CONSERVATION SCIENCE IN MEXICO'S NORTHWEST

ECOSYSTEM STATUS AND TRENDS IN THE GULF OF CALIFORNIA

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ECOLOGICAL CONSERVATION IN THE GULF OF CALIFORNIA

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1. INTRODUCTION: HISTORY OF CONSERVATION EFFORTS IN THE GULF OF CALIFORNIA

In 1973, George Lindsay—one of Baja California's most eminent botanists—visited the islands of the Gulf of California together with Charles Lindbergh, Joseph Wood Krutch, and Kenneth Bechtel. Lindbergh, one of the most celebrated popular heroes of the 20th century, had become by that time a committed conservationist, interested in the preservation of whales and in the conservation of nature at large. Joseph Wood Krutch, a naturalist, had written *The Forgotten Peninsula*, one of the first natural history descriptions of Baja California. George Lindsay had helped to organize a series of scientific explorations into the Gulf of California and the Peninsula of Baja California, first from the San Diego Natural History Museum, and later from the California Academy of Sciences (Banks 1962a,b; Lindsay 1962, 1964, 1966, 1970, and Wiggins 1962). These expeditions proved to be of historic importance for conservation science. Among many other brilliant young biologists, Michael Soulé, a young doctoral student from Berkeley, invested his time on the islands studying the ecology and biogeography of lizards, testing in them many of the tenets of ecological theory that Robert McArthur had put forward (Soulé 1969; see Figure 1). The influence of the region on him was profound: Two decades later, Soulé reached international fame applying the tenets of island biogeography he had developed in the Gulf of California islands to the revolutionary creation of a new branch of science he called Conservation Biology (Soulé 1986).

Kenneth Bechtel, a philanthropist from San Francisco, had given financial support to the Audubon Society in the 1950s–60s to study the seabird rookery at Isla

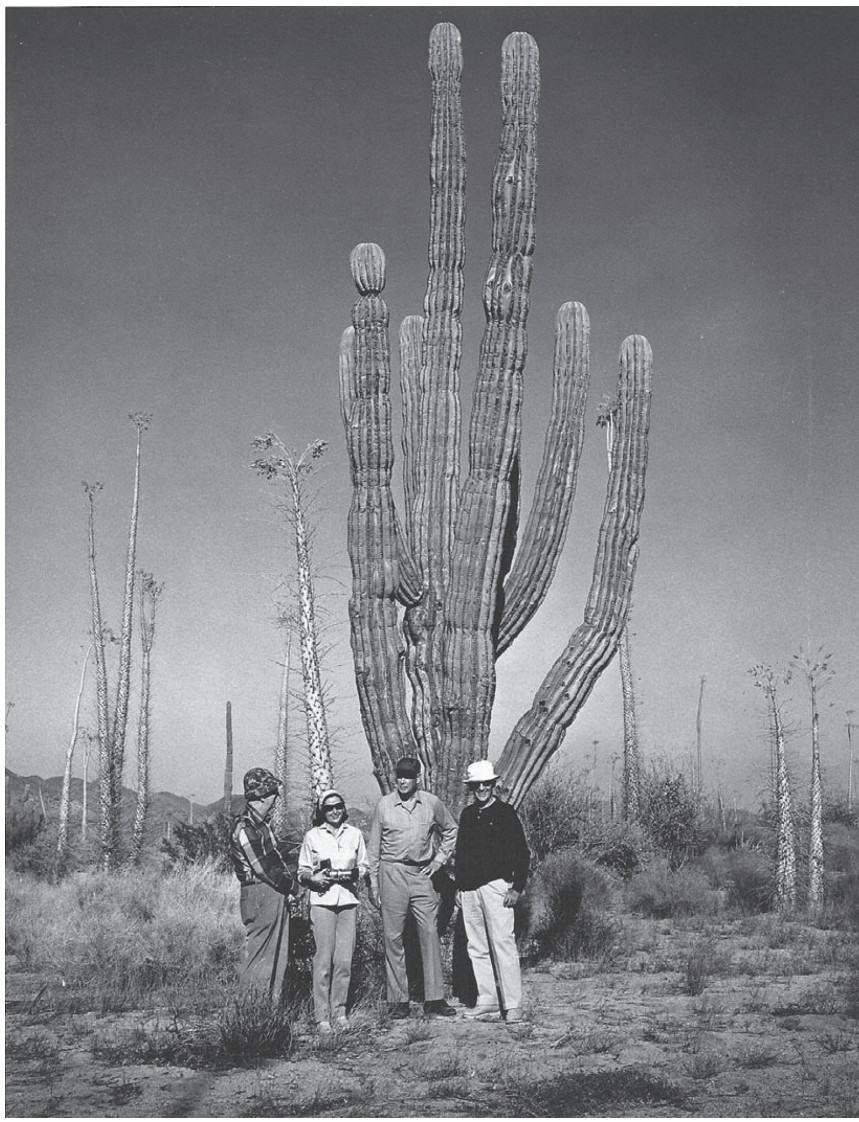

FIGURE 1. John Sloan, Chris Parrish, and Michael Soulé checking lizard traps for population studies in Ángel de la Guarda Island, near Bahía de los Ángeles, in 1963 (courtesy of the San Diego Natural History Museum archives).

Rasa, which had been decreed a protected area by the Mexican Government in 1962. Bechtel was interested in showing the Gulf of California to people who might

FIGURE 2. Joseph Wood Krutch, Nancy Bechtel, Charles A. Lindbergh, and Kenneth Bechtel in Baja California's Central Desert, near Bahía de los Ángeles in year 1969, three years before their flying boat expedition to the islands (photo taken by George Lindsay, courtesy of SDNHM archives).

be aroused by its astounding natural beauty and might help to protect it. For this purpose, he organized the trip and invited Lindbergh to visit the region (see Figure 2).

The group flew a chartered Catalina flying-boat that allowed them to get to small and remote islands. They landed in the water, and then piloted up to the beach so they could have shade under the wing. They visited many of the islands, starting from Consag north of Bahía de los Ángeles, and ending in Espíritu Santo, east of the Bay of La Paz. It was a wonderful and memorable trip.

Two or three months later, both Lindbergh and Lindsay traveled to Mexico City, to watch the Mexican premiere of a documentary film on the Gulf of California by the California Academy of Sciences that Kenneth Bechtel had sponsored. Taking advantage of the opportunity, and also of his immense popularity, Charles Lindbergh requested to see the President of Mexico, Luis Echeverría. Unfortunately, the President was abroad, on a foreign tour to Asia. The President's Private Secretary received them, possibly expecting to hear innovative ideas from Lindbergh with

respect to aviation in Mexico. Much to his amazement, he heard Lindbergh raving passionately about Baja California, and very especially about the islands of the Gulf.

Later, Lindbergh called the American ambassador and asked him to organize a press conference for representatives from the Mexican media. Shortly after, the startled George Lindsay saw the editors of about five major Mexican newspapers come into their suite at the Hotel del Prado, in front of the Alameda in downtown Mexico City. The media leaders wanted enthusiastically to meet Lindbergh, expecting an interview on aviation and perhaps on Lindbergh's heroic solo flight across the Atlantic. With astonishment, they heard him preach about the immense natural wealth and the beauty of the Gulf of California.

A few months after that trip, in August 26, 1974, Charles Lindbergh died. He never saw the Gulf islands under any type of legal protection. Four years after his surprising appearance in Mexico City, however, a decree was issued protecting all of the islands of the Gulf of California. George Lindsay firmly believed that Lindbergh's intervention helped to promote the necessary governmental awareness for the decision to take place and conservation measures to ensue (SDNHM 1996). He was probably right: The slow build-up of the individual efforts of devoted conservationists and scientists has brought the islands of the Gulf of California under increasing levels of conservation. Many naturalists have devoted their best efforts to the protection of the region. This chapter will analyze some of the results of these actions.

1.1. The beginning of conservation efforts

Possibly the first conscious efforts to protect the islands 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 (see timeline of conservation events in Table 1). Walker was at that time a researcher at the San Diego Natural History Museum, and later became Associate Director at the Arizona-Sonora Desert Museum. He was very knowledgeable on the natural history of the region, and possessed first-hand field experience in Baja California and the islands of the Gulf of California, and especially on Isla Rasa. He wrote many popular articles on the natural history of the region, and through these publications he popularized the plight of Isla Rasa (Walker 1951, 1965).

Kenneth Bechtel (the same philantropist who later organized the flying-boat expedition described above) was at that time a trustee of the Audubon Society. In the early 1950s he donated 5,000 dollars for the preservation of Isla Rasa, starting Walker's research on Rasa, which was later also supported with a grant from

TABLE 1. Timeline of significant conservation events in the Gulf of California 1951–2014.

Year	Event
1951	Lewis Wayne Walker publishes "Sea birds of Isla Raza" in the National Geographic magazine.
1952	Kenneth Bechtel donates 5,000 dollars to the Audubon Society for the preservation of Isla Rasa, effectively setting in motion L.W. Walker's and Dr. Bernardo Villa's long-term work on the island.
1963	Tiburón Island is decreed a Wildlife Refuge and Nature Reserve by President Adolfo López Mateos.
1964	The Mexican Federal Government decrees Isla Rasa a protected "Nature Reserve and Refuge of Migratory Birds" (Reserva Natural y Refugio de Aves Migratorias).
1965	A small, two-room stone field station is built on Rasa Island as part of Dr. Villa's ongoing research and conservation work.
1967	To recover Sonoran wildlife, white-collared peccari and pronghorn antelopes are introduced to Tiburón Island by Mexico's Federal Government. The species do not prosper.
1973	In Spring, Kenneth Bechtel organizes a flying-boat expedition to the islands of the Gulf of California, with Charles Lindbergh, George Lindsay, and Joseph Wood Krutch.
1973	Inspired by the flying-boat expedition, Lindbergh and Lindsay travel to Mexico City to see President Luis Echeverría. They meet with the President's cabinet and the editors of the major Mexican newspapers, and urge them to preserve the islands of the Gulf of California.
1975	A decree is issued by President Luis Echeverría, restituting Tiburón Island to the Seri People as part of their communal property and declaring the coastal waters of Tiburón Island for the exclusive use of the Seri and off-limits for other fishermen.
1975	Bighorn sheep are introduced to Tiburón Island as a part of a federal program to study and protect the Sonoran subspecies.
1978	The Mexican Government issues a decree protecting all the islands of the Gulf of California under the category of "Wildlife Refuge" (Refugio de Vida Silvestre).
1979	Enriqueta Velarde takes over the research and conservation tasks in Isla Rasa, inspired by Bernardo Villa's pioneer work. Since then, biologists have been present in Rasa during each seabird breeding season.
1982	Mexico's first Environmental Ministry (Secretaría de Desarrollo Urbano y Ecología) is created. All natural protected areas are put under its jurisdiction.
1988	As a result of the work of Enriqueta Velarde's team, the National University of Mexico and the Federal Government publish the book Islas del Golfo de California, bringing national attention to the islands of the Gulf of California and their conservation problems.
1988	Mexico's first environmental law (Ley General de Equilibrio Ecológico y Protección al Ambiente) is passed.

Year	Event
1992	The Government of Mexico obtains a the approval of a 25-million-dollar donation from the Global Environment Fund for the management and the conservation of ten protected areas, including Islas del Golfo de California.
1993	On June 10, at Cerro Prieto near Puerto Peñasco, the President of Mexico decrees the establishment of the first marine reserve in Mexico, the Biosphere Reserve of the Upper Gulf of California and Delta of the Colorado River. This opens discussions on protecting the waters surrounding the islands in the Gulf of California.
1993	A successful program is initiated by Jesús Ramírez to eradicate introduced rats and mice from Isla Rasa using modern rodenticides.
1995	Complete eradication of introduced rodents in Isla Rasa is achieved.
1995	UNESCO's Man and the Biosphere (MAB) Program dedicates the Protected Area Islas del Golfo de California as an international Biosphere Reserve.
1995	The environmental impact statement for a hotel in Coronado Island is strongly challenged by local and national conservation and citizen groups, leading to the abandonment of the project.
1995	The Mexican company Salinas del Pacífico introduces the Baja California subspecies of the desert bighorn to Isla del Carmen. In contrast with the support that the Sonoran Bighorn program in Isla Tiburón had enjoyed, the Isla del Carmen plan is received with criticism by conservationists in the Peninsula.
1996	The Parque Nacional Bahía de Loreto is created by a Federal decree to protect the Bay of Loreto, including its five islands, from large fishing fleets.
1996	Mexico's environmental law, the "Ley General de Equilibrio Ecológico y Protección al Ambiente" is amended. The new law recognizes eight categories of natural protected areas, demanding re-categorization of all previously decreed natural protected areas into the new system.
1997	The Fund for Natural Protected Areas is created with 16.48 million dollars that still remain from GEF's original 25-million grant for ten protected areas in Mexico. The protected area Islas del Golfo de California Natural starts receiving part of the financial revenues generated by the fund, a process that ensures long-term financing for conservation.
1998	The management plan of Espíritu Santo, the first island-specific conservation plan in the Gulf of California, is completed with the joint participation of local research centers, conservation NGOs, and Ejido Bonfil. The Ejido landowners accept constraints on the development in their own insular lands.
1998	The Seri people start auctioning permits for sport hunting of bighorn sheep in Tiburón Island. Half of the proceeds go to support research, conservation and management actions, the other half goes to the Seri tribe.
1998	With the active participation and involvement of the local community, a binational group of researchers, governmental resource managers, and the Ejido Tierra y Libertad draft a management and conservation plan for the islands surrounding Bahía de los Ángeles.
2000	The Mexican Federal Government re-categorizes the islands of the Gulf of California, first established in 1978, into a Wildlife Protection Area. Administrative offices for the islands are strengthened.

Year	Event
1999	The Mexican Federal Government creates the National Commission for Natural Protected Areas (Comisión Nacional de Áreas Naturales Protegidas, CONANP) and starts seriously committing towards the conservation of natural areas.
2000 to 2010	Following the experience of the Upper Gulf, Mexico's National Commission for Protected Natural Areas starts decreeing protected waters around some of the most important islands of the region, under the category of Biosphere Reserves (Islas Marías, Isla San Pedro Mártir, Isla Guadalupe, Bahía de los Ángeles, Canales de Ballenas y Salsipuedes) or National Parks (Cabo Pulmo, Bahía de Loreto, Islas Marietas, Archipiélago de San Lorenzo, Archipiélago Espíritu Santo).
2012	On June 15, 2012, President Felipe Calderón publicly announced the cancelation of the Cabo Cortés project, and his government's commitment to the protection of the Pulmo reef. The Cabo Pulmo community had achieved one of Mexico's most noteworthy success in marine conservation.
2012	After years of conflict between developers and the citizens of La Paz, the Mexican Federal Government declares the bay of Balandra as a Wildlife Protection Area, effectively yielding to the local inhabitants who wanted to preserve this beautiful bay as part of their natural heritage.

the Belvedere Scientific Fund (also related to the Bechtel family). This financial support was shared Dr. Bernardo Villa's laboratory at the Instituto de Biología in the National University of Mexico (Universidad Nacional Autónoma de México, or UNAM; for a list of acronyms see Table 2). The funds were used to maintain a biologist and a field station on the island.

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 biologist and conservationist (see Figure 3). Beltrán's own interest on the issue—and the public notoriety that Isla Rasa had achieved through popular publications and through 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 a decree was published in the official government register (Diario Oficial de la Federación) declaring Isla Rasa a Nature Reserve and a Refuge of Migratory Birds (DOF 1964).

The work at Rasa was later supported with donations from the Roy Chapman Andrews Fund at the Arizona-Sonora Desert Museum. This and other funds contributed to maintain the presence on Isla Rasa of researchers and students from Bernardo Villa's laboratory. 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 that time, Dr. Enriqueta Velarde, decided to extend the idea to other islands of the Gulf of California. With

TABLE 2. Protected Natural Areas in the Gulf of California region, classified according to their conservation category and sorted according to their date of creation.

Natural Protected Area	Date of creation	Area (ha)	Location
a. Biosphere Reserves			
Complejo Lagunar Ojo de Liebre	14 Jan. 1972	60,343	Baja California Sur
El Vizcaíno	30 Nov. 1988	2,493,091	Baja California Sur
Alto Golfo de California y Delta del Río Colorado	10 Jun. 1993	934,756	Baja California and 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	Colima
Islas Marías	27 Nov. 2000	641,285	Nayarit
Isla San Pedro Mártir	13 Jun. 2002	30,165	Sonora
Isla Guadalupe	14 Apr. 2005	476,971	Baja California
Bahía de los Ángeles, Canales de Ballenas y Salsipuedes	5 Jun. 2007	387,957	Baja California
Marismas Nacionales	12 May 2010	133,854	Nayarit
b. National Parks			
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
Islas Marietas	25 Apr. 2005	1,383	Nayarit
Archipiélago de San Lorenzo	25 Apr. 2005	58,442	Baja California
Archipiélago de Espíritu Santo	10 May 2007	48,655	Baja California Sur
c. Wildlife Protection Areas			
Cabo San Lucas	29 Nov. 1973	3,996	Baja California Sur
Islas del Golfo de California	2 Aug. 1978	321,631	Gulf of California
Valle de los Cirios	02 Jun. 1980	2,521,776	Baja California
Sierra de Álamos-Río Cuchujaqui	19 Jul. 1996	92,890	Sonora
Meseta de Cacaxtla	27 Nov. 2000	50,862	Sinaloa
Balandra	30 Nov. 2012	2,513	Baja California Sur
d. Sanctuaries			
Ventilas Hidrotermales de la Cuenca de Guaymas y de la Dorsal del Pacífico Oriental	5 Jun. 2009	145,565	Pacific and Gulf deep trenches

FIGURE 3. Governmental officers and scientists from Mexico City visit Isla Rasa in 1963: Left, in a white shirt, Alejandro Villalobos from the Instituto de Biología of UNAM; second from right, with a dark felt hat, Dr. Enrique Beltrán (photographic copy taken by George Lindsay from an 8 mm film by Antero Díaz of Bahía de los Ángeles; courtesy of SDNHM archives).

the scientific support of George Lindsay and Daniel Anderson from the University of California, Davis, and the financial and conservationist support of Spencer Beebe from The Nature Conservancy, Enriqueta Velarde, at that time at UNAM, launched the first conservation project for the islands. The project produced, among many other applied results, the book *Islas del Golfo de California*, printed by UNAM and the Mexican Federal Government, which was extremely influential in bringing attention to the islands and their conservation problems.

Many of the biologists that participated in this early team are now crucial players in the conservation of the Gulf of California. The team included, among others, Alfredo Zavala, who played later a big role as Regional Director of the Wildlife Protection Area of the Islands of the Gulf of California; the late Jesús Ramírez Ruiz, who in the early 1990s eradicated introduced rodents from Isla Rasa; together with María Elena Martínez, Luis Bourillón, and Antonio Cantú, who are active conservationists in different NGOs in the region (see Bourillón *et al.* 1988). In many ways, it can be said that the conservation work at Isla Rasa was the catalyst that started most of the other conservation work in the Gulf of California.

Chronologically, however, Isla Tiburón was the first island of the Gulf of California to receive official status as a protected area, through a decree published a year before Isla Rasa's. The largest island of the Gulf of California, Tiburón, occupies

120,756 ha. In pre-Hispanic times Tiburón was an important part of the territory of the Seri Indians (or Comcaác, in their own language; Felger and Moser 1985). Because of this, the island is not only an important natural site, but also harbors important historic, archaeologic, and cultural elements of the tribe's history in the region. Although in the 20th century the Seri have not permanently lived on the island, they have always used it as their main fishing camp, hunting grounds, and plant collecting territory, and have always considered it part of their tribal land.

On March 15, 1963, Tiburón was decreed a Wildlife Refuge and Nature Reserve by President Adolfo López Mateos (DOF 1963). This first decree was issued as a result of an initiative by Enrique Beltrán. The ruling, however, was based on biological and ecological grounds, and failed to take into consideration the needs and demands of the Comcaác People. Twelve years later, in 1975, the Secretary of the Agrarian Reform gave the Seri formal possession of Tiburón Island as part of an *ejido* (*i.e.*, communal land) allotment for the tribe. This was the first recognition by the Federal Government of the Seri's right to their ancestral territory. On February 11, 1975, a decree was issued by President Luis Echeverría, restituting Tiburón Island to the Seri People as part of their communal property. Although this decree was basically issued as part of a series of governmental actions to empower native peoples within their traditional lands, it also had conservationist implications for the island as well as 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), and declared it off-limits for other fishermen.

1.2. Biosphere Reserves and biological diversity

In the early 1970s, roughly at the time of Lindbergh's trip to Mexico City, many changes were occurring within the Mexican scientific and conservation groups. These scientific transformations also helped to protect the islands. In 1974 the Instituto de Ecología, A.C. (Institute of Ecology, a federally-funded non-profit research organization) started 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 a group of ecologists in 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 concept of "natural parks" which basically advocated for pristine areas free of human influence. Rather, Biosphere Reserves promoted sustainable use as an effective tool for

conservation, based on (a) the global approach to conserve 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.

The international success of the Mexican Biosphere Reserves caught the attention of Mexican environmental authorities, who realized that large natural areas could be protected under the new scheme as it did not preclude resource use but rather pursued a judicious utilization of natural resources. 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 of these changes that the decree protecting them as a whole was issued in 1978 (DOF 1978).

2. PRESENT STATUS OF PROTECTED AREAS IN THE GULF OF CALIFORNIA

Mexico's environmental legislation, the Ley General de Equilibrio Ecológico y Protección al Ambiente (DOF 1988, 1996) recognizes eight categories of natural protected areas that can be established by the 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) Wildlife Protection Areas (áreas de protección de flora y fauna), and (6) Natural Sanctuaries (santuarios).

The Mexican Federal Government has decreed ten Biosphere Reserves in the Gulf of California region, all operated under the administration of the National Commission for Natural Protected Areas (CONANP): (1) Complejo Lagunar Ojo de Liebre, (2) El Vizcaíno, (3) Alto Golfo de California y Delta del Río Colorado, (4) El Pinacate y Gran Desierto de Altar, (5) Sierra La Laguna, (6) Archipiélago de Revillagigedo, (7) Islas Marías, (8) Isla San Pedro Mártir, (9) Isla Guadalupe, (10) Bahía de los Ángeles, Canales de Ballenas y Salsipuedes, and (11) Marismas Nacionales (see Table 2).

The region also harbors eight National Parks (Sierra de San Pedro Mártir, Constitución de 1857, Isla Isabel, Cabo Pulmo, Bahía de Loreto, Islas Marietas, Archipiélago de San Lorenzo, and Archipiélago Espíritu Santo), as well as six Wildlife Protection Areas (Cabo San Lucas, Islas del Golfo de California, Valle de los Cirios, Sierra de Álamos-Río Cuchujaqui, Meseta De Cacaxtla, and the bay of Balandra), and one atural Sanctuary: the deep hydrothermal vents of the Guaymas Basin. Two very large and very important reserves—Valle de los Cirios and Islas del Golfo de

California—were originally decreed as Wildlife Refuges and were re-categorized in June 2000 into their current category as Áreas de Protección de Flora y Fauna (DOF 2000).

At present, UNESCO's Man and the Biosphere (MAB) Program has 42 Mexican reserves accepted into its international network of Biosphere Reserves, seven of which are in the Gulf of California region: (1) El Vizcaíno, in the central part of the Baja California Peninsula (admitted to the MAB network in 1993), (2) El Pinacate y Gran Desierto de Altar, in the core of the Sonoran Desert (1993), (3) Alto Golfo de California y Delta del Río Colorado, in the Upper Gulf of California (1995, also dedicated as a site of global significance within the International Convention of Wetlands or RAMSAR Convention), (4) Islas del Golfo de California (1995), (5) Sierra La Laguna, the high sierras of the Cape Region of Baja California (2003), (6) Islas Marietas (2008), on the southern border of the Gulf of California, and (7) Islas Marías, three islands in the Mexican Pacific immediately south of the Gulf (2010). Furthermore, the World Heritage Convention has accepted four areas in the Gulf of California region as World Heritage Sites. These are (a) the Whale Sanctuary of El Vizcaino and (b) the Rock Paintings of the Sierra de San Francisco, both in the Vizcaíno Biosphere Reserve and designated in 1993, (c) the islands and Protected Areas of the Gulf of California (2005), and El Pinacate and Gran Desierto de Altar Biosphere Reserve (2014).

As a Wildlife Protection Area, under Mexican Law the islands of the Gulf of California do not enjoy the same strict restrictions that are imposed on Biosphere Reserves. The reasons to designate the islands within Mexican legislation with a different category to the one they hold internationally is possibly related to the large size and the spatial complexity of the whole archipelago, and the difficulties involved in strict law enforcement within the whole 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 islands of the Gulf of California is possibly the result of an effort to fulfil the Mexican Government's commitment with the UNESCO-MAB network and with the Global Environmental Facility (GEF), which has funded part of the conservation work on the islands. In 1996 the administration of the natural protected area was divided into three regional headquarters: (a) the southern islands are managed from an administrative office at La Paz, (b) Tiburón, San Esteban, San Pedro Nolasco, and some smaller islands near the Sonoran coast are managed from an office in Guaymas, and (c) the western midriff islands are managed from headquarters in Bahía de los Ángeles.

3. CASE STUDIES: MAIN CONSERVATION EFFORTS IN THE GULF OF CALIFORNIA

3.1. The Northern Gulf

3.1.1. The preservation of the Alto Golfo

From the mid-fifties it has become well known that the Upper Gulf of California (known in Spanish as the *Alto Golfo*) and the delta of the Colorado River are important sites for the reproduction and breeding of many species of birds and fish. This very productive region, however, has been under heavy fishing pressure. In 1975, the totoaba fish (*Totoaba macdonaldi*) was facing extinction through over-fishing. This problem forced the Federal Government to decree a moratorium for totoaba harvest in the Gulf of California.

Other problems, however, kept mounting. In the mid-eighties marine mammalogists started showing a strong concern on the population status of the vaquita porpoise (*Phocoena sinus*), which is endemic to the Upper Gulf of California. The vaquita is indeed a very rare marine mammal. Described in 1958, only a few specimens have been studied. The occurrence of vaquita specimens as incidental take in gill nets in the Upper Gulf started to signal an alert to Mexican and international conservation groups.

In the early nineties, the population of vaquita was estimated as less than five hundred. The vaquita was classified as endangered, and the International Whaling Commission labeled it as one of the highest priority 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), with the purpose of evaluating and studying the issue, and recommending adequate measures for the conservation of both endangered species. Dr. Bernardo Villa, one of the Mexican biologists who had dedicated much time to the studying of the fauna of the Gulf of California, was named President of the Committee, and it enjoyed the participation of several leading Mexican biologists and conservationists. Dr. Samuel Ocaña, formerly governor of Sonora and a devoted conservationist, was appointed technical secretary of the group. 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.

In June, 1992, an international meeting was organized in San Diego by the University of California Mexico-US Program (UC-MEXUS) to discuss two conservation

issues of great relevance for marine mammals: the problem of dolphin incidental take in Mexican tuna fisheries, and the totoaba-vaquita extinction threat. The meeting was called by Dr. Arturo Gómez Pompa, a professor at UC Riverside, and also at that time special advisor on environmental matters to the President of Mexico. Thus, the problem of overfishing in the Gulf of California started to appear in the international arena, harming Mexico's reputation on conservation and natural resource management.

In 1992, a severe crisis struck the fishermen of El Golfo de Santa Clara and Puerto Peñasco, in Sonora, and San Felipe, in Baja California, all three located in the Upper Gulf of California. Their shrimp catches had fallen precipitously (Arvizu 1987), and the fishermen blamed the federal authorities in general, and the Secretary of Fisheries in particular, for failing to enforce fishing bans to allow the recovery of the resource. The idea started to grow among the fishermen that the sea had to rest and its fisheries had to recover.

In the summer of 1992, the Technical Committee met in Hermosillo, Sonora. At this meeting, both the Director General of Natural Resources (Dirección General de Aprovechamiento Ecológico de los Recursos Naturales) of Mexico's National Institute of Ecology, Exequiel Ezcurra, and Prof. Arturo Gómez Pompa, expressed their support for the idea of establishing a natural protected area in the Upper Gulf. Most members of the Committee showed sympathy for the proposal, but the representatives of both the Secretary of Fisheries (Secretaría de Pesca) and the National Institute of Fisheries (Instituto Nacional de la Pesca) expressed their complete opposition. As a result, it was decided to request to 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.

Towards the end of 1992, the study was completed. The next step was to gain the approval and the consensus of the fishing communities in El Golfo de Santa Clara, Puerto Peñasco, and San Felipe, as well as the *ejido* communities in the delta of the Colorado River itself. The first months of 1993 were employed in discussing with these communities the costs and benefits of a protected area. Slowly, the people in the area started first to accept and later to support the idea. In March, 1993, Sven Olof Lindblad, owner of Lindblad Expeditions, donated a week of usage time in his boat "Sea Bird" for conservation projects. In collaboration with the World Wildlife Fund, the National Institute of Ecology (Instituto Nacional de Ecología, or INE) from Mexico's Federal Government used the opportunity to assemble businessmen, scientists, conservationists, social leaders from the small-scale fisheries and traditional authorities from the indigenous peoples around the Gulf of California, and

bring all these sectors together to discuss the issues around the sustainable management of the region. As a result of the "Sea Bird" cruise, a joint declaration was issued, signed by all the invited participants, urging the Federal Government to protect the habitat of the vaquita by declaring a marine reserve in the Upper Gulf. Finally, the project was presented to the Secretary of Social Development in the Federal Government, Luis Donaldo Colosio, a native of Northern Sonora and much interested in the idea. With the support of Colosio, the project moved forward.

In June 10, 1993, at a memorable occasion at Cerro Prieto, a volcanic mountain in the Gran Desierto near Puerto Peñasco, the President of Mexico, 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 DOF 1993). 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, the US 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-US border.

The objectives of the establishment of this reserve were the conservation of endangered species both from the Gulf of California and the Colorado River estuary, including the vaquita, the totoaba, the desert pupfish (*Cyprinodon macularius*), and the Yuma clapper rail (*Rallus yumanensis longirostris*). The establishment of the reserve also intended to protect the reproduction and breeding of many other species in the zone. Perhaps more importantly, this was the first marine reserve established in Mexico. In spite of the opposition of the 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. The debate around the Upper Gulf of California facilitated efforts by various conservation groups to extend the decreed protection into the waters adjacent to some important islands, opened the door for protecting the waters surrounding the islands in the Gulf of California, and set the pace for new marine protected areas to come, such as Bahía de Loreto, Cabo Pulmo Archipiélago de Revillagigedo, Islas Marías, Islas Marietas, Isla San Pedro Mártir, Isla Guadalupe, Bahía de los Ángeles, Canales de Ballenas y Salsipuedes, Archipiélago de San Lorenzo, and the deep vents of the Guaymas Basin.

Despite this positive legacy, the Upper Gulf Biosphere Reserve has continued to suffer from social conflict and natural resource degradation. Governmental authorities have tried to enforce different types of fishing gear, but the vaquita population is still in severe decline and the situation of the species is dire. Recently, the illegal

fishing of totoaba has come back, driven by the high prices its swim bladder gets in the Asian food market. The recovery of the Upper Gulf marine ecosystem, the subject of conservationists' dreams when the reserve was created, still seems to be very far away. There are, however, some reasons for optimism: The Colorado River delta, which once supported lush vegetation and a rich biodiversity and had become became a salt-caked wasteland after the river was dammed, received in 2014 an experimental flood to help restore the ecosystem (Stokstad 2014). Through a partnership of NGOs (the Sonoran Institute, Pronatura Noroeste, and the Environmental Defense Fund), the Colorado River Delta Water Trust was created in Mexico to acquire and lease water to restore the delta.

3.2. The Midriff Islands

3.2.1. Isla Tiburón

Tiburón was the first island in the Gulf of California protected by presidential decree, closely followed by Rasa. The main purpose for protecting Tiburón in 1963 was to create a mule deer (*Odocoileus hemionus sheldoni*) refuge, protecting the species from the extensive poaching that prevailed in the Sonoran mainland (Quiñonez and Rodríguez 1979). The 1963 sanctuary was put under the management of the Secretaría de Agricultura y Recursos Hidráulicos (SARH, Secretariat of Agriculture and Water Resources) an agency of the Federal Government. SARH built basic facilities for poaching control, 130 km of dirt roads, two airstrips, a small wildlife research station, and some water reservoirs to improve habitat quality for game species. At that time, the hunting habits of Seri Indians were considered a threat to the game species and an essential part of the problem of game conservation on the island. As a result, no hunting permits were granted initially to the tribe, despite the fact that Tiburón had always been part of their traditional hunting territory.

Bighorn sheep (*Ovis canadensis mexicana*, the Sonoran Desert subspecies; see Monson 1980) were introduced in 1975 as a part of a federal program to study and protect bighorn in Sonora (Becerril-Nieva *et al.* 1988, cited in Hernández-Alvídrez and Campoy-Favela 1989). Twenty sheep (4 males) were introduced to the island, captured by staff from the New Mexico Department of Game and Fish in the mainland mountain ranges in front of the island (Montoya and Gates 1975). Before the sheep introduction, in 1967 two other species of mammals were introduced from the Sonoran mainland: 20 white-collared peccari (*Tayassu tajacu*) and 17 pronghorn antelopes *(Antilocapra americana*; Quiñónez and Rodríguez 1979).

In 1975, however, the government approach to Indian issues changed and the interests of the Seri people on the wildlife of Tiburón were taken into account for the first time. Under the administration of Mexican President Luis Echeverría, the

island was returned to Seri ownership, although it still remained for a time under federal control. For two years (1975–1977) marines (the Mexican Navy had permanent presence on the island on small outposts since the 1970s) and game wardens prohibited Seri from landing on the island (Olivera and López 1988).

The bighorn sheep transplant was the only successful introduction. In fact, the population grew to a number between 500 and 600 animals, as evaluated through aerial censuses (Lee and López-Saavedra 1994, Pallares 1999, Wilder *et al.* 2014). In the late 1980s biologists from the Centro Ecológico de Sonora (CES, Ecological Center of Sonora, a state research center) continued the wildlife studies that SARH biologists initiated in the middle 1970s. Wildlife research on the island restarted with great vigor in 1995 when an ambitious project to study and manage bighorn sheep was launched. Scientists from the National University of Mexico, the Arizona Department of Game and Fish, and staff from two conservation NGOs, Unidos para la Conservación and Agrupación Sierra Madre, surveyed and studied the bighorn population. Under an innovative scheme for research and conservation funding, half of what is earned during the international auctioning of the sport hunting permits goes to support research by UNAM's scientists and for conservation and management actions for the bighorn sheep population on Tiburón. The other half goes to the Seri tribe. In 1998 the prices paid for the permits during an auction in Reno, Nevada raised to unprecedented levels: American hunters bid up to $395,000 dollars for two permits. The 1999 auction resulted in $150,000 dollars for two more permits (Navarro 1999).

The Seri community has been actively involved in this project, hiring a professional wildlife biologist for local field coordination and training a team of young Seri men as field technicians. Seris are also bringing to the project their traditional ecological knowledge about the wildlife of the island. The entire Seri community is expected to benefit from this sheep-hunting program. Money raised from hunting permits is deposited in a trust fund administered by a Seri technical committee. These monies are used for health, educational and cultural projects, as well as for supporting the operational cost of the Seri traditional government.

The bighorn sheep project in Tiburón also has the objective of providing animals to repopulate former bighorn sheep distribution ranges in Sonora, Chihuahua and Coahuila. Thus, with all this funding and support Tiburón Island is now contributing in an enormous way to the conservation of bighorn sheep in mainland Mexico, and at the same time it is generating another source of income for the Seri people. This innovative management project also plans to fund studies of other important species on the island, like the endemic mule deer, apparently suffering from habitat competition by the sheep, and predation from the growing coyote (*Canis latrans*)

population. Under a new federal Program for Wildlife Conservation and Diversified Productive Use of Land, Tiburón Island is now managed as a Unit for the Management and Sustainable Use of Wildlife (UMA for its acronym in Spanish).

An interesting sequel to the bighorn story occurred in 2014. Despite the success of the bighorn introduction, this conservation story has been controversial due to the non-native status of bighorn sheep on the island. The impact of unchecked bighorn sheep herbivory on the island's flora, which includes several regional endemic species, was not considered prior to the introduction. However, in 2012 during a field survey for fossil woodrat (*Neotoma*) middens on Tiburón Island, Ben Wilder we discovered large pieces of an apparent sheep dung in a small rock shelter in the eastern foothills of Tiburón. Pellets from the recovered dung mat were ^{14}C-dated to 1476–1632 calendar years before present, proving that bighorn sheep had been in the island at least since the end of the Pleistocene to around 1000 years before present (Wilder *et al.* 2014). The bighorn "introduction" had really been a case of rewilding the island with its native fauna.

3.2.2. Isla Rasa

Rasa island, the major site for breeding seabirds in the Gulf of California (Bancroft 1927, Case and Cody 1983), has served as a role model for successful ecological conservation of islands in the Gulf of California. Immediately after its legal protection in 1964 (DOF 1964) the seabirds on this island were studied intensively, and protected thereafter thanks to an enormous commitment of effort by almost three generations of Mexican biologists, and the support from numerous research and conservation organizations (Tobías 1968, Velázquez-Noguerón 1969, Velarde *et al.* 1994, Velarde 1988, 1993).

In the early 1960s a concern for the protection of Rasa grew following drastic reductions in the population numbers of nesting seabirds caused by egg collecting. In 1940, the population of seabirds (all species combined) was estimated to be one million (Walker 1965), in the late 1960s it had reduced to 25,000 (Barreto 1973), and possibly reached a historic low with an estimated number of 5,000 in 1973 (Villa 1983). The pioneering conservation efforts and lobbying of Louis Wayne Walker of the Arizona Sonora Desert Museum and the National Audubon Society, George Lindsay and Robert Orr of the California Academy of Sciences, Bernardo Villa from the National University of México, and some leading residents of Bahía de los Ángeles, notably Antero Díaz (Velarde *et al.* 1985), led the federal government to declare the island a seabird sanctuary.

Once the island was declared a sanctuary, biologists working for the Mexican Direction of Wildlife spent time on the island during the seabirds' breeding season

FIGURE 4. Enriqueta Velarde disentangling an elegant tern (*Thalasseus elegans*) from a mist net for biometric recording in Isla Rasa, *ca.* 1988 (photo: Fulvio Eccardi).

to provide on-the-ground protection, and to collect baseline data on population numbers. In 1965 a two-room stone house was built on the island (Vidal 1967). The lengths of stay of researchers on the island became more prolonged every year, as UNAM students working under Villa's guidance became involved in the conservation efforts. Villa himself spent many seasons on the island between 1975–1985, and in 1979 one of his students, Enriqueta Velarde, took over the research and conservation tasks inspired by Villa's remarkable pioneering work (see Figure 4). Under Velarde's direction, biologists have been present during the seabird breeding season (middle March to early July) from 1979 to the present time. These scientists and students have researched in detail the seabirds' breeding ecology and behavior, and the island's natural history. They also have helped prevent possible disturbance by the 300 or more ecotourists that visit the island every year (Villa *et al.* 1979, 1980, Velarde and Anderson 1994), and deter fishermen from collecting eggs, and landing or hiking in the nesting areas. The success of this island research and protection is evident. Seabird populations have rebounded dramatically: Heermann's Gulls maintained an estimated average of 260-350 thousand birds throughout the 1990s (Vermeer *et al.* 1993; Velarde and Ezcurra, this publication), while the Elegant Terns increased from 45 thousand individuals in the early 1990s to around 200 thousand birds in 1999 (Velarde and Anderson 1994; Velarde *et al.*, in this publication). Regardless of numerous obstacles, since 1979, the seabird population numbers and annual breeding success have been monitored systematically by a dedicated band of researchers and graduate students.

In 1993–1994, a program to eradicate introduced rats (*Rattus rattus*) and mice (*Mus musculus*) was initiated by the late Jesús Ramírez, who also did the pioneering research to start the Bighorn Sheep program in Tiburón Island. The complete eradication of introduced rodents using modern rodenticides was achieved by 1995. Researchers have since found no sign of rodent activity in the island while doing monitoring work. Now that the island is free of introduced mammals, scientists are monitoring ecological changes in the nesting colonies, the vegetation, the insect populations, and have plans to restore the populations of burrow-nesting seabirds that may have once used this island (such as the Craveri's Murrelet *Synthliboramphus craveri*, the Black Storm-Petrel *Oceanodroma melania* and Least Storm-Petrel *O. microsoma*, and perhaps even the Black-vented Shearwater *Puffinus opisthomelas* that was present in the island in the early 1920s (Bancroft 1927, Boswall and Barrett 1978). Perhaps more importantly, the continued presence and the relentless work of Enriqueta Velarde on the island has yielded one of the most detailed datasets in the world on nesting seabirds and their interaction with pelagic fish, and has produced a long trail of research papers describing the dynamics of the Midriff marine ecosystem (Velarde *et al.* 2004, 2013, Vieyra *et al.* 2008).

3.2.3. Bahía de los Ángeles

The concern for the protection of the islands inside the Bahía de los Ángeles was fueled by members of the local Ejido Tierra y Libertad, especially the late Antero Díaz and his family, and in collaboration with several American researchers working in this area since the late 1950s. In the early 1970s the oceanographer Antonio Reséndiz arrived at Bahía de los Ángeles to start a small program devoted to sea turtle research, with the help of Dr. Grant Bartlett of the Laboratory of Comparative Biochemistry in San Diego. Reséndiz' work was not limited to sea turtles, as he collaborated extensively with almost all researchers that arrived at Bahía de los Ángeles, and founded Campo Archelon, a small research center. With the support of his wife Betty since 1985, the center developed into a focal point for local conservation efforts in the bay area. He is the current President of the Ejido Tierra y Libertad.

In 1988, efforts by residents led by Carolina Espinoza culminated in the construction of the local Museum of Natural History and Culture. This exceptional museum has functioned as an information center for visitors describing the natural and cultural history of the area, highlighting the ecological importance of the islands, and providing environmental education opportunities for the local people.

The proximity of Bahía de los Ángeles to southern California, and its small islands inside protected waters, make this area an ideal place for natural history trips and

ecotourism. The growth in human use and the impacts on the bay and its islands prompted a binational group of researchers, governmental resource managers, and key local people to draft a management plan for the islands (Bourillón and Tershy 1997). A prioritized set of actions was proposed, which involved placing information signs on the common landing and camping sites on the islands, defining and delimiting hiking trails, and starting an information/orientation/registration system for island visitors. With financial support from a U.S. Fish and Wildlife Service grant under a joint program with Mexico's National Institute of Ecology, and with the support of Dr. Dan Anderson and the late Dr. Gary Polis, a group of members of the *ejido* established a committee in 1998 to fully implement the plan (Jiménez *et al.* 1999). This management plan has shown how the active participation and involvement of a local community can effectively increase local conservation through simple and low cost management actions, usually not adequately considered in large-scale programs for island conservation.

The growing awareness of the importance of environmental conservation by the community of Bahía de los Ángeles eventually yielded larger fruits. Thanks to the joint work of the community and Pronatura Noroeste—a conservation NGO—in June 2007 the larger coastal area around Bahía de los Ángeles was decreed as a Biosphere Reserve by the Mexican Federal Government. Together with the decree, a comprehensive study was published establishing the baseline conditions of the region and setting a precedent of ensuring sound scientific information accompanying the declaration of new Natural Protected Areas (Danemann and Ezcurra 2008).

3.3. The Lower Gulf

3.3.1. Conservation in the Bay of Loreto

Loreto is a small town on the Central Gulf Coast of Baja California Sur, its bay is protected by five islands (Coronado, del Carmen, Danzante, Monserrat and Santa Catalina). The growing pressures of large, industrial fishing boats (mainly shrimp bottom trawlers) on the fisheries of the bay induced a collapse of the local fisheries in the 1970s and 1980s, and in doing so generated a concern among the local small-scale, or *panga*, fishermen and the sport fishing operators as to how to protect the bay from overfishing.

Many measures were proposed, some extreme ones including the sinking of boats into the bay to destroy the shrimpboat dragnets, but little was done at first. In 1995 the Municipal President of Loreto, Sr. Alfredo García Green, started meeting with conservationists and concerned citizens to discuss the issue. Under the leadership of Grupo Ecologista Antares (GEA, a local conservation group), a proposal was

prepared and submitted to the Federal Government to protect the Bay of Loreto, including its five islands. On July 19, 1996, the Parque Marino Nacional Bahía de Loreto was created by a Federal decree (DOF 1996a). In December 1996, when Mexico's Environmental Law was changed, the marine park was re-categorized as a National Park (DOF 1996b).

Conceptually, this 206,580 ha National Park was major breakthrough. Although the islands of the Gulf of California had legal protection since 1978, the sea surrounding them did not. Many conservationists have argued that the decree protecting the islands should be extended to the marine ecosystems around them, but fierce opposition from the large-scale fisheries lobby had prevented this from happening. In the Bay of Loreto, the concerns of the local community proved to be stronger than the short-term economic interests of the fishing industry. In 1999, the park had financing for a Director, vehicles, basic equipment, and an office. It also had a working management plan and the full support of the local people, two facts that promote the park as a leading coastal protected area in Mexico.

3.3.2. Isla Coronado

In 1995, two Italian investors proposed building a hotel on Isla Coronado, a small, 850 ha island situated 11 km north of the town of Loreto. This island being part of the Protected Area of the Islands of the Gulf of California, the project required an Environmental Impact Statement (EIS). The hotel of 40 rooms was designed to have all the technological advances to be "environmentally friendly": solar panels for water heating, sewage treatment, water desalinating plant, and careful management of solid waste. The project was presented by the proponents as a viable alternative for the protection of the island. It planned to concentrate on low impact tourism and to enable a research station to be built next to the hotel that would monitor the island's wildlife and provide guidelines for a conservationist management of the site (Anonymous 1995a). The project, however, was strongly challenged by local and national conservation and citizen groups, and was finally abandoned.

Nevertheless, the development of the proposal, the discussion that arose around the project, and the arguments for its final cancellation, offer another example of the strong attraction islands exert for tourist resorts, and of the rationale used to justify their development. The Coronado project is also a prime example of the problems, conflicts of interest, and dangers for island conservation that can be caused by lack of clear governmental policies.

The main argument used by the developers was the limited conservation and management actions that were in place on Isla Coronado despite its legal protection since 1978. The presence of introduced animals (cats and sheep) and the high levels

of human use by fishermen and tourists were used as strong arguments to propose that a research station, to be sponsored by the hotel and managed by the University of Baja California Sur (Universidad Autónoma de Baja California Sur, or UABCS), was the only and best option to protect the island and ameliorate its deteriorated ecological status. The probable, but not yet certain, extinction of the endemic pack rat of Coronado (*Neotoma bunkeri*) due to 30 years of cat predation was another argument used to support the claim that the island was disturbed and could be developed.

However, most of the opponents to the project argued that once the place is connected to the coast by means of daily transport of food, personnel, tourists, baggage, people, machinery, trash, etc., it would be almost impossible to ensure that no new exotic animals or weedy plants will reach the island. Coronado Island is now part of the Parque Nacional Bahía de Loreto and it is better protected than it was before. Additionally, the introduced species are being successfully eradicated (Arnaud 1998).

There are ongoing development plans and growing pressures to develop other Gulf islands for tourism, mainly those in which private persons can claim ownership, such as San José, Cerralvo, Carmen, and Espíritu Santo. The same arguments brandished for Coronado, namely that protection of the island was not being enforced and that an "environmentally minded" development could protect the island better, are being used to pursue other development proposals in the Gulf of California.

3.3.3. Isla del Carmen

Possibly the most beautiful and scenic of the islands of the Bay of Loreto, Isla del Carmen—an island with private ownership claims—has been for many years a favorite destination for ecological tourists, and plays a major role both in the Protected Area of the Islands of the Gulf of California in general, and in the Loreto Bay National Park in particular.

Based on the apparent success of the breeding program of the Sonoran Bighorn sheep in Isla Tiburón, the National Institute of Ecology of Mexico decided to promote a similar program in Isla del Carmen, this time aimed at the Baja California subspecies (*Ovis canadensis weemsi*), an endemic taxon that is found only in the Sierras El Mechudo, La Giganta, and Las Tres Vírgenes within the Peninsula of Baja California. In 1995, the Mexican company Salinas del Pacífico, S.A., presented a project to recover the peninsular populations of bighorn by breeding them in the protected environment of Isla del Carmen (Anonymous 1995b). The National Institute of Ecology supported the plan, and gave the company a permit to capture 15 adult bighorn, 12 females and 3 males, in the Sierra de El Mechudo. The master plan establishes that when the herd reaches 175 individuals in an estimated time of

10 years, adults will be captured and used to repopulate the peninsular mainland. The plan, however, was received with criticism by conservationists in the Peninsula. Firstly, the peninsular population was evaluated in the early 1980s, and the count gave some 5–7 thousand individuals, a large number by any count. Secondly, there is no evidence that the mainland population is under any important threat. Thirdly, an island population size of less than 175 does not seem sufficiently large to insure the recovery of a peninsular population of many thousand. And, lastly, although the Baja California bighorn is indeed a rare and valuable wildlife species, trying to insure its long-term survival through a program that is based on the introduction of these game animals into fragile island environments is not justifiable. In short, although the bighorn program in Isla del Carmen was done with a conservationist justification, there is reason to doubt the value of the enterprise from a truly conservationist perspective.

3.3.4. Isla Espíritu Santo

Espíritu Santo is a large, 10,200 ha island surrounded by a set of smaller islets known as Isla Partida, Los Islotes, La Ballena, El Gallo, and La Gallina. It lies some 20 km north of the city of La Paz. Because of its proximity to La Paz, the island has been intensely used in the past and is still the most intensely visited island of the Gulf of California. It is filled with evidence of pre-hispanic occupancy by the Pericú people. In the 19th century Don Gastón Vives established here the first pearl oyster farm in the world. The ruins of the pearl farm ponds are still visible in Bahía San Gabriel, south of the island.

In the 1960s the ports in the state of Baja California Sur were granted legal status as duty free areas, and the economy made a rapid transition from ranching and agriculture into international commerce. As a result, communications developed rapidly: ferry ports, airports and the transpeninsular highway were built, and tourism started to take off. Some pioneering entrepreneurs who loved the natural beauty of the region started to develop at that time a new brand of nature tourism that involved low-impact activities such as whale watching, kayaking, camping, and visits to the islands. Eco-tourism was then a new and revolutionary concept in Mexico, and its development in the Gulf of California has since set an example for other regions of the country. Espíritu Santo became a major destination for local nature tours. Coastal fishing in open *panga* boats also developed in the 1960–1970s, and the fishermen started to use the island for temporary camps, and were still using it for that purpose in the 1990s. Twenty-two camps were in operation in Espíritu Santo in 1999. Finally, the academic and research sector also developed with the new economy in Baja California Sur. The University of Baja California Sur and two top Mexican

research centers were established in La Paz in the 1970s, and researchers started to visit the island and use it as a convenient research area and field station. In spite of these uses, the island is still in an extremely good state of conservation, an empirical fact that shows that low-impact nature tourism can indeed meet its declared goals.

Despite the common use by many stakeholders, the island had legal owners. In 1976, two years before the decree protecting the islands of the Gulf of California was issued, the Secretaría de la Reforma Agraria (SRA, or Secretariat of Agrarian Reform) gave legal tenure of the island to the Ejido Alfredo Bonfil from La Paz. In the 1990s, facing a crisis of underground water depletion in the mainland, the *ejido* started to look for alternative, non agricultural uses for their land and turned to Espíritu Santo. In 1992 the Mexican Constitution was amended to allow communal *ejido* lands to be privatized, and the Ejido Bonfil obtained authorization from SRA to parcel out 90 ha of island acreage for development. Thus, a frontal conflict arose between the presidential decree declaring the islands of the Gulf of California a natural protected area, and the development authorization for Espíritu Santo. This lead in turn to a sort of legal stalemate in which the *ejido* people had the right to develop the island but had not been able to get the permits from the Secretariat of the Environment (Mexico's Secretaría de Medio Ambiente, Recursos Naturales y Pesca, or SEMARNAP).

In order to resolve this situation, the *ejido* decided to cooperate in the preparation of a management plan for the island. They rapidly realized that their biggest chance of obtaining some income from the island's land surface lay in being able to use it in a manner compatible with its status as a natural protected area. The management plan was drawn up by CICIMAR, a local research center, with the participation of the Management Authorities of the protected area Islas del Golfo de California, ISLA (a conservation NGO), The Nature Conservancy, the University of Baja California Sur, the Mexican Center of Environmental Law (Centro Mexicano de Derecho Ambiental, or CEMDA), and, most importantly, the Ejido Bonfil. A number of workshops were held, and in 1998 the final document was ready. The management plan for Espíritu Santo was the first island-specific plan to be finished in the Gulf of California, and it has become a landmark for regional conservation. The fact that the *ejido* landowners agreed to participate—and in doing so accepted the potential consequence of there being restrictions to development in their own insular lands—was indeed a turning point and a lesson for the growing pressures for traditional tourism development that the islands of the Gulf of California are facing.

The successful work with the Ejido Bonfil brought together an alliance of Mexican and international conservation organizations and a diverse group of funders to ensure that the island remained as protected area. Mexican grant makers such

as the Mexican Foundation for Environmental Education (FUNDEA) and Fondo Mexicano para la Conservación de la Naturaleza, and International funders such as the Marisla Foundation and The David & Lucille Packard Foundation, got together with Mexican conservation NGOs (ISLA, Niparajá, Pronatura, and CEMDA) and two international NGOs [World Wildlife Fund (WWF), and The Nature Conservancy (TNC)] to bring Espíritu Santo under the control of the Mexican National Commission for Protected natural Areas (CONANP). The legal tool used was that of a "negotiated expropriation" in which the Ejido Bonfil voluntarily accepted having their land expropriated at a previously agreed price; the funders and the NGOs raised the funds necessary to pay the ejido; while in the same action the Federal Government expropriated the land to give it to CONANP.

The general assembly of the ejido members voted the initiative in June 2001 and agreed to the cession of the island for the negotiated prize. Another year would pass during which 36 private plots that had already been sold by the ejido were bought back, stipulating that the land was being bought to be donated to the nation of Mexico as part of its system of protected natural areas. In January 2003 the expropriation decree was finally issued, and on February 25, 2003, President Fox took part in a public ceremony in La Paz to formalize this historic expropriation with the local State authorities, the ejido members, and local conservation groups. Four years later, on May 10, 2007, a decree was issued by President Felipe Calderón declaring the waters surrounding Isla Espíritu Santo as a National Park (DOF 2007), adding the adjacent marine environment to the land surface of the island that was already under protection. Despite the proximity to La Paz and the pressures for development it once had, the island is now legally safe, and is, to this day, one of the most successful marine and insular protected areas in the Gulf of California.

3.3.5. Cabo Pulmo

The Castro family came in the early 1930s to the bay of Cabo Pulmo to fish for pearl oysters after they became scarce in the Bay of La Paz. Enrique Castro, the founder of the community, free-dove for pearl oysters on the reefs around Cabo Pulmo. The work was hard and perilous (see Figure 5). The mother of pearl and the pearls they collected were sold at a meager price to merchants traveling up and down the coast on horseback. In their 1939 exploration book *The Log from the Sea of Cortez*, John Steinbeck and Ed Ricketts described in detail the ecological richness of the reef, but also highlighted the poverty of the community and the unending decline of the pearl fishery. Towards the end of the 1930s the pearl oysters were running out and the community was turning more and more to fishing (Squires 1959).

FIGURE 5. A typical pearl fishing skiff from Baja California Sur, *ca.* 1930 (courtesy of the Archivo Histórico de Baja California Sur).

At first the family concentrated on catching sharks, which are large and easy to catch with a bait line. When dried, they were sold as salt cod. Within a few years when the sharks ran out they turned to green turtles, which at the time were very abundant in the Gulf. Before long the turtles became rare, too, and so they turned to finfish. As the finfish declined at Cabo Pulmo, the men had to travel further and further out to sea and up and down the coast to feed their families.

To survive the community family began to travel to Bahía Magdalena in the Pacific coast to fish during the summer for spiny lobster and, if they could find any, for abalone. They would then return to Cabo Pulmo in the winter. But competition for lobster was fierce, and their catch provided barely enough for a meager subsistence. Mario Castro, grandson of Enrique, decided to confront their increasingly paltry condition and traveled in the early 1970s to Cabo San Lucas in search of employment. Here he discovered that tourists would come to the Cape to dive and explore. Mario, who was a good free-diver like his father and his grandfather, was offered the opportunity to become a dive instructor. Before long, he returned to

Cabo Pulmo as a newly qualified diving instructor with a plan to earn a living taking divers out onto the beautiful reefs of Cabo Pulmo he knew so well.

By the late 1980s there were very few fish on the reef, and visiting scientists from La Paz and around the world started talking to the community about protecting the reef and the remnants of their once-plentiful living resources. The community gathered to discuss the way forward and decided that, if they were going to succeed in the new business of diving they needed to create a marine park. With the help of local conservationists, in 1992 the community of Cabo Pulmo petitioned Luis Donaldo Colosio, Minister for the Environment, to declare their coast a marine park and a protected natural area. Within three years, in 1995, a region of 71 km^2 was decreed as Cabo Pulmo National Park. At that time, the reefs at Cabo Pulmo were notable only for their coral formations as, in all other respects, the depleted populations of large fish resembled those of any other rocky reef in the region.

A Mexican scientist, Octavio Aburto, undertook a survey of more than 150 reefs in the Gulf of California, including Cabo Pulmo, in 1999. Four years after the Cabo Pulmo National Park had been created, the reef was still badly degraded. In 2009, Aburto again undertook a repeat survey of all the Gulf of California reefs he had documented ten years before. All but one reef appeared to be either in the same poor condition or had further deteriorated. The exception was Cabo Pulmo, where the biomass had increased by almost 500% and the biodiversity had doubled (Aburto-Oropeza *et al.* 2011). The Cabo Pulmo community had zealously protected their home reefs in their National Park, which had now become an outstanding example of what reefs once looked like before exploitation. They had reverted to the wild; they had transformed a broken marine ecosystem into a flourishing and vibrant one that people from all over the world were attracted to, and they had gone from depending upon extracting living resources for the local markets to making a livelihood by keeping those same resources alive.

But this apparently happy ending was shadowed by new threats. The pulmeños—the members of the Cabo Pulmo community—were recently been engulfed in one of Mexico's most outstanding conservation discussions. A Spanish developer applied for a federal permit to initiate a mega-development project at the margins of the marine park. The project, first called Cabo Cortés, proposed the construction of 15 large hotels, thousands of villas and holiday houses, a large marina, and two golf courses side by side with the marine park and the small Cabo Pulmo community. The project would have demanded some 9 million cubic meters of water annually (plus some 15 million as a by-product of the settlement of services for this gigantic development) from a strategic aquifer that has already reached its full capacity. Worse still, the nitrogen fertilizers leached from the site, the increased load of

sediments, and the eutrophic wastewater dumped into the sea would have meant, in all certainty, the decay and eventual death of the Cabo Pulmo reef.

The community acted. All the pulmeños became organized, they teamed with Mexican and international conservation agencies, they built alliances with marine scientists studying their reef, and learned to communicate with the media using the internet and social networks. Patiently, but with incredible constancy, they built their case. They convinced the Mexican society they were not against progress, development, or change—in fact, they had been harbingers of social innovation—but were opposed to environmentally destructive development. The discussion raged for two years, with more and more organizations taking sides with the unlikely champions, the pulmeños. Actors, intellectuals, scientists, all joined in.

Eventually, the community's perspective won: On the morning of June 15, 2012, the President of Mexico, Felipe Calderón, publicly announced the cancelation of the Cabo Cortés project, arguing that it had failed to demonstrate its long-term sustainability and the lack of significant impacts on the Pulmo reef, Mexico's most noteworthy success story in marine conservation.

After its cancellation, two further projects by two different development companies with a similar proposal, have attempted to build large developments in exactly the same site. The very success of the community in the conservation of their reef makes the place attractive for environmentally-disruptive developments. In these two occasions, however, the community was well prepared. Using the social networks, a response was quickly organized. Scientists read the new Environmental Impact Statements and found strong elements of criticism. The new studies failed in meeting the standards the Mexican legislation requires, and some of its information had been fabricated, or falsified. With the help of some Mexican non-profits and the Council for Protected Areas, the scientists demanded legal action against the developers. The first project—Los Pericúes—was cancelled on August 31, 2012, by the company itself who realized the project was not going to be authorized. The second project—Cabo Dorado—was denied by the environmental authority on May 30, 2014, for failing to meet required sustainability standards.

In many ways, the members of the Cabo Pulmo community have become local heroes and for the first time in history the country is looking at marine conservation with interest. The success story of Cabo Pulmo is viewed by many as one of those rare stories in which a small group of persons with a well-defined dream are able to prevail against all odds. The story of Cabo Pulmo has shown how marine protected areas can indeed offer an alternative to heal overfished seas, turning degraded coasts into a new vision of prosperity for all. The return of the large fishes to Cabo Pulmo is also the return of a dream to Mexico's coasts.

4. CONCLUDING REMARKS

A radical change has occurred during the 1990s in the management of some protected areas in Mexico, including the islands of the Gulf of California. During President Zedillo's administration (1994–2000), the National Commission for Protected Natural Areas was created. Following the excitement of the Rio Summit in 1992, Mexico started negotiations with the Global Environmental Fund to procure international funds for its protected natural areas. In addition, the Mexican government itself committed to invest a growing part of its budget towards conservation. From "paper parks" with no fixed budget, the protected areas in the Gulf of California region now have a modest but permanent financial flow that supports their operations. As part of the negotiations with GEF, the Mexican Federal Government agreed to permanently support the salary of the basic managerial staff. This commitment, taken in the mid-1990s, has been not only maintained but expanded. In the case of the islands of the Gulf of California, and because of the sheer size of the protected area, three administrative offices were established in 1996, operating out of (a) La Paz, Baja California Sur, (b) Guaymas, Sonora, and (c) Bahía de los Ángeles, Baja California. A fourth office was established in Loreto, Baja California Sur, to supervise the Loreto Bay National Park. Thanks to these actions, the local inhabitants of all the islands of the Gulf of California—temporary residents totaling some 700 or less at any given time—and of those of the surrounding communities are in many parts slowly changing their economic activity from traditional fishing to the services sector, including tourism services, field research, and education. The general management plan of the protected area Islas del Golfo de California, finally approved in October 2000, aims to promote carefully channeled ecotourism, with emphasis on environmental education.

Conservation in the Gulf of California region has progressed through the support of researchers, non-governmental 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 island conservation. Local commitment has been the driving force of environmental protection in the islands and the key to the success of conservation programs.

Most of the attempts to develop the islands and other pristine natural areas have been based on the argument that some of there is already a certain level of environmental degradation, mostly as a result of introduced species and of exploitation of natural resources. However, development of these areas, and in particular of the Gulf islands, would only generate more degradation. It is entirely false that by developing one or a few well preserved natural areas the rest may be better conserved. Empirical

experience in other regions of Baja California such as Los Cabos and Nopoló has shown that once development programs are established, others soon follow. No island is dispensable, and that all must be protected effectively. If some of the islands are degraded, then the conclusion must be that the island should be restored, not that it should be developed. The experience of eradication of introduced fauna in Isla Rasa—and the subsequent recovery of the marine bird populations—shows that restoration ecology can be very effective in these environments. No island in the Gulf of California is unimportant for conservation.

Finally, the incorporation of the Gulf of California islands and regional protected areas into MAB's international network of Biosphere Reserves and into the World Heritage List generates an immense responsibility for the Mexican Government and the local communities. The islands are now a recognized part of the global heritage of the world's biological diversity, and efforts must be done to protect them effectively as such.

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Exploring Mexico's northwest, the Baja California Peninsula, its surrounding oceans, its islands, its rugged mountains, and rich seamounds, one feels diminished by the vastness and the greatness of the landscape while consumed by a sense of curiosity and awe. In a great natural paradox, we see the region's harsh arid nature molded by water through deep time, and we feel that its unique lifeforms have been linked to this desert and sea for thousands of years, as they are now.

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Elisabet V. Wehncke

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