

## CHAPTER 15

# Parque Marino Las Baulas

CONSERVATION LESSONS FROM A NEW NATIONAL PARK AND FROM  
45 YEARS OF CONSERVATION OF SEA TURTLES IN COSTA RICA

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THE EDGE OF THE SEA marks one boundary of the tropical dry forest in Costa Rica. Just as the ocean draws Costa Ricans and foreigners to vacation spots along the Pacific coast in the summer, the beaches are a magnet for biologists, conservationists, developers, and politicians. This is because the beaches are critical habitat for all these people and a focal point for one of the greatest dramas in conservation at the beginning of the twenty-first century. Biologists come to study sea turtles and other exotic flora and fauna, conservationists come to save species from extinction, developers come with international financing to foster coastal development as an economic boom, and politicians chant the mantra of "sustainable development" to justify the uncontrolled spread of tourist and residential facilities along the coast. In one sense, all these people interact in a play that will determine the future of this ecotone between the forest and the marine ecosystems. Local residents are on stage as minor characters, and exotic species

make occasional cameo appearances to attract the attention of tourists and potential buyers of land and houses before disappearing from the scene. It is not at all clear that this play will have a happy ending.

The star of this play is the flagship species for this ecotone, the sea turtle. Unfortunately for the star and its ecosystem, it is not clear whether in the future we will look back on this play as high drama, a comedy of errors, or a tragedy. The stage is one of the newest parks in the Costa Rican system of natural areas, Parque Marino Las Baulas. The park is situated along the Guanacaste coast and protects the largest surviving nesting population of leatherback turtles in the Pacific Ocean.

In this chapter we focus on the biology of sea turtles that nest on tropical dry forest beaches of Costa Rica; give the history of conservation efforts for these species in Costa Rica; discuss local, national, and international aspects of this conservation activity; present the status of Par-

que Marino Las Baulas; detail the process that led to its formation; consider flaws and limitations of the human and turtle actors; and present recommendations for the future.

## BIOLOGY OF SEA TURTLES

Four species of sea turtles nest on the Pacific coast of Costa Rica. Leatherback turtles, *Dermochelys coriacea*, nest primarily in Guanacaste Province. Olive ridley turtles, *Lepidochelys olivacea*, nest in large flotillas or *arribadas* at Playa Nancite in the Santa Rosa Sector of Parque Nacional Guanacaste and at Ostional on the Nicoya Peninsula and singly on other beaches. Black turtles, *Chelonia mydas agassizii*, nest in small numbers at several beaches from Parque Nacional Guanacaste to the Osa Peninsula, including Playa Naranjo, Playa Cabuyal, and Playa Naranjo in Guanacaste and Playa Carate and Playa Río Oro in Osa. Hawksbill turtles, *Eretmochelys imbricata*, nest on Playa Carate and Playa Río Oro on the Osa Peninsula (Drake 1996).

### LEATHERBACK TURTLE

The leatherback turtle is the largest sea turtle, reaching a length of 2.8 m from head to tail and a mass of 916 kg. The carapace (upper shell) is 130 to 190 cm long and elongate with seven sharply peaked longitudinal ridges. It tapers to a point in the rear called the pygal process. The thin, leathery skin is black with white spots, and the head is large with an irregular pink spot above the pineal gland. On the Pacific coast leatherbacks nest primarily from October to February, whereas on the Caribbean coast they nest from March to June. This coincides with the dry season on each coast. Between 70 and 90 percent of leatherbacks on the Pacific coast of Costa Rica nest at Parque Marino Las Baulas.

### OLIVE RIDLEY TURTLE

The olive ridley is the smallest sea turtle, with an adult size of 36 kg and length of 76 cm. It has a hard shell and is olive drab in color. It nests in large *arribadas* at Playa Nancite and Playa Ostional and as solitary individuals at these and

other beaches on the Pacific coast of Costa Rica during most months of the year, but especially from August to February. There are no ridley turtles on the Caribbean coast of Costa Rica.

### BLACK TURTLE

The black turtle is a subspecies of the green turtle and is 100 cm long, compared with 120 cm for the green. Eastern Pacific *Chelonia* populations are distinct but are not taxonomically distinct at the species level (Karl and Bowen 1999). On the Pacific coast black turtles nest primarily from August to February, although some nesting occurs throughout the year. On the Caribbean coast green turtles nest from June to September.

### HAWKSBILL TURTLE

Hawksbill turtles are rare on the Pacific coast of Costa Rica. They are 90 cm long and are distinguished by their birdlike beak and beautiful "tortoise shell"-covered carapace. In general, hawksbill populations are only a small fraction of their presettlement numbers throughout their range (Bjorndal 1999). They are now seen primarily as solitary nesters, but in areas where they are protected, such as Buck Island Reef National Monument in the U.S. Virgin Islands and Jumby Bay Island off Antigua, they nest in groups just like green and black turtles (Meylan 1999). They probably did so in the past before they were hunted to near extinction for their shells. There is little scientific information about their biology in Costa Rica, but hawksbills are in the Golfo Dulce and nest on the beaches of the Osa Peninsula (Drake 1996). Hawksbills also nest along the Caribbean coast of Costa Rica.

## REGIONAL AND GLOBAL CONTEXT

Sea turtles are an excellent example of the need for conservation efforts to focus on local, national, and international levels in order to establish effective protection plans and policies. Because these species travel great distances in the ocean, they live in waters controlled by many nations and in international waters, as well.

Hundreds of leatherback turtles nest on the Caribbean coast of Costa Rica and Panama. Protection is provided in Tortuguero National Park, where the Caribbean Conservation Corporation (CCC) has an ongoing study. Farther south, John Denham's Pacuare Reserve protects 6 km of beach where in some years 100–200 leatherbacks nest. His rangers patrol the beach and face poachers who are armed with weapons ranging from machetes to automatic weapons. The aggressive program of patrolling and arrests deters poachers and keeps nest loss to a minimum. Denham's rangers also use hatcheries to protect nests from more remote portions of the beach. South of Limón, Didier Chacón and his volunteers of Asociación ANAI protect beaches in the Refugio Nacional de Fauna Silvestre Gandoca-Manzanillo near the Panamanian border. In Panama leatherbacks are unprotected, and poachers kill adults to get their eggs in addition to digging up nests in the Bocas del Torro region. John Denham and Clara Padilla of the Wildlife Conservation Society began a protection program there in cooperation with Panamanian authorities in 2002.

There are other major nesting beaches for leatherbacks in Mexico. The Mexican population was 70,000 females in 1980 (Pritchard 1982) but declined to fewer than 200 in 1999 (Spotila et al. 1996; L. Sarti and D. Dutton pers. comm.). Although biologists monitor many beaches and provide protection at Mexiquillo in Michoacán, there is no protection on beaches to the south such as Tierra Colorado in Guerrero and Bahía Chacahua and Barra de la Cruz in Oaxaca. Poachers take essentially all the eggs on these beaches and kill some adults (E. Possardt pers. comm.). In 1998 and 1999 Georgita Ruiz's federal rangers in Oaxaca confiscated trailer truck loads of turtle eggs from middlemen who purchased eggs from poachers. These included tens of thousands of eggs from olive ridley, black, and leatherback turtles. A few leatherbacks also nest in Nicaragua.

The leatherback turtle is declining in numbers at a catastrophic rate in the Pacific Ocean, and if current trends continue, it will disappear

from these waters within the next few years (Spotila et al. 1996, 2000). The decline is due primarily to the incidental catch of turtles in longline, gill net, and trawl fisheries. Harvesting of eggs from nesting beaches and some killing of adults on nesting beaches and at sea by indigenous peoples for food and medicinal oils and ointments also all have an impact.

Olive ridley turtles that nest in Costa Rica traverse great distances in the eastern Pacific (Plotkin et al. 1995, 1996). In contrast to leatherbacks (Morreale et al. 1996), olive ridleys do not follow migration corridors but rather swim in diverse patterns in waters ranging from Mexico to Peru and the Galápagos. These turtles live in waters under the jurisdiction of many countries and in international waters. Any successful conservation plan must address the problem of interactions of sea turtles with the fishing industry of the Americas and Asia, as well.

In addition to the two *arribada* beaches in Costa Rica, olive ridleys nest at one *arribada* beach in Pacific Mexico and two *arribada* beaches in India. Other *arribada* beaches in Mexico were destroyed by the 1980s through extensive killing of adult females for the leather trade. There are some minor *arribada* beaches on the Pacific coast of Nicaragua and Guatemala and scattered nesting along Pacific Mesoamerica.

Black turtles nest in Nicaragua, El Salvador, Guatemala, and Mexico, as well as Costa Rica. Conservation takes place at many beaches in these countries, but the poaching of eggs takes place on most beaches and is a serious problem for survival of this species. In Nicaragua conservationists working with members of local communities protect the main beaches of Chococente and La Flor. Soldiers provide protection for the beaches, and hatcheries protect some nests. Development threatens these beaches. In Guatemala the Asociación de Rescate y Conservación de Vida Silvestre (ARCAS) protects several small beaches and places eggs in hatcheries. Local people are paid in flour, corn, and other foods in return for ten eggs from every nest of eggs that they take. That means that only 10 percent of the eggs at most are being saved. Although

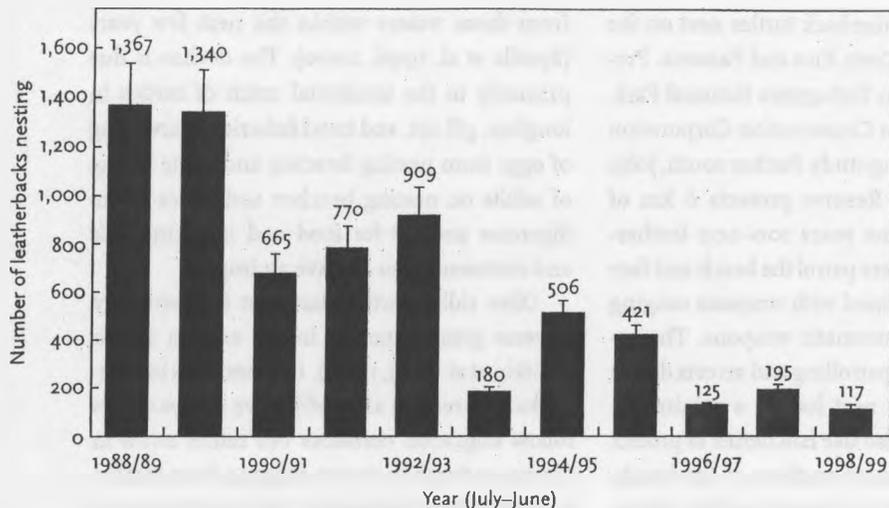


FIGURE 15.1. Numbers of leatherback turtles nesting on Playa Grande from the 1988/89 nesting season to the 1998/99 nesting season. Data from 1988 to 1992/93 are based on counts of the number of nests and assume a clutch frequency of 7. Numbers from 1993/94 to 1998/99 are based on Passive Integrated Transponder (PIT) tag identification of individual nesting female turtles. The population has undergone an exponential decline during this period.

this is a noble effort, it is doomed to failure. Studies on freshwater turtles (Congdon et al. 1994) and modeling of life history characteristics of sea turtles (Spotila et al. 1996) demonstrate that this level of predation on nests cannot be sustained by a turtle population. Owing to the high rate of mortality of the few turtle hatchlings released into the ocean, insufficient animals are being produced to ensure a return of adults when this cohort would be maturing and returning to nest.

In Mexico considerable effort is being made to monitor black turtle beaches in Michoacán. In addition, Mexican marines have provided protection for biologists, turtles, and their nests. However, poaching is still rampant, and despite efforts with local communities, these populations are still being heavily exploited.

#### EXTINCTION OF LEATHERBACK TURTLES?

In 1996 (Spotila et al. 1996) we estimated the number of leatherbacks nesting on 28 beaches around the world from the literature and from communications with investigators studying those beaches. In 1995 there were about 34,500

adult female leatherbacks, compared with about 115,000 in 1980 (Pritchard 1982). The greatest declines occurred in Malaysia and the Pacific coast of Mexico. Both of these colonies experienced an exponential decline. We are now seeing an exponential decline at the beaches of Las Baulas National Park, as well (fig. 15.1). The eastern Pacific population is now about 1,750, and the world population is about 27,600 (table 15.1).

Stable leatherback populations cannot withstand an increase in adult mortality above natural background levels without decreasing. However, protection of eggs and hatchlings during the first day of life can have a significant effect on overall stability of leatherback populations with a moderate increase in adult mortality (5%). Leatherback populations in the Pacific and Indian Oceans cannot survive the current levels of adult mortality from fisheries in these oceans. Atlantic populations are also being exploited at a rate that cannot be sustained. Thus, leatherbacks are on the verge of extinction (Spotila et al. 1996, 2000).

If our models are right and protection of nests and hatchlings can offset moderate levels of adult mortality, then perhaps an all-out

TABLE 15.1  
Regional Population Estimates for  
Nesting Leatherback Turtles, *Dermochelys coriacea*

REGION	ESTIMATED NUMBER OF NESTING FEMALES
Western Atlantic	15,000
Eastern Atlantic	4,700
Caribbean	4,000
Eastern Pacific	1,750
Western Pacific	1,700
Indian Ocean	450
Total	27,600

Source: Numbers are based on data reported in Spotila et al. (1996) and recent information from nesting beaches.

conservation effort in Costa Rica may save the leatherback in the Pacific Ocean. Certainly nesting beaches must be preserved and nests protected or there will be no "next generation." However, this effort will not be sufficient in the face of large-scale mortality in the fishery.

#### PARQUE MARINO LAS BAULAS

Parque Marino Las Baulas (map 15.1) on the Guanacaste coast includes the Bahía de Tamarindo, adjacent beaches, and mangrove estuaries. The park has three beaches that are used by leatherbacks as nesting sites, Playa Ventanas, Playa Grande, and Playa Langosta.

Playa Grande is a crescent-shaped white sand beach composed of finely broken shell rubble and sand and is regarded as one of the world's finest surfing areas. The other beaches are of similar composition but smaller in length. Eighty to 90 percent of leatherbacks nest on Playa Grande. There is increasing development along all three beaches just outside the 50-m public zone. The Estero Tamarindo is the largest estuary in dry Pacific Central America and hosts many species of plants and animals. Flagship species include the red, white, black, buttonwood, and tea mangroves, American crocodile, Roseate

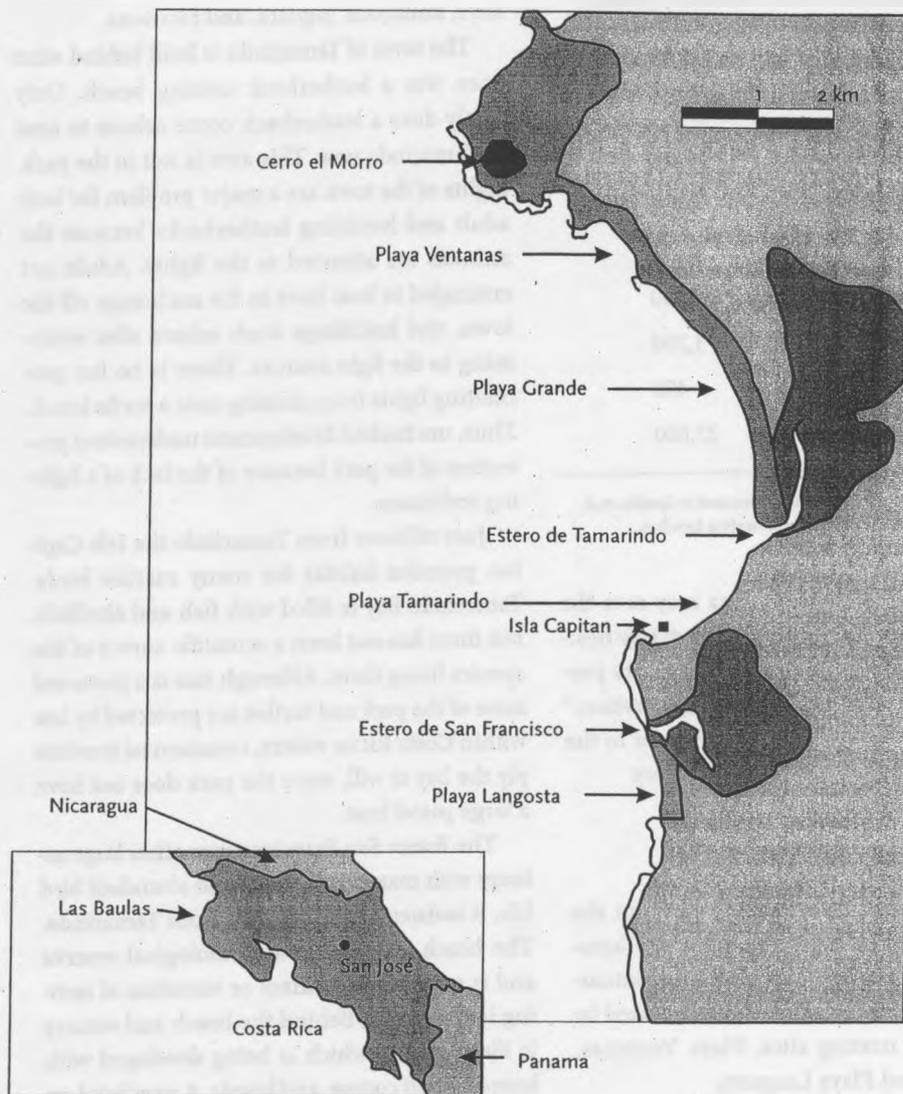
Spoonbill, White Ibis, Boatbill Heron, Wood Stork, Great Blue Heron, egrets, howler monkeys, kinkajous, jaguars, and raccoons.

The town of Tamarindo is built behind what once was a leatherback nesting beach. Only rarely does a leatherback come ashore to nest in Tamarindo now. This area is not in the park. Lights of the town are a major problem for both adult and hatchling leatherbacks because the animals are attracted to the lights. Adults get entangled in boat lines in the anchorage off the town, and hatchlings wash ashore after swimming to the light sources. There is no law prohibiting lights from shining onto a turtle beach. Thus, unchecked development undermines protection of the park because of the lack of a lighting ordinance.

Just offshore from Tamarindo the Isla Capitán provides habitat for many marine birds. Tamarindo Bay is filled with fish and shellfish, but there has not been a scientific survey of the species living there. Although this is a protected zone of the park and turtles are protected by law within Costa Rican waters, commercial trawlers ply the bay at will, since the park does not have a large patrol boat.

The Estero San Francisco is another large estuary with mangrove forests and abundant bird life; it isolates Playa Langosta from Tamarindo. The beach is set aside as a biological reserve and is not open to tourism or visitation of nesting leatherbacks. Behind the beach and estuary is Finca Pinilla, which is being developed with homes, a golf course, and hotels. A new hotel on the rocky shore north of Playa Langosta and the estuary poses a threat to this nesting beach from its lights, noise, and activity. Workers filled in part of the estuary near the hotel site. Despite the filing of a legal action (*denuncio*) against the hotel by park officials, the estuary has not been restored as of 2003. The hotel now blocks access to Playa Langosta and uses the beach and estuary as a private location for guests despite their reserve status. Again, another *denuncio* has had no effect on this activity.

In the 1988/89 season, 1,367 leatherbacks nested on Playa Grande. In contrast, during the



MAP 15.1. Parque Nacional Las Baulas. Redrawn from Steyermark et al. (1996) with permission.

1998/99 season only 117 leatherbacks nested there (fig. 15.1). Average annual mortality at sea for these turtles is 28 percent. In a given year 75 percent of leatherbacks are first-time nesters, and 25 percent are repeat migrants. Most sea turtle populations have a smaller percentage of repeat migrants than do freshwater turtles (Congdon et al. 1993, 1994) owing to some level of exploitation by humans. However, these percentages are especially low for the Las Baulas population.

Leatherbacks are long-lived like other large marine organisms. Populations of long-lived organisms cannot withstand heavy human exploitation (Congdon et al. 1994; Crouse 1999; Heppell et al. 1999; Musick 1999). The short lives of leatherbacks that we observe at Las Baulas today are not normal and reflect intense fishing pressure imposed on them. Thousands of leatherbacks died each year in oceanic long-line and gill net fisheries in the 1980s and 1990s (Frazier and Brito Montero 1990; Nishimura and

Nakahigashi 1990; Wetherall et al. 1993; Eckert and Sarti 1997).

#### THE MAKING OF A PARK: THE LONG JOURNEY TO AN UNCERTAIN FUTURE

Parque Marino Las Baulas exists primarily because of the efforts of Maria Teresa Koberg, Mario Boza, Clara Padilla, and Peter Pritchard. Much has been written in the popular press, magazines, and books about this park, and much is incorrect. We worked at Las Baulas since 1990 and participated in or observed most of the activity surrounding the park. We were involved in research and conservation efforts at the park and worked with officials of the Ministry of Environment and Energy (MINAE) and its National Park Service (SPN) in efforts to consolidate the park. Between 1990 and 1999 we raised more than \$788,000 in grants and donations to support these efforts from ten organizations (including Earthwatch, the U.S. National Science Foundation, the National Geographic Society, Drexel University, World Wildlife Fund, Guinness, Ltd., and the U.S. National Marine Fisheries Service) and many individuals. Here we relate the history of the park as we participated in it.

In the late 1980s the Estero de Tamarindo and Playa Grande were designated as the Tamarindo Wildlife Refuge, a Refugio Nacional de Vida Silvestre, and the estuary was protected as a wetland under the RAMSAR Convention on wetlands. The beach was protected up to 50 m above the high-tide mark. However, the refuge designation did not improve on the nationwide legal protection given to mangroves, ocean beaches, and turtles.

Under its refuge status Playa Grande was the scene of uncontrolled poaching, tourism, and beachfront development. The beach was bright with camera flashes during the height of the nesting season, and many people rode on the backs of leatherbacks as they crawled up and down the beach. Poachers stole almost every egg laid. One person built a hotel along the northern

portion of the beach without any environmental assessment or permits. Another person built a hotel at the southern end of the beach by cutting mangroves and filling in part of the Tamarindo estuary. Plans also existed for a major development of 250 houses behind Playa Grande and more than 50 behind Playa Ventanas. A major luxury resort for 5,000 with a casino, nightclub, hotel, condominiums, and a yacht club was planned for Playa Grande.

Maria Teresa Koberg led the early efforts to obtain protection for the leatherbacks and was a pioneer in converting poachers to guides and rangers. Her most famous convert was Esperanza Rodríguez, the matriarch of a family that was long the major source of poaching on Playa Grande. From 1988 to 1996 Rodríguez made daily nest counts on Playa Grande while riding the beach at sunrise on her horse. These data were critical to our understanding of the population trends of leatherbacks there. Koberg, not Wilson and Pastor (Honey 1999), mounted a program of education and protection. She brought in Boy Scouts from Costa Rica and Minnesota. They patrolled the beach and protected nests and turtles by persuasion. She obtained national media attention and promoted the idea of a park.

In 1990 a report by Pritchard and members of the local community (Pritchard et al. 1990) recommended the formation of a park. In 1991 President Rafael Angel Calderón issued a decree that established the park as Las Baulas de Guanacaste (Executive Decree No. 20518, 5 June 1991). Even though the limit to the park was only 125 m inland from the high tide, it did protect the ocean offshore to 19.2 km.

Koberg was the first director of the park and established a protection program involving leaders and members of the Playa Grande and Tamarindo communities. She brought in a young biologist, Randall Arauz, who began a program of education in nearby villages. In 1992 he became the second director of the park and carried out a vigorous program of research and conservation on Playa Grande (Arauz and Naranjo 1994). Gradually residents began to accept the

park as they became turtle guides and realized that their concerns were being heard (Naranjo and Arauz 1994).

In 1991–92 we raised funds for rural guards and obtained grant support for Anny Chaves, who, with her students, conducted a study of the nesting ecology on nearby Playa Langosta and a program of environmental education in local villages (Chaves et al. 1996). On Playa Grande a 1,300-m restricted zone that tourists could not enter provided a haven for nesting leatherbacks (Herzog 1992). Significant progress was made with local residents through a cooperative program with the Fundación la Gran Chorotega, a local nongovernmental organization that promoted preservation of local cultural and biological resources of Guanacaste.

During the 1992/93 nesting season we moved our research to Playa Grande to assist in conservation efforts, population data collection, and other research in the main portion of the park. Earthwatch volunteers and students and faculty from Drexel and Indiana-Purdue University at Fort Wayne tagged turtles and controlled ecotourists. Paladino taught guides in Spanish about turtles and control of ecotourists. In addition, we helped park rangers construct the first house for the park that served as the headquarters and a home for the director and his family. We also conducted botanical surveys and produced guidebooks for the estuary and dry forest.

In the 1993/94 season we began to tag permanently all leatherbacks on the beach and continued studying their nesting ecology and physiological ecology (Steyermark et al. 1996). A cooperative agreement between MINAE and Drexel University provided English-language training to several ministry employees involved in developing the park. The park, under director José Quiros, continued to offer training courses for local guides, and we continued our meetings and education efforts, as well. We also met with many of delegates of the National Assembly to educate them about turtles and the need for a national law to formalize the park.

From 1994/95 to 1997/98 Sergio Obando was director and did an excellent job in beginning the consolidation of the park. Outreach in local villages increased, and we established a program of conservation education in the Playa Grande community and Matapalo school. In 1995 the National Assembly finally passed a law making the park a permanent entity. Unfortunately, an apparent “clerical error” established the park as 125 m under the sea instead of 125 m inland from high tide. As of 2002 this error has not been corrected.

During the Obando period more funds came to the park. With the help of Earthwatch Europe we obtained a grant from the Guinness Corporation’s “Water of Life” program to provide a building fund for the park. This grant allowed the construction of a large dormitory building for park volunteers. We also funded and mentored students from the Universidad Nacional in Heredia, who carried out tagging and nesting ecology studies on Playa Langosta. They controlled poaching and when necessary brought park rangers to that beach to maintain order. The park closed Playa Langosta to tourists so that it was a refuge for leatherbacks.

In the 1998/99 season one of our Universidad Nacional students became the director of the park after graduation. Rotney Piedra brought to the position not only enthusiasm but also training in sea turtle biology. By 1999, residents generally accepted the park. Tourists could only go on the beach with a guide, group size was officially limited to ten, and park rangers were more diligent about their duties. English-language and conservation training at Drexel improved Piedra’s ability to manage the park. He increased controls on the beach and worked with local landowners to improve protection of the turtles. By 2001 Piedra’s rangers were effective, and guides cooperated with researchers.

As of 2002 there were still many problems. The park law needed to be fixed to establish boundaries properly along the land behind the beaches. Agreements were needed with landowners behind Playa Grande to support the park.

A lighting law was needed to protect adults and hatchlings from lights behind the beaches and from Tamarindo. The urbanization plan for the area needed to be completed, and park consolidation was still ongoing. Development was the dominant factor threatening the park. Completion of the hotel in Tamarindo overlooking Playa Langosta created a new threat to that beach. Conservation at Las Baulas is thus still a work in progress. To assist in this effort we formed a nongovernmental organization, the Leatherback Trust, and registered it in Costa Rica as Fideocomiso Baulas. Funds from the Leatherback Trust support a biologist, two rangers, development of a management plan, and other initiatives toward park consolidation. In 2003 we raised another \$325,000 for this effort.

#### 45 YEARS OF SEA TURTLE CONSERVATION IN COSTA RICA

Conservation biologist Archie Carr began sea turtle conservation in Costa Rica in 1954 when he visited Tortuguero with Costa Rican businessman Guillermo "Billy" Cruz. In 1955 he started the green turtle tagging project that continues to this day (Bjorndal et al. 1999). In 1959 U.S. businessman Joshua Powers formed the Brotherhood of the Turtle after reading *The Windward Road* (Carr 1955). This later became the Caribbean Conservation Corporation (CCC), which ensured continued funding for the green turtle project at Tortuguero. The original goal of the CCC was "to save the green turtle from destruction, to give it a chance to renew its numbers, and to redistribute it to all beaches where it was once common" (Godfrey 1999: 1). The approach was one of scientific research, conservation, and restoration.

Along the way Archie Carr worked with leading citizens of Costa Rica to convince them to protect turtles. In 1963 President Francisco Orlich signed the first executive decree regulating hunting of sea turtles and collection of their eggs. Also in 1963 the first guards came to Tortuguero to protect turtles. In 1970 Costa Rica prohibited all turtle hunting and egg collection and established Tortuguero as a national park,

thus protecting the 48-km nesting beach. In 1973 Costa Rica signed the Convention on International Trade in Endangered Species (CITES), making international trade in sea turtles and other endangered species illegal. In 1975 the government expanded Tortuguero National Park to include the nearby hills and lowlands.

Throughout this time Carr continued his green turtle studies at Tortuguero and established an ethic in Tortuguero that respected and protected turtles. By employing villagers at the Casa Verde field station and doing turtle nest counts in the park, Carr had a significant impact on the local economy, and this formed an economic basis for the development of turtle conservation in the village. He linked economic progress of the local community with conservation long before anyone made up terms such as "grassroots community-based conservation, parks for people, sustainable development and use, and conservation for development" (Brandon et al. 1998: 1). This later laid the groundwork for ecotourism there. Carr's students carried out numerous pioneering studies on the hearing and orientation of hatchlings. Scientific research was always a key part of the conservation effort at Tortuguero (Spotila 1988). There was little interest in research and conservation at Tortuguero among Costa Rican universities during this period. The Escuela de Biología was just beginning at the University of Costa Rica. In addition, Limón Province was far removed from the Central Valley in travel time and mind-set.

In 1978 a major scientific expedition sailed to Tortuguero on the *Alpha Helix*, and several key physiological studies took place. It was here that Standora et al. (1982) accomplished the first successful radio and sonic telemetry of sea turtles. In 1980 Morreale et al. (1982) demonstrated the importance of temperature-dependent sex determination to the conservation of sea turtles. Throughout this period there was a continued harvest of 500 adult green turtles a year for slaughter in Limón. In 1982 local pressure led to an increase in the regulated harvest to 1,800 green turtles per year. By the mid-1980s an ecotourism boom started in Tortuguero, and the

nighttime population of the village jumped from about 100 to 500 with the addition of several hotels and cabins. The turtle ethic began to break down as more people came to Tortuguero from other areas and money flowed into the community from illegal arms traffic to Nicaragua during the Contra war. The paving of the runway, development of the area inland from Tortuguero, and finally construction of an illegal road to Tortuguero in 1996 ended its isolation.

Throughout this period the CCC increased its conservation efforts. It erected an information kiosk in 1985, initiated a comprehensive conservation and development plan in 1989, and obtained approval of a maritime terrestrial zone for Tortuguero in 1993. Despite the untimely death of Archie Carr in 1987, his family, students, and the CCC staff, energized by Cindy Taft, redoubled their efforts to preserve green turtles and expand conservation efforts in Nicaragua and into the leatherback nesting season. We began physiological and nesting ecology studies on leatherbacks at Tortuguero in 1989 (Paladino et al. 1990) and included education and conservation as a central part of our program.

Talks in the schools, visits with community leaders, employment of local residents, and encouragement of the park guards brought visibility to the leatherbacks and gave them a status and level of protection approaching those of green turtles. Our rule of thumb became "no scientists, no protection," and we expanded our project to the entire leatherback nesting season. That extended protection on the beach to include both the leatherback and green turtle seasons, March through September. This developed into an annual tagging program (Campbell et al. 1996) and nicely complemented the CCC conservation efforts in Tortuguero and Nicaragua. In 1994 the CCC completed its new field station and visitor center in Tortuguero, and in 1998 Costa Rica and Panama signed an agreement for the collaborative management of sea turtles in the Caribbean.

More green turtles arrived to lay eggs in 1998 than ever before. The nesting beach was protected. Thousands of people had their first mys-

tical encounter with a green turtle in the dark and silence of the night. They did so under the watchful eye of a local conservationist/guide trained and certified by the CCC. The guides were well informed, friendly, and staunch defenders of turtles. Protection of the beach was increasing.

Meanwhile, on the Pacific coast, olive ridleys, along with leatherbacks at Las Baulas, dominate the nesting beaches of Pacific Costa Rica. Hughes and Richard (1974) were the first to document the large number of sea turtles that nested on many beaches there and the mass nesting of olive ridleys at Playas Nancite and Ostional. Steve Cornelius, a Peace Corps volunteer, documented the nesting of turtles on Playa Naranjo. Through the 1970s and 1980s he and Douglas Robinson of the University of Costa Rica carried out a series of studies on sea turtles along the Pacific coast (Cornelius 1976, 1986). Robinson and his university students began serious study of sea turtles on most of these beaches.

Robinson came to the University of Costa Rica in 1966 from Texas A&M University for a brief stay and spent the rest of his life there. He established the Museum of Zoology at the University and the Programa de Tortugas Marinas, which served as a focal point for education of Costa Rican and foreign students in sea turtle biology and conservation. He directed the thesis studies of several students and established the first computer database for flipper tag returns from turtles along the Pacific coast of Central America. He also played a key advisory role in the development of conservation policies and laws in Costa Rica. The program continued at the university after his death in 1991 but, lacking a director with his mature leadership and scientific training, was floundering by the mid-1990s, and the university ended it. Fortunately, a vigorous program directed by Claydette Mo remained at nearby Universidad Nacional. In addition, a cadre of former students remained from the Robinson group at the University of Costa Rica, and Mario Alvarado, Randall Arauz, Jorge Ballesterero, Juan Carlos Castro, Anny Chaves, and Isabel Naranjo continued to be

active in sea turtle biology and conservation. Unfortunately only Roldan Valverde continued on to receive a Ph.D.

Perhaps the most ambitious project started by Robinson was the experiment with a controlled harvest of olive ridley eggs at Ostional. In 1980 he saw that the little village situated on one of the most important sea turtle nesting beaches in the world would play a critical role in the future of sea turtle conservation. Even though harvesting of sea turtle eggs had been illegal in Costa Rica since 1966, it still took place at night at Ostional and elsewhere. Robinson established the Ostional turtle station of the University of Costa Rica to study the *arribada* phenomenon and began to involve villagers in the protection of the *arribada*. The concept evolved that villagers could take the eggs from the first 24 hours of the *arribada*, since they would be destroyed anyway, and protect them from the later portion of the event. This led to the current controlled harvest. From 1977, when Robinson first proposed the idea, until 1987, when the Costa Rican Congress reformed the Wildlife Conservation Law, which prohibited egg harvesting, to allow a controlled harvest at Ostional, a vigorous debate within Costa Rica and worldwide among sea turtle biologists considered all aspects of the plan. The final arrangement saw the Ostional community form an economic development association, Asociación de Desarrollo Integral de Ostional (ADIO), to manage the harvest and the University of Costa Rica entrusted with legal responsibility for carrying out scientific studies needed to sustain the population.

The Ostional experiment is a qualified success and has been the subject of numerous articles worldwide (e.g., Baker 1994). The village has a new school, a new clinic, a new Guardia Rural office, and a new sense of civic pride in what the members of the community have accomplished. Local wardens patrol the beach, villagers help to count the turtles, and the egg harvest is conducted in a regular and fairly well managed way (Ballesterio et al. 1996).

Many problems remain, however. The Ostional project has not diminished the illegal egg

trade, which still occurs on both coasts of Costa Rica and invades national parks whenever rangers or scientists let their guard down. Away from the beaches enforcement is severely lacking or nonexistent. In addition, since the loss of Robinson, efforts of biologists have lacked the guidance needed to maintain the scientific integrity of the project. The *arribadas* have decreased in numbers of turtles during the late 1990s. It is not clear how much of this decline is due to the long-term egg harvest and how much is due to the mortality of olive ridleys in the net and longline fisheries in the Pacific. Development in Nosara, 12 km south, has forced land values out of the reach of local people, just as at Las Baulas. Developers are buying land surrounding Ostional and planning to build tourist facilities. It would be premature to term this experiment a success and a major mistake to take it as a model for sustainable development of other communities near sea turtle nesting beaches. This is an unfinished experiment, one in great need of more vigorous management by MINAE, in concert with more vigorous enforcement of laws for sea turtle protection throughout Costa Rica.

#### LESSONS AND RECOMMENDATIONS FOR THE FUTURE

Many lessons can be learned from the story of sea turtles in Costa Rica. In 1964 Archie Carr wrote the following about conservation in Africa: "But the saving of wild beings from obliteration cannot be expected to pay for itself in more than a sprinkling of special cases. For most of the wild things on earth, the future must depend upon the conscience of mankind. . . . The welfare of the wildlife will have to be reckoned against the rights of multiplying African man" (172-73). In 1993 Bonner echoed these sentiments when he stated that if Africa's wildlife is to be saved it will require radical policies and changes in attitudes. Certainly both of these sentiments apply to the saving of sea turtles in Costa Rica. The central lesson of the past 45 years is that there has to be a radical change in the approach of Costa Ricans and their government if

they are to succeed in preserving sea turtles on their beaches and in the oceans.

#### SUCCESS IN SOME ASPECTS

A dedicated cadre of conservationists have succeeded in establishing and maintaining a wonderful park system in Costa Rica. Mario Boza, Alvaro Ugalde, Pedro León, Sigfredo Marín, and their colleagues have worked vigorously and effectively for the parks. At the same time they have been helped by many North American biologists who have provided a scientific basis for management of the parks. From the beginning foreigners have played an essential role in the national park system (Wallace 1992). In general, parks have had the support of most of the people of Costa Rica. Sea turtles are viewed as charismatic creatures, and certainly people of the Central Valley believe that Costa Rica is defending these animals.

#### THE FUNDAMENTAL PROBLEM

The consensus is that it is on the beaches and among local people where problems arise. This is a convenient alibi that masks a more fundamental problem in the Costa Rican approach to sea turtle protection and wildlife conservation in general: the "power elite"—the ruling class that controls the political and economic power in a country—of Costa Rica sees economic development and profit as more important than conservation of natural resources, development of a modern park system, and protection of wildlife, including sea turtles. This is a familiar problem in all countries. It is always a matter of balancing budget priorities in government and of raising private funds for conservation organizations. However, in Costa Rica conservation is losing, and whereas in the United States and Europe the "civil society" is committed to conservation, this is not true in Costa Rica. There is a fundamental lack of philanthropy on the part of wealthy Costa Ricans. They expect foreigners and their conservation organizations to continue to provide monetary support for the park system. Although many young Costa Ricans and middle-class adults have volunteered their time

and donated modest amounts of money (from \$5 to \$10,000) to support sea turtle and other conservation projects, wealthy Costa Ricans, in general, have not provided substantial amounts to support the park system. In addition, there is little support in the government for the park system. This is most obvious in the lack of commitment of funds to the parks. Despite ecotourism being the number one source of foreign revenue, inadequate funding hinders development of park infrastructure, training of park personnel, and protection. Even more damaging is the subservience of the park system and environmental protection to development and tourism interests. When there is a choice between demands of protection of turtles on the beach at Las Baulas and access to turtles by guides and tourists, the latter wins because of the power of the tourism agency, Instituto Costarricense de Turismo (ICT), to overrule MINAE. There is a tax on tourists entering and leaving the country, but this money goes to support ICT, not the parks. Although Costa Rica is seen as a leader in ecotourism and parks (Terborgh 1999), it is essentially mining its parks for tourist dollars and putting few resources back into parks to sustain them. Finally, laws to prevent poaching, protect beaches, regulate fishing, and defend wildlife are weakly enforced (see chapters 22 and 23).

There is a lack of leadership at the highest levels in MINAE and the government and an entrenched, inefficient bureaucracy in MINAE and the Park Service. The low priority the government gives to protection leads to institutional weakness. The political leadership fails to demand successful conservation and fails to provide adequate training and motivation to MINAE and Park Service staffs. Most personnel of the park system and MINAE lack formal training in how to develop a park, build infrastructure, interact with tourists, and defend the parks. They spend their time ensuring their own welfare in the bureaucracy rather than the welfare of the natural resources they are supposed to protect. Most rangers are poorly educated, poorly paid, and little motivated to do their jobs. In fact, they

do not know exactly what a park ranger is supposed to do. As in other countries (Terborgh 1999), most guards are not empowered, and so they occupy themselves with controlling tourists and scientists while closing their eyes to the more serious challenge of evicting squatters and controlling developers. Although it is true that Costa Rica has a much more organized park system than most other tropical countries (Terborgh 1999), it is also true that its parks sustain a much greater number of ecotourists and a much greater rate of development along their borders than parks in those countries.

Costa Rica is caught in the same trap as many other nations. With an expanding population, a declining resource base, and a large foreign debt, there seems to be little hope for securing the resources needed to ensure protection of the established national parks, let alone new ones such as Las Baulas. Without sustainable development the future will be grim, and our play about sea turtles will indeed end as a tragedy. However, no nation has captured or is close to reaching the golden egg of sustainable development, and there is no guarantee that sustainable development will lead to harmony between humans and nature (Frazier 1997).

#### NEED FOR RADICAL CHANGE

Costa Ricans will have to outgrow their *laissez-faire* attitude toward environmental protection and establish strong, clear laws to control development and protect the parks and natural resources contained in them on land and sea. They also will have to reform the legal system to provide vigorous enforcement of these laws. We agree with Terborgh (1999) that there is no substitute for enforcement. Without it all is lost.

Next the park system will have to be revitalized. It can no longer operate as a biodiversity welfare system dependent on donations from foreign governments and conservation organizations. Plenty of resources are available in the form of ecotourism dollars and biodiversity royalties. If Costa Ricans want to preserve their biodiversity, their parks, and, most important for this story, their sea turtles, they will have to

use some of those resources to fund their conservation infrastructure adequately. Personnel need to be adequately trained, led, and paid in order for them to do their jobs effectively. Professionals with university and advanced degrees need to be hired. Perhaps an exchange program with park systems in nations such as the United States and Canada, not based on a welfare program but on a work program, would be effective. Rangers from those nations could be given release time to come to Costa Rica to train rangers on-site and to learn about the biodiversity in Costa Rica firsthand, and rangers from Costa Rica could take their place in the home country and learn how an effective park system functions by working in it.

If more progress is not made, it may be necessary to internationalize the parks in order to save them (Boza 1993). Sea turtles are international resources. Leatherbacks at Las Baulas are an international treasure, and the beaches there must be vigorously protected or leatherbacks will become extinct in the Pacific Ocean. If the people of Costa Rica cannot protect the nesting beaches, pressure will increase for the international community to step in and carry out that function. Certainly the precedent has been established that the international community has the right to intervene in a country to protect human rights, as in Bosnia and Kosovo. It will not be too long in the future before the international community establishes the precedent that it has the right to intervene in a country to protect nature and biodiversity vital to the future well-being of the global community. This is one basis of the evolving theory of environmental security. This theory arose from the concept of preventive defense (Carter and Perry 1999), which seeks to prevent wars before they occur. Environmental security goes a step further and states that environmental problems such as overpopulation, lack of resources, and environmental degradation can be the causes of conflict and will become the predominant causes of conflict in the decades to come (Myers 1993).

Because Costa Rica has so much biodiversity and the most critical sea turtle nesting beaches

in the Pacific, it has the obligation to protect them by making changes in its conservation strategy so that its parks accomplish their stated purpose. If it does not, it can expect that other nations will become increasingly involved.

This play does not have to end as a tragedy. Costa Rica has the basis for success in sea turtle conservation and in reforming its park system and environmental ministry. It has a democratically elected government that enjoys the support of the people. Most of its population appreciates the intrinsic value of nature, and most of its people are educated. There is already a large area of land set aside in parks and a cadre of senior conservationists who can lead a revitalized park system, and the youth of the nation are committed to the protection of plants and animals. There is no nation in the tropics better positioned to take the next step into real nature conservation. All that is needed is the political will on the part of the power elite to change their priorities and make conservation an ethical imperative (Oates 1999) instead of an advertising initiative.

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