Krutch had written *The Forgotten Peninsula*, a sparkling natural history description of Baja California. George Lindsay had previously organized a series of scientific explorations into the Gulf of California and the Baja California peninsula (Banks 1962a,b; Lindsay 1962, 1964, 1966, 1970). Bechtel had given financial support to the Audubon Society in the 1960s to study the seabird rookery at Isla Rasa. Two or three months later, both Lindbergh and Lindsay traveled to Mexico City and met President Echeverría's top-level cabinet to promote the conservation of the Gulf. Although no cause and effect has been established, the fact is that four years after Lindbergh's appearance in Mexico City a decree was issued protecting all of the islands of the Gulf of California (SDNHM 1996; *Diario Oficial* 1978).

## The Seri People and the Protection of Tiburón Island

Isla Tiburón was actually the first part of the Gulf of California to receive official status as a protected area (through a decree published a year before that concerning Isla Rasa's ecology). The largest island in the Gulf, Tiburón occupies 120,756 hectares. In pre-Hispanic times it was an important part of the territory of the Comcáac or Seri Indians (Felger and Moser 1985). As a result, the island not only is an important natural site but also harbors historic, archeological, and cultural artifacts. Although the twentieth-century Seri have not lived permanently on the island, they have always used it as their main fishing camp, hunting ground, and plant-collecting territory and have always considered it part of their tribal land.

On March 15, 1963, in response to an initiative by Enrique Beltrán, Tiburón was decreed a wildlife refuge and nature reserve by President Adolfo López Mateos (*Diario Oficial* 1963). However, the declaration was based solely on biological and ecological grounds, and it failed to take into consideration the needs and demands of the Comcáac themselves. Twelve years later, in 1975, the Secretary of the Agrarian Reform gave the Seri formal possession of Tiburón Island as part of an *ejido* (communal land) allotment for the tribe, thus recognizing for the first time the Seri's right to their ancestral homeland. On February 11, 1975, a decree was issued by President Luis Echeverría that restored Tiburón Island to the Seri People as part of their communal property. Although this decree was issued as part of a series of governmental actions to empower native peoples within their traditional lands, it also had conservation implications for the island as well as for the mainland coast. The decree established that the coastal waters of the island could be only used by the Seri and by their fishing cooperative, the Sociedad Cooperativa de la Producción Pesquera Seri (INE 1994); these waters were declared off-limits to other fishers.

## The Development of Mexican Conservation Efforts

The Mexican government and civil society have shown increasing concern for these regional environmental issues. New legal and institutional frameworks have been adopted, and innovative institutional arrangements have been created among various governmental agencies and stakeholders

to face the mounting problems. In the second half of the twentieth century, several regulations were adopted to avoid the overexploitation of a number of species or to prevent their extinction. Perhaps the most notable effort was the declaration in 1955 of a protection zone in the delta of the Colorado to protect the breeding habitat of many marine species, including the totoaba. In the 1960s, efforts were made to protect the seabird colonies of the islands. The failure of the protection zone in the Colorado River delta—coupled with the persistent decline in the totoaba population—forced the government to implement even more drastic measures, including a total ban on the totoaba fishery by 1975.

Over the years, modest but continued funding was provided to Bernardo Villa's laboratory at UNAM by the Audubon Society, the Roy Chapman Andrews Fund of the Arizona-Sonora Desert Museum, Conservation International, and others who contributed to maintaining the presence of Mexican researchers and students on Isla Rasa. Many of these students later became leading conservationists in the Gulf of California. Dr. Villa's work in the early 1980s effectively combined research with conservation. One of his young students at the time, Dr. Enriqueta Velarde, decided to extend this idea to other islands of the Gulf. With scientific support from George Lindsay of Cal Academy and Daniel Anderson of the University of California at Davis, together with financial support from Spencer Beebe of the Nature Conservancy, Enriqueta Velarde launched the first conservation project for the islands. The project produced, among many other applied results, the book *Islas del Golfo de California* (Bourillón et al. 1988), which was extremely influential in bringing attention to the islands and their conservation problems.

Many of the biologists who participated in this early team are now crucial players in conservation efforts throughout the Gulf. The team included, among others, Alfredo Zavala, now Baja California's regional director for the Protected Area of the Islands of the Gulf of California; the late Jesús Ramírez Ruíz, who in the early 1990s eradicated introduced rodents from Isla Rasa; and Luis Bourillón and Antonio Cantú, who now head conservation-oriented nongovernmental organizations (NGOs) in the region. In many ways, the conservation work at Isla Rasa was the catalyst that started many of the more recent conservation efforts in the Gulf (Velarde and Anderson 1994).

## The Biosphere Reserve Concept

In the early 1970s, many changes were occurring within the Mexican scientific and conservation groups that also helped to protect the ecosystems of the Gulf of California. In 1974 the Instituto de Ecología, a non-profit research organization, was created in Mexico City and soon began to promote the concept of Biosphere Reserves in the country. Although widely accepted at present, the idea of Biosphere Reserves, which had been developed by UNESCO's Man and the Biosphere Program (MAB), was radically new in 1975. Biosphere Reserves were conceived as natural protected areas where the indigenous populations living inside the area or in the surrounding "buffer zones" were encouraged to use their natural resources in a sustainable manner. The new approach departed radically from the natural park concept, which basically advocates pristine areas free of human influence. Instead, Biosphere Reserves promote sustainable use as an effective tool for conservation.

Many of the concepts of global ecology and conservation were already operational in MAB's concept of Biosphere Reserves almost twenty years before. These concepts included: (a) a global approach to conserving biodiversity through a planetary network of protected areas; (b) the preservation of cultural diversity together with natural diversity; (c) the involvement of local populations in the protection of natural resources; and (d) the promotion of the sustainable use of nature. Although the islands of the Gulf of California were initially not conceived as a Biosphere Reserve but rather as a Wildlife Refuge (*Refugio de la Vida Silvestre*), it was in the wake that the decree protecting them was issued in 1978 (*Diario Oficial* 1978).

## The Establishment of SEMARNAP

In December 1994, a revolutionary transformation occurred within the Mexican federal administration. The newly elected president, Ernesto Zedillo, decided to create a ministry of the environment in charge of pollution control and natural resources management. The creation of the Secretaría de Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP) opened the door for many impressive changes in the establishment and management of protected natural areas. In the most important reserves—including

the Upper Gulf of California and Colorado River Delta Biosphere Reserve—"paper parks" gave way to "hands on" resource management. Also, this decade saw a steady increase in funding from the Mexican government and in human resources dedicated to the management of nature reserves.

The establishment of some key marine protected areas in the Gulf shortly before or after the creation of SEMARNAP (namely, the Upper Gulf Biosphere Reserve and the Cabo Pulmo and Loreto Bay National Parks; see table 11.2) were of immense conceptual importance, as they opened the way for other marine reserves in Mexico where, because of a long-standing feud between conservationists and the fisheries authorities, no marine protected areas had previously been accepted. Specifically, it facilitated current efforts by various NGOs to extend decreed protection into waters adjacent to some important islands such as Islas Mariás, San Pedro Mártir, San Lorenzo-Las Ánimas-Salsipuedes, Rasa, and Partida. However, in spite of their tremendous practical and conceptual significance, the establishment of protected areas in the Gulf during the 1990s accounted for less than 4 percent of the Gulf's marine area.

The creation of SEMARNAP brought an additional management tool to ongoing discussions on the Gulf's sustainability in the form of Mexico's territorial-use planning regulations, or *Ordenamiento Ecológico*. The *ordenamiento* is a process established in the Mexican environmental law to regulate the spatial use of natural resources and land use at different scales. It demands the best available scientific knowledge, participation of the regional stakeholders, and a series of comprehensive hearings and negotiations with local governments, local businesses, and nongovernmental organizations. The planning studies for the Gulf of California started in 1997; however, because of their sheer complexity, the hearings and discussions are still ongoing. Almost a decade after it was started, the territorial-use planning of the Gulf has yet to be accomplished and thus is one of the conservation agenda's most important pending objectives.

## **Legal Status of Protected Areas in the Gulf of California**

Mexico's environmental legislation, the Ley General del Equilibrio Ecológico y la Protección al Ambiente (*Diario Oficial* 1988, 1996b) recognizes seven categories of natural protected areas that can be established by

**TABLE 11.2.** Protected natural areas in the Sea of Cortez region, including the Mexican northwestern Pacific Ocean.

	Date of Creation	Area (ha)	Location(s)
<i>Biosphere Reserves</i>			
Complejo Lagunar Ojo de Liebre	14 Jan. 1972	60,343	Baja California Sur
El Vizcaíno	30 Nov. 1988	2,546,790	Baja California Sur
Alto Golfo de California y Delta del Río Colorado*	10 Jun. 1993	934,756	Baja California, Sonora
El Pinacate y Gran Desierto de Altar	10 Jun. 1993	714,557	Sonora
Sierra La Laguna	6 Jun. 1994	112,437	Baja California Sur
Archipiélago de Revillagigedo*	6 Jun. 1994	636,685	Baja California Sur
Islas Mariás*	27 Nov. 2000	641,285	Nayarit
Isla San Pedro Mártir*	13 Jun. 2002	30,165	Sonora
Isla Guadalupe*	25 Apr. 2005	476,971	Baja California
<i>National Parks</i>			
Sierra de San Pedro Mártir	26 Apr. 1947	72,911	Baja California
Constitución de 1857	27 Apr. 1962	5,009	Baja California
Isla Isabel	8 Dec. 1980	194	Nayarit
Cabo Pulmo*	6 Jun. 1995	7,111	Baja California Sur
Bahía de Loreto*	19 Jul. 1996	206,581	Baja California Sur
Archipiélago de San Lorenzo*	25 Apr. 2005	58,442	Baja California
Islas Marietas*	25 Apr. 2005	1,383	Nayarit
<i>Wildlife Protection Areas</i>			
Cabo San Lucas	29 Nov. 1973 (7 Jun. 2000)	3,996	Baja California Sur
Islas del Golfo de California	2 Aug. 1978 (7 Jun. 2000)	358,000	Baja California, Baja California Sur, Sonora, Sinaloa
Valle de los Cirios	2 Jun. 1980 (7 Jun. 2000)	2,521,776	Baja California
Sierra de Álamos-Río Cuchujaqui	19 Jul. 1996	92,890	Sonora

*Notes:* Areas marked with an asterisk (\*) contain open marine waters decreed as part of the reserve and are hence true marine protected areas. Reserves showing a second date of creation (in parentheses) were first decreed in some other category and later re-categorized to their current status.

federal authority. These are: (1) biosphere reserves (*reservas de la biosfera*); (2) national parks (*parques nacionales*), including both terrestrial and marine parks; (3) natural monuments (*monumentos naturales*); (4) areas for the protection of natural resources (*áreas de protección de recursos naturales*); (5) areas for the protection of wildlife (*áreas de protección de flora y fauna*); (6) natural sanctuaries (*santuarios*); and (7) unclassified areas.

The term *Biosphere Reserve* is applied both to protected areas as defined by Mexican law and to areas integrated within UNESCO's Man and the Biosphere (MAB) network of protected areas. Some reserves in Mexico are considered Biosphere Reserves under Mexican law but have not yet fulfilled the conditions to be incorporated within MAB's international system; conversely, other Mexican protected areas are formally recognized by MAB as Biosphere Reserves but do not have formal Biosphere Reserve status under Mexican law (Gómez-Pompa and Dirzo 1995; SEDUE 1989). Within the Gulf of California Region, UNESCO's MAB Program has designated three protected areas as part of its international network of Biosphere Reserves: (1) El Pinacate y Gran Desierto de Altar, in the core of the Sonora Desert and designated in 1993; (2) Alto Golfo de California y Delta del Río Colorado in the Upper Gulf, designated in 1995 and also dedicated as a site of global significance within the Ramsar International Convention of Wetlands; and (3) Islas del Golfo de California, which were designated in 1995. However, the Gulf islands do not have a formal recognition as Biosphere Reserves under Mexican federal law. Originally decreed as a reserve zone and refuge for wildlife and migratory birds, the islands were re-categorized in June 2000 as an Area for the Protection of Wildlife (*Área de Protección de Flora y Fauna Islas del Golfo de California*; see *Diario Oficial* 2000a and table 11.2).

As a wildlife protection area, the islands do not enjoy the same strict restrictions that are imposed on Biosphere Reserves. The reasons to nationally designate the islands within a different category from the one they hold internationally are possibly related to the large size and spatial complexity of the whole archipelago and to the difficulties involved in law enforcement within the larger protected area. In spite of their less-restrictive status under Mexican law, the islands of the Gulf of California are in practice managed as a large reserve, and substantial efforts are devoted to their

protection (Breceda et al. 1995; INE 1994). The relevance given by federal authorities to the Gulf islands may be the result of an effort to fulfill the Mexican government's commitment to the UNESCO-MAB network and to the Global Environmental Facility (GEF), which has funded part of the conservation work on the islands. In 1996 the administration of the islands was divided into three regional headquarters: (a) the southern islands are managed from an administrative office at La Paz; (b) Tiburón and San Esteban are managed from an office in Guaymas; and (c) the western Midriff Islands area is managed from headquarters in Ensenada.

Additionally, it is an explicit policy of the Mexican Commission for Protected Natural Areas (CONANP) to re-decree many of the Gulf islands as smaller protected areas with a "donut" ring of marine protected waters around them. This policy, established in the late 1990s, has already yielded a number of islands with protected adjacent marine territories, such as Archipiélago de Revillagigedo (decreed in 1994), Islas Mariás (2000), Isla San Pedro Mártir (2002), and Isla Guadalupe (2005), as Biosphere Reserves in addition to Archipiélago de San Lorenzo (2005) and Islas Marietas (2005) as National Parks (table 11.2).

### **The Case of the Alto Golfo**

There are myriad stories of dedicated work and heated debates over each of the protected areas of the Gulf of California. In a previous paper (Ezcurra et al. 2002) we analyzed eight of these case studies, the conflicts behind their creation, and the ongoing discussions about their future land use. In this section we concentrate on one case where discussions and debate have been (and continue to be) especially heated: the Alto Golfo, in the northernmost tip of the Upper Gulf of California. The history and evolution of conservation efforts in the Upper Gulf provide an outstanding case study for reflecting on how the conservation movement has evolved in the region and how it has matured in Mexico as a country. Understanding past and ongoing conflicts in the Upper Gulf is of great importance for understanding the viability of the conservation movement in Mexico. In this section we present some historic facts, discuss the events that led to the creation of this important reserve, and examine the conflicts that ensued.

## Background

The Upper Gulf of California and Colorado River Delta Biosphere Reserve is formed by part of the surrounding Sonora Desert, the northern marine waters of the Gulf of California, and the lowermost part of the Colorado River. Its high marine biological productivity is based on the churning of nutrients in Colorado River sediment deposits by one of the biggest tidal fluxes on the planet (Thomson et al. 2000). This productivity makes the Upper Gulf an extremely important area for the reproduction, nursery space, and growth of many resident and migratory species. Currently, the total number of marine species recorded for the reserve is 1,438, of which 11 are in danger of extinction—notably the vaquita (*Phocoena sinus*), or Gulf of California harbor porpoise, and the totoaba (*Totoaba macdonaldi*), the largest member of the worldwide croaker (drum) family (Sciaenidae). Both of these species are endemic to the Upper Gulf.

The Upper Gulf's marine richness is reflected in its highly valuable fisheries, especially shrimp, which make the Alto Golfo one of the most important fishing grounds in Mexico. Historically, the most significant economic activity for the reserve's inhabitants, and for some outsiders as well, has been gillnet and trawler fishing (McGuire and Greenberg 1993). Fishers began to establish camps in the Upper Gulf of California at the beginning of twentieth century, and by the 1940s the totoaba fishery was at its maximum and enjoyed a well-developed and profitable export market.

In the 1950s it became well known that the Upper Gulf and the delta of the Colorado River were important sites for the reproduction and breeding of many species of birds and fish. For that reason, in 1955 the Mexican Fishing Authority first declared the area as protected for reproduction and as a nursery. As the years passed, however, it also became apparent that this productive region was still suffering from increased and unsustainable fishing pressure. By 1975, the totoaba was facing extinction through overfishing. This problem forced the federal government to decree a moratorium on harvesting the totoaba in the Gulf of California. Thus, the area was re-decreed in 1974 as a reserve zone for fisheries resource restocking, but the depletion of natural resources continued in spite of this decree (*Diario Oficial* 1974). In 1975, the Ministry of Fisheries established a permanent ban on totoaba captures, which remains in force today.

However, other problems continued to mount. In the mid-1980s, marine mammalogists became concerned about the vaquita harbor porpoise population in the Upper Gulf. The vaquita is indeed a unique and extremely rare marine mammal. First described in 1958, only a few specimens have been studied to date. The occurrence of vaquita specimens as incidental take in gill nets in the Upper Gulf signaled an alert to Mexican and international conservation groups.

In the early 1990s, the vaquita population was estimated to be fewer than 500 animals. The vaquita was classified as endangered, and the International Whaling Commission labeled it as one of the highest-priority conservation marine mammals in the world. It was then that the Mexican federal government created, through the Secretary of Fisheries, the "Technical Committee for the Protection of the Totoaba and the Vaquita" (Comité Técnico para la Preservación de la Totoaba y la Vaquita) for the purpose of evaluating and studying the issue and then recommending adequate measures for the conservation of both endangered species. After a few sessions, it became evident that serious discrepancies existed between various constituents of the committee. While some members favored immediate action to protect the Upper Gulf of California from the devastating effects of overfishing, others were of the opinion that regulating fisheries in any way would harm the local economy. As a result of these conflicts, it was decided to request two of the most recognized research centers in Sonora—the Centro Ecológico de Sonora (CES) and the Centro de Investigación y Desarrollo de los Recursos Naturales de Sonora (CIDESON)—to develop and elaborate upon a feasibility study for a Biosphere Reserve.

The study was completed near the end of 1992 and argued in favor of establishing a reserve in the Upper Gulf (CTPTV 1993). Different research and conservation groups spend the first months of 1993 discussing the costs and benefits of a protected area with local communities (El Golfo de Santa Clara, Puerto Peñasco, and San Felipe, as well as the ejidos in the delta of the Colorado River). Slowly, the people in the area began to accept and then to support the idea. With the support of local businessmen, scientists, conservationists, social leaders of the small-scale fisheries, and traditional authorities of the indigenous peoples around the Gulf, the project was presented to Secretary of Social Development Luis Donaldo Colosio,

a native of northern Sonora who was very interested in the idea. With the support of Colosio, the project moved forward.

On June 10, 1993, President Carlos Salinas de Gortari decreed the establishment of the Biosphere Reserve of the Upper Gulf of California and Delta of the Colorado River (*Reserva de la Biosfera del Alto Golfo de California y Delta del Río Colorado*; see *Diario Oficial* 1993). At that time the project had strong support from both the local population and conservation groups. Important decision makers attended the ceremony, including many cabinet members from the Mexican federal government; the governors of Sonora, Baja California, and Arizona; U.S. Secretary of the Interior Bruce Babbitt; and the traditional governor of the Tohono O'Odham (Papago) people, whose lands extend on both sides of the Mexico-U.S. border.

This reserve was the first one established including parts of the territory of two states, Baja California and Sonora, as well as federal marine waters (INE 1995). Thus, coordination between these entities was from the very beginning a crucial factor in the successful pursuit of the reserve's objectives.

### The Political Juncture

It is interesting at this point to reflect on the particular political juncture that drove the establishment of the reserve. The area had twice previously (in 1952 and 1973) been decreed as a protected area and the decrees had not had the desired effect, so why did this third decree carry so many expectations and have so much support?

The main reasons given by federal authorities for officially decreeing that the area be protected were the uniqueness of its ecological attributes and the catastrophic depletion of natural resources in the Upper Gulf. On the one hand, the problem of overfishing in the Gulf had started to appear in the international arena, harming Mexico's reputation on environmental conservation and appropriate natural resource management.

On the other hand, in 1992 a severe crisis had struck the fishers of the Upper Gulf of California (El Golfo de Santa Clara, Puerto Peñasco, and San Felipe). Their shrimp catches had fallen precipitously (Arvizu 1987), and the fishers blamed the federal authorities in general, and the Secretary

of Fisheries in particular, for failing to enforce fishing bans that would allow recovery of the resource. The idea started to grow among the fishers themselves that the sea had to rest and that its fisheries had to recover—that things had to change in some way. A decree establishing a protected area seemed to affirm this imminent change and offer an opportunity to start again (McGuire and Greenberg 1993).

Additionally, by 1992 biodiversity conservation and natural resource sustainability had become high-profile international priorities for most countries in the wake of the Rio Summit (also known as UNCED, the United Nations Conference on Environment and Development), from which the specific commitments of Agenda 21 emerged (Cicin-Sain et al. 2002). It was a priority for the Mexican government to signal its willingness and resolution to comply with Agenda 21, and the Upper Gulf had been identified both internally and internationally as a significant conservation problem and hence a potential stumbling block in international affairs.

Finally, the North American Free Trade Agreement (NAFTA, signed in 1992) among Mexico, Canada, and the United States had raised a number of environmental objections in all three countries, and the Mexican government was eager to give positive signals of environmental commitment. Because of its proximity to the U.S. border, the Upper Gulf Biosphere Reserve seemed an ideal proposition. By federally protecting this area, Mexico improved its international environmental image and attained a more favorable position in the NAFTA negotiations. At the same time, however, international and national expectations were raised.

### The Aftermath

In 1993, when the Biosphere Reserve was established, the Upper Gulf was facing a deep historic and socioeconomic crisis. Perhaps for this reason, the fishing communities of the region initially supported the reserve project. In retrospect, however, the fishers' support seems now to have been based on the expectation of a temporary resolution that would ban trawling and harmful gillnet sizes for three or five years and thus allow the recovery of the Upper Gulf. After a few years, as the restrictions imposed by the reserve on natural resource started to become clear, the initial enthusiasm waned.

Additionally, in 1993 there was little actual oversight or administration of protected natural areas in Mexico, and most of the reserves existed only on paper. There was no governmental field experience and very little budget for conservation and management of protected areas. The Environmental Attorney General (PROFEPA, the federal authority in charge of environmental enforcement) had just been created, and it did not have the capacity to enforce regulations in remote protected areas.

In short, it seems now that neither the local communities nor the federal government were prepared for the long-term commitment required by the establishment of this reserve. Yet many things have changed since 1993: the National Commission for Natural Protected Areas (CONANP) was created in 1999, and the reserve now boasts a management plan, core funding for its field operation, dedicated staff, and a director. The Mexican Fisheries authority was briefly moved to SEMARNAP between 1995 and 2000 but was then moved back to the Ministry of Agriculture (SAGARPA), where it now resides. As a result, coordination between the federal administrations of fisheries and the environment has become more difficult and complex.

At present, the biggest obstacles to achieving the objectives of the Upper Gulf reserve are poor intergovernmental coordination, conflicts between sectors, low institutional capacity of conservation organizations, and lack of political will to enforce the law. These factors facilitate increased illegal fishing in the reserve—and with it an increment in vaquita mortality, among many other species that reproduce in this unique and fragile area. The dice are still in the air, and the future of the Upper Gulf remains in question.

### Learning from Conflict

The challenge has remained unchanged during the past fifty years: all of the conservation and protection efforts for the Upper Gulf have hinged on the need to design and implement a program that guarantees the preservation of the area's ecological value as well as the sustained use of its natural resources by local inhabitants. The sociopolitical efforts articulated by authorities and conservation organizations have been mainly limited to the three decrees already mentioned, and true achievements in conservation

have remained elusive. Three important lessons can be derived from this experience.

1. *The objectives of a new protected area must be balanced with capacity and experience.* It is difficult to imagine a better juncture to establish a protected area in the Upper Gulf than 1993, but the decree revealed an immense lack of awareness regarding the long-term commitments needed to consolidate an operational reserve in an area as conflictive as the Upper Gulf. After eleven years, this is still the reserve's weakest point, and much work is needed on it.
2. *The raised expectations of different actors must be met.* Owing to seventy years of open-access fishing without any type of resource management, the Upper Gulf of California is one of the most difficult areas of Mexico in which to achieve conservation and sustainable management. Establishing the Upper Gulf Biosphere Reserve raised great expectations, but the high social pressure on the area's natural resources, the historical bi-national conflicts over Colorado River water, and the convergence of several authorities making decisions within the area have combined to create a sense of disillusionment in the local people that is now working against the aims of the reserve.
3. *Implementation of alternative solutions is important.* For more than fifty years the conservation and management of the Upper Gulf have been addressed by federal decrees, but these have proved to be insufficient. Alternative solutions that are based on active participation of the local stakeholders are of paramount importance in resolving the regional conflicts. Among these, the fishers' own proposals for a sustainable use of their resource should be taken more seriously by authorities and social organizations.

Despite the current impasse in the Upper Gulf Biosphere Reserve, it is essential to recognize that this was the first marine reserve established in Mexico and thus represented an initiative of immense significance. Despite the opposition of Mexican fisheries authorities, it opened the way for new marine protected areas in the Gulf of California, in the Mexican Pacific Ocean, and on the other coasts of Mexico. Specifically, it led to discussions on the possibility of protecting the waters surrounding each of the islands

in the Gulf. The Upper Gulf debate established these discussions as an on-going process and showed that conservation at sea and the establishment of marine protected areas, although difficult, can be achieved in Mexico.

## **Toward a Regional Conservation Agenda**

In spite of some local successes, the depletion of the Gulf and its marine and coastal resources remains a predominant driving force and has serious economic consequences. The perceptions of national and foreign investigators of this depletion are already driving investment and economic opportunities away. It follows that the maintenance of fundamental ecological processes and ecosystem functions is critically needed to protect long-term economic investments as well as biodiversity in the region, which are necessary for lasting economic development and improvements in quality of life. Today, a growing number of leaders from different sectors are becoming more aware of the need to come together and jointly address these issues.

The region is governed by a complex mix of authority emanating from the federal government, the surrounding five states, and 40 coastal municipalities, and there is often little synergy among them. Poorly planned economies—often the result of poor coordination among authorities—are one of the greatest threats to ecosystems in the Gulf of California. As a consequence, the Gulf faces often strongly opposed priorities for regional development among the three levels of government, which are characterized by poor coordination among authorities and increasing dispersion of resources and actions. Thus, although political change (in the form of open elections) has swiftly occurred around the Gulf of California, the reformed institutions have not yet been able to tackle the urgent issues of resource degradation in a coordinated fashion.

Furthermore, there is a notorious absence of a well-developed, consolidated relationship between environmental scientists and decision makers. Indeed, the region is a large, interconnected set of biological communities, but governance is fragmented and most research done in the Gulf has been based on specific, simple aspects of conservation—small, disjunct parts of a complexly functioning regional ecosystem. Few of the regional research and conservation efforts have concentrated on a multidisciplinary

approach, and little effort has been placed on large-scale, ecosystem-based research and management.

On the other hand, regional cooperation among nongovernmental agencies has yielded positive results in the past. We described previously how, through their rich network of cooperation, ALCOSTA (the regional alliance of NGOs) was capable of raising concerns about the Escalera Náutica development project, thereby transforming it into one that was much more open to environmental conservation issues. Other cooperative efforts have also yielded successful results for conservation. In December 1997, a group of scientists and conservationists teamed together in a joint project known as the Coalition for the Sustainability of the Gulf of California. After three years of working together, they produced a comprehensive map defining areas of biological importance in the region (CSGC 2004; Enríquez-Andrade et al. 2005; see color plate 7B), which became a milestone document in regional planning and a tool for assisting in the determination of regional priorities. Among other uses, the documents and the maps produced by the coalition became critical inputs to the governmental plans for use of the Gulf and its surrounding coasts.

Finally, cooperation between regional NGOs and research groups allowed the presentation of a regional agenda at the 2003 "Defying Ocean's End" meeting in Los Cabos (Carvajal et al. 2004; see color plate 8A). This cooperative agenda established seven specific objectives in approaching sustainability within the Gulf of California.

1. *Improve the management of regional marine and coastal protected areas.* Although impressive progress has been attained during the last decade by the Mexican government in the funding and management of its protected natural areas, many of them still subsist as "paper parks," with inadequate funding and little effective management while facing increasingly difficult conflicts among sectors. If the regional protected areas are to be effective in their conservation goals, they must improve in their capacities to address these complex issues and receive enhanced funding, equipment, and staffing.
2. *Enlarge the system of marine and coastal protected areas.* Although some marine protected areas have been created in the Gulf

(namely, the Upper Gulf, Islas Mariás, and San Pedro Mártir Biosphere Reserves and the Cabo Pulmo, Islas Marietas, San Lorenzo, and Loreto Bay National Parks), these cover only 4 percent of the Gulf's marine area. Effective conservation in the region cannot be achieved without securing the protection of spawning aggregation areas, critically endangered species, and endangered ecosystems such as seamounts, coastal lagoons, coral reefs, estuaries, and marine mammal habitats (Sala et al. 2002). Therefore, a significant increase in marine protected areas must be obtained, probably reaching 15 percent of the Gulf's marine and coastal areas.

3. *Develop a comprehensive plan to manage and protect priority coastal wetlands.* The degradation of coastal wetlands is one of the Gulf's most serious threats. With little consideration given to the ecological purposes they serve, mangrove forests are being cut for the development of aquaculture (mostly shrimp farms) and tourism projects. Furthermore, coastal wetlands in general are threatened by consumptive water use upstream and by pollution of rivers and waterways. The ecological services provided by estuaries and lagoons are critical for the survival of the Gulf of California fisheries and for the health of the large marine ecosystem as a whole. A comprehensive plan to effectively protect coastal wetlands, stop mangrove deforestation, and maintain the ecological services of coastal lagoons and estuaries must be developed and its actions implemented with urgency.
4. *Reduce the ecological impact of shrimp trawling.* Many of the strongest issues of unsustainability in the Gulf stem from the destructive effect and economic inefficiency of the current shrimp bottom-trawling fleet. The only alternative to solve this growing problem is to reduce the fleet size by at least half through a legal buyout. If effective legal means are put in place to ensure that no new fishing permits will be issued in the future—and hence that the fleet will not grow again to unsustainable levels—then action of this sort would allow negotiation of effective enforcement of the existing no-take zones and introduction of exclusion-efficient fishing gear that will reduce by-catch by 40 percent.

5. *Implement a regional plan that regulates the use of land, coasts, and waters.* The main instrument in Mexican legislation for regulating the use of space within environmental guidelines is the "Ordenamiento Ecológico," or Ecological Planning of the Territory, which demands full and comprehensive hearings and negotiations with local governments, local businesses, and nongovernmental organizations. Because of its complexity, effective territorial planning has been difficult to achieve in the Gulf of California and is now one of the most urgent objectives. For this purpose, the participation of civil society and of local conservation alliances is critical.
6. *Re-orient regional tourism toward low-impact, environmentally sustainable resource use.* The Escalera Náutica has become one of the most debated projects in the region. On the one hand, most environmentalists agree that the primary sector of the Gulf economy has reached its limits and that it would be desirable to shift the economy away from unsustainable fisheries and water-intensive agriculture and toward the services sector (including tourism). On the other hand, experiences in Mexico with unsustainable tourism have made environmentalists wary of the dangers and impacts of development projects. The development of a culture of environmentally sustainable tourism is still one of the biggest challenges in the Gulf of California.
7. *Articulate and implement a common regional development vision.* The last point of the agenda, the development of a regional vision, is possibly the most crucial aspect of the Gulf's conservation agenda. The various sectors involved—including government, private business, communities, conservation organizations, and civil society at large—need to transcend their own agendas and move toward the development of a joint way of seeing the region. A new, proactive paradigm is needed that would allow different sectors and social groups to propose new and sustainable modes of development instead of defending unsustainable alternatives. Regional conservation will be successful if, in collaboration with local business and political leaders, a regional development vision based on the long-term protection of the Gulf and its resources can be pieced together collectively and agreed upon.

Aware of the growing problems that the Gulf is facing, a cluster of socially and environmentally concerned leaders who recognize that conservation is essential to creating long-lasting economic and social prosperity came together and created the Sustainable Northwest Initiative (NOS). NOS is working under the model and inspiration of the Chesapeake Bay program and the Great Barrier Reef, adapting the lessons learned in those places to advance an agenda for sustainability for the Gulf of California. As a first endeavor, NOS is promoting the development of a common societal vision that would allow a sustainable future and a shared journey toward a mode of development that also conserves the region's rich natural heritage.

### **Conservation and the Search for a Viable Future**

It is hoped that the increasing pace of conservation efforts will be able to stall the environmental degradation that the Gulf of California has been suffering and diminish the threats to its long-term sustainability. There seems to be a growing awareness in the region, as never seen before, of the need to take urgent action to protect the environment and develop in a sustainable manner. Conservation groups, research institutions, federal and state governments, conscientious businesspersons, and eco-tourism operators have all been contributing to the growing appreciation of the environment and to the attendant conservation actions.

In the past, conservation in the Gulf has progressed through the support of researchers, nongovernmental organizations, local communities, and local, state, and federal governments. The involvement of local groups as allies in conservation has possibly been the single most important element in successful conservation efforts. Local commitment has been the driving force behind environmental protection and the key to the success of such conservation programs as the Bay of Loreto and the Biosphere Reserve at Bahía de Los Angeles.

At this moment in time, environmental conservation needs to become part of a larger vision, developed jointly by all sectors, that can drive regional development for years to come with increasing consideration for growing social needs, the environment, and the Gulf's natural resources and their sustainability. The Gulf of California receives what little remains of the discharges of the Colorado River Basin, and the survival of the Upper Gulf is a challenge for both Mexico and the United States. Thus, its

larger basin is part of a binational collection of linked ecosystems, where both Mexico and the United States share the responsibility of protecting their joint natural heritage. In order to achieve this, both countries must develop further efforts to promote true cooperative work. The region is one large continuum, with shared watersheds and estuaries, species, and natural resources. The protection of these unique environments is of great importance for the survival and well-being of all of us—now and for countless generations to come.

There are plenty of opportunities for creative solutions to the problems the Gulf is facing today. In the end, however, the solution lies in the hands of the local actors of all sectors and in their ability to come together. If we are to conserve the amazing beauty, remarkable biological productivity, and magnificent biological richness of this unique place on the planet, then we must find new ways of coordinating and cooperating among ourselves. We need to change the way we work, combining forces and using our collective knowledge, creativity, and abilities to achieve our common goals.