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Arizona-Sonora Desert Museum Studies in Natural History

SERIES EDITOR
Richard C. Brusca

Sea Turtles of the Eastern Pacific Advances in Research and Conservation

Edited by
Jeffrey A. Seminoff and Bryan P. Wallace

Foreword by Peter C. H. Pritchard



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Contents

Exhibit C-115

Page 2 of 19

Foreword vii

PETER C. H. PRITCHARD

Introduction 1

JEFFREY A. SEMINOFF AND BRYAN P. WALLACE

Part I: Sea Turtle Biology and Human Dimensions

- 1 **Biology and Conservation of Sea Turtles in the Eastern Pacific Ocean: A General Overview** 11
JEFFREY A. SEMINOFF, JOANNA ALFARO-SHIGUETO,
DIEGO AMOROCHO, RANDALL ARAUZ,
ANDRES BAQUERO GALLEGOS, DIDIER CHACÓN CHAVERRI,
ALEXANDER R. GAOS, SHALEYLA KELEZ, JEFFREY C. MANGEL,
JOSE URTEAGA, AND BRYAN P. WALLACE
- 2 **Sea Turtles in the Tropical High Seas: Climate Variability, Oceanography, and Ecosystem Responses** 39
VINCENT S. SABA
- 3 **Offshore Oasis: Ecology of Sea Turtles at Oceanic Islands of the Eastern Pacific** 63
PATRICIA ZÁRATE
- 4 **Sea Turtles of the U.S. West Coast: Life in the Higher Latitudes** 88
SCOTT R. BENSON AND PETER H. DUTTON

Part II: International Management and Policy Frameworks

- 5 **Fisheries Management off the U.S. West Coast: A Progressive Model for Sea Turtle Conservation** 113
MARK HELVEY AND CHRISTINA FAHY



serve as habitats ship bet The Eas most dy unique s this mas estuarie ocean, a often th The dist resulte morph o olive rid on the p understa How that mak also pro fishing e of eggs z turtle po and stori describe exploitat vation in region. T the biol

- 6 No "Silver Bullets" but Plenty of Options: Working with Artisanal Fishers in the Eastern Pacific to Reduce Incidental Sea Turtle Mortality in Longline Fisheries 136
MARTIN HALL, YONAT SWIMMER, AND MARILUZ PARGA
- 7 International Instruments: Critical Tools for Conserving Marine Turtles in the Eastern Pacific Ocean 154
JACK FRAZIER

Part III: Field-Based Conservation and Signs of Success

- 8 Leatherbacks in the Balance: Reconciling Human Pressures and Conservation Efforts in Pacific Costa Rica 193
BRYAN P. WALLACE AND ROTNEY PIEDRA CHACÓN
- 9 Nesting Beach Conservation in the Mexican Pacific: The Bridge between Sea Turtles and People 224
ANA REBECA BARRAGÁN
- 10 Saving the Eastern Pacific Hawksbill from Extinction: Last Chance or Chance Lost? 244
ALEXANDER R. GAOS AND INGRID L. YAÑEZ
- 11 Current Conservation Status of the Black Sea Turtle in Michoacán, México 263
CARLOS DELGADO TREJO AND JAVIER ALVARADO DÍAZ
- 12 Empowering Small-Scale Fishermen to Be Conservation Heroes: A Trinational Fishermen's Exchange to Protect Loggerhead Turtles 279
S. HOYT PECKHAM AND DAVID MALDONADO DÍAZ
- 13 Interpreting Signs of Olive Ridley Recovery in the Eastern Pacific 302
PAMELA T. PLOTKIN, RAQUEL BRISEÑO-DUEÑAS, AND F. ALBERTO ABREU-GROBOIS
- Appendix 337
About the Editors 357
About the Contributors 358
Index 369

Nearly five hundred years ago, in 1554, a short, stout, bearded, affable French savant *bon vivant* and former monk by the name of Guillaume Rondelet published a large-format book, ostensibly about marine fishes. The title—*Libri de Piscibus Marinis, in quibus verae Piscium expressae sunt*—was a confusing one. While the title refers to fishes, this must be construed as "fish" in the medieval sense of aquatic creatures in general. Thus, to this day, the papal decree establishing turtles as "fish," and therefore available for consumption during Holy Week, continues to confound the efforts of Venezuelan tortoise conservationists (and Archie Carr's celebrated 1967 book *So Excellent a Fish* is about turtles, not fish). Rondelet clearly had a broad concept of the word "fish," his book offering not only a droll engraving of a freshwater mammal (a beaver) but also a salamander, a crocodile, and several renderings of bizarre and fanciful hybrids between fish and humans, including the Bishop Fish ("De Pisce Episcopii hanitu") and the King Fish ("De Pesce monachi habitu"), although he avoids committing to whether he believed in the existence of the latter monstrosities himself.

Rondelet spent much of his life near his birthplace at Montpellier, in the south of France, and his book also included a pair of rather Gothic but clearly recognizable engravings of the two species of marine turtles most likely to be found in Europe: the loggerhead (*Testudo corticata*) and the leatherback (*Testudo coriacea* or *T. mercurii*). The engraving of the leatherback was not the first ever published—Candidus (1460) had illustrated the species a century earlier—but Rondelet's was a superior piece of art. Each engraving was accompanied by a lengthy text, summarizing the published statements of the author's predecessors on the subject of turtles. As it happened, the predecessors were ancient indeed—Pliny, Aristotle, Strabo, Opius, Hesychius—and most of them had little to say about turtles that was not just inaccurate hearsay or, even worse, unchecked imagination. Rondelet did his homework, and his great contribution was to examine the state-

Leatherbacks in the Balance

Reconciling Human Pressures and
Conservation Efforts in Pacific Costa Rica

BRYAN P. WALLACE AND
ROTNEY PIEDRA CHACÓN

Summary

For decades Costa Rica has been regarded as the model for biodiversity conservation in Central America, primarily because of its network of protected areas spanning diverse terrestrial ecosystems. Likewise, Costa Rica recently has emerged as a regional leader in efforts to repeat these conservation successes in the marine realm. In particular, Costa Rica is home to several well-developed sea turtle conservation efforts, specifically along its Pacific coast. One of the best-known examples of the struggles, complexities, and successes of sea turtle conservation in the eastern Pacific Ocean has occurred at Parque Nacional Marino Las Baulas (PNMB), in Guanacaste Province, northwest Costa Rica. The leatherback nesting colony at PNMB has been reduced more than 90 percent over the past two decades, mirroring the regionwide precipitous decline of eastern Pacific leatherbacks, which is considered to be one of the most urgent sea turtle conservation issues globally. However, unlike most leatherback nesting beaches in the eastern Pacific, historic threats (e.g., harvest of eggs) to nesting leatherbacks at PNMB have been eradicated through comprehensive protection of nesting females and their eggs and hatchlings by integrated efforts of park rangers, scientists, local communities, and volunteers. For these reasons, the leatherback nesting colony at PNMB has been identified as the most likely site for recovery of leatherbacks in the eastern Pacific. In this chapter, we review how the relationships between humans and leatherbacks and their nesting habitat have changed over time, how the current scenario of conflicting as well as convergent human interests is affecting the continued threat of ex-

inction confronting eastern Pacific leatherbacks, and how current conservation efforts and scientific research focusing on leatherbacks in Costa Rica are being leveraged to achieve broader national and international conservation aims. We end by presenting three possible scenarios that might portray the future of human interests and conservation of leatherbacks and natural areas in PNMB.

Brief Background on Costa Rica Conservation Issues

Costa Rica is unique with respect to the rest of Central America for several reasons. For example, Costa Rica has enjoyed peace (it has no standing army) as well as relative political and economic stability (representative democracy and a market-based, capitalist economy) during the same period that several of its neighbors have been dramatically affected by civil wars, governmental turmoil and dysfunction, and severe poverty. Indeed, the 2010–2011 United Nations Human Development Index, which assesses the achievements in health, knowledge, and standard of living for countries around the world, ranked Costa Rica among countries with “High Human Development” (UNDP 2007).

These fortuitous characteristics have also allowed biodiversity conservation to flourish in Costa Rica as a movement, as the engine of a highly lucrative tourism industry, as a well-developed national parks system, and as a source of national pride and identity for Costa Ricans. As such, Costa Rica has earned special recognition as a model for conservation in Latin America, owing to its landmark network of terrestrial protected areas that encompasses a wide array of ecosystems and associated biodiversity. In fact, according to the Ministerio del Ambiente, Energía y Telecomunicaciones (MINAET) and the Sistema Nacional de Áreas de Conservación (SINAC), approximately 26 percent of Costa Rica’s land area is afforded some form of protection (SINAC 2011).

Likewise, in the marine realm, Costa Rica recently reinforced its regional leadership in conservation when former president Abel Pacheco declared the nation’s intention to protect 25 percent of its marine exclusive economic zone under some type of management scheme; currently 16 percent of Costa Rica’s marine areas have some form of protected status (SINAC 2011). While suffering from challenges faced by protected area systems

worldwide, which consist predominantly of resource deficiencies (e.g., numbers of trained staff, money, equipment), the system of protected areas in Costa Rica has achieved significant success in biodiversity conservation (Boza 1993).

Not only has Costa Rica’s investment in biodiversity conservation increased over the past few decades, but revenue from tourism now constitutes more than 20 percent of all of Costa Rica’s exports, or more than double the revenue generated by coffee and banana exports combined (Instituto Costarricense de Turismo 2005). Not surprisingly, this influx of tourism and investment in tourism-related development projects is not always in harmony with conservation of natural resources and protected areas. Thus, biodiversity conservation in Costa Rica currently finds itself at the mercy of often competing human interests. However, because the tourism industry ultimately depends on healthy, protected ecosystems and biodiversity, integration of sound conservation strategies into land-use and resource management plans and development projects is imperative for both lucrative tourism and vibrant biodiversity to persist in Costa Rica.

Because conservation is typically local in scale, each struggle between competing interests transpires according to its unique circumstances and players. It is in this context that several efforts to conserve populations of sea turtles in Pacific Costa Rica are taking place.

Sea Turtles in Costa Rica: Overview of Species and Special Nesting Sites

Faced with the daunting challenge of creating a system of protected areas from scratch in a developing country, Don Mario Boza, Don Alvaro Ugalde, and others decided to highlight areas where strong scenic, historic, and natural values coincided to generate interest and support for the idea of protected area conservation (Boza 1993). Interestingly, but perhaps not surprisingly, of the first four national parks created in Costa Rica in 1970–1971, three—Tortuguero, Cahuita, and Santa Rosa—included important sea turtle nesting beaches. Currently, all six of the eleven Conservation Areas within the framework of SINAC that have marine coastlines include protected areas in which sea turtles occur. Five of the world’s seven sea turtle species occur in Costa Rica: the loggerhead (*Caretta caretta*), the

hawksbill (*Eretmochelys imbricata*), the green turtle, also called the East Pacific green turtle or black turtle (*Chelonia mydas*), the olive ridley turtle (*Lepidochelys olivacea*), and the leatherback turtle (*Dermochelys coriacea*) (see plates 1–10). The loggerheads (see chapter 12), hawksbills (see chapter 10), black turtles (see chapter 11), and olive ridleys (see chapter 13) in the eastern Pacific are covered elsewhere in this volume.

Costa Rica (Tortuguero National Park, specifically) is considered by many to be the cradle of sea turtle conservation and research, owing to the legacy of famed sea turtle researcher Archie Carr. Dr. Carr's pioneering work started in the 1950s and included studies on nesting ecology and reproduction as well as at-sea movements and migrations. His books, including *The Windward Road* (1956) and *So Excellent a Fish* (1967), offer detailed and fascinating perspectives into Dr. Carr's life and work. In the decades since Dr. Carr raised the international profile of sea turtle conservation, many new sea turtle conservation projects involving countless researchers, volunteers, and local communities have taken root in Costa Rica. Sea turtles are now iconic species for Costa Rica's biodiversity conservation efforts and ecotourism industries.

A microcosm of the complex and challenging interactions among people, sea turtles, and natural areas they share in the eastern Pacific region is Parque Nacional Marino Las Baulas (PNMB, or Leatherback National Marine Park) on the Pacific coast of Costa Rica (plate 1). PNMB has been the setting for a remarkable story, starting with the relationship between a small local community and thousands of leatherbacks each year, thirty years ago, to a burgeoning residential and tourist population and fewer than a hundred leatherbacks per year at present (fig. 8.1). Creating a balance among the survival of leatherbacks, the livelihood of the local communities, and the prosperity of developers and investors has been elusive, and it will require effective cooperation among all parties and interests involved.

Playa Grande in the Early Days: Lots of Turtles, Few People

The number of human players and the nature of their interactions with leatherbacks and leatherback nesting habitat within present-day PNMB have changed tremendously during the past five decades. During the 1950s

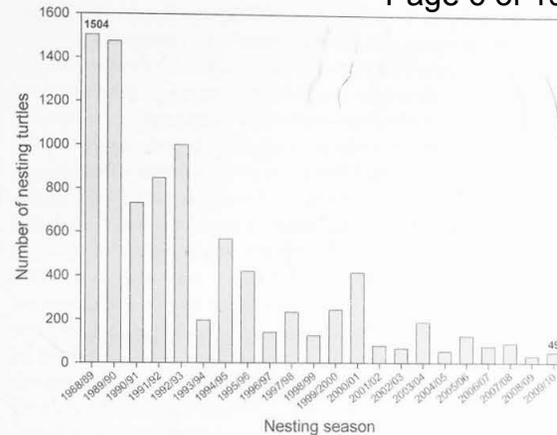


FIGURE 8.1. Number of nesting leatherback turtles in Parque Nacional Marino Las Baulas, Costa Rica, from 1988 through 2010. Annual nesting has declined from approximately 1,504 leatherbacks in 1988/1989 to 49 individuals in 2009/2010. Figure courtesy of M. Santidrián Tomillo, F. V. Paladino, and J. R. Spotila.

through the early 1970s, the area including Playas Grande, Ventanas, Tam-arindo, and Langosta and surrounding mangrove estuaries and maritime forests was inhabited by a just handful of families, because it was accessible from outside areas only on horseback or by foot. Local families made trips to the beach at night, gathering in small *fiestas*, as parents brought their children to Playa Grande to watch the leatherbacks come ashore to lay their eggs. As turtles lumbered back to the sea after nesting, children would literally ride turtles down to the surf and jump off before being carried into the dark ocean horizon.

People who lived in the area recall the increase in leatherback numbers on Playa Grande (the primary nesting beach in the system) from relatively few in the early 1950s to more than 100–150 individual turtles *nightly* during the December–January peak of the nesting season in the late 1960s

and early 1970s (Wallace and Saba 2009). Witnesses likened these incredible numbers of nesting leatherbacks on the beach to swarms of *hormigas*, or ants—an amusingly illustrative comparison considering the enormous size of adult leatherbacks (~1.5 m long and ~400 kg in mass). At that time, local families engaged in subsistence harvest of leatherback eggs, typically using no more than one or two nests per week. Thus, leatherback eggs supplemented local families' typical food intake, which included agriculture (e.g., rice, fruits, and livestock) and other local sources (e.g., deer from the dry forest and clams, crabs, and fish from the ocean and estuaries). This level of egg harvest was sustainable and by itself would have had a negligible impact on the leatherback population.

What Led to the Collapse: No Eggs Left Behind

By the late 1970s, however, Playa Grande was a very different place. Several people who lived in the area at the time corroborated that the main turning point was the construction of the road that led directly to the beach. Because people could reach Playa Grande by motorized vehicles, subsistence egg harvest gave way to systematic egg harvest that resulted in more than 90 percent of all eggs being removed from the beach each night (Santidrián Tomillo et al. 2007). This eventually would be a primary driver for the overall population decline at PNMB, coupled with unsustainably high mortality due to interactions with fisheries (Santidrián Tomillo et al. 2008; reviewed by Wallace and Saba 2009).

The eggs were largely sold to far-off markets in the Central Valley of Costa Rica (home to the capital, San José, and surrounding towns) and Limón, rather than remaining within the local communities. In previous years, parents had brought their children to the beach to watch the *hormigas*, and the number of turtles was always greater than the number of people on the beach at any given time. In contrast, during this period of comprehensive egg harvest, the beach was occupied from one end to the other with people collecting entire clutches of the billiard-ball-sized eggs from nearly every nesting leatherback. Tracts of beach roughly 100 m in length were reserved by individuals who claimed the "rights" to all the clutches laid by turtles in their section. The eggs were then sold to middlemen, who transported them by truck to the distant markets. Instead of only coming from

communities adjacent to Playa Grande, the people who reaped the bounty of leatherback eggs at Playa Grande came from all over Guanacaste Province and the rest of Costa Rica, and from various walks of life. For example, one anecdote recalls policemen from Liberia (the provincial capital, ~50 km from Playa Grande) coming directly to the beach after their shifts—still in uniform—to partake in the harvest.

Because leatherbacks continued to nest in extremely large numbers during this period of intense egg harvest, local people generally did not foresee the imminent population collapse that would result from essentially removing a generation of new recruits from the leatherback population. In fact, an ironic (if not chronologically accurate) local legend maintained by a few old-timers has it that it was the formation of the national park and the scientific activities of the monitoring studies (e.g., tagging, weighing, measuring, etc.)—not the population impacts of comprehensive egg harvest—that drove the turtles away because they were averse to the change in treatment from the caring, respectful handling during the harvest years to the callous manipulation by scientists under the national park regime.

Egg harvest as a main factor in declines of sea turtle populations is not unique to Playa Grande. Comprehensive egg harvest contributed to the collapse of the Terengganu, Malaysia, leatherback population in the western Pacific Ocean (Chan and Liew 1996), as well as to the decline of leatherbacks nesting on the Pacific coast of México (Sarti Martínez et al. 2007; see chapter 9 in this volume). Sea turtle eggs are consumed worldwide for subsistence and are used for baking, but they are also considered delicacies and are widely believed to be aphrodisiacs (Spotila 2004; see plate 12). The black market for sea turtle eggs remains strong in Costa Rica as well, where local bars throughout Guanacaste and elsewhere continue to offer *tragos* or shots of raw sea turtle egg yolks that accompany sugar cane liquor drinks (*guaro*) or beers. Income generated by the legal egg harvest of the first 36 hours of olive ridley *arribadas* at Playa Ostional Wildlife Refuge has resulted in numerous community development projects (Campbell 1998, 2007); however, this egg harvest program's existence and execution remain controversial (Spotila and Paladino 2004). Nonetheless, as the example of Playa Grande's leatherbacks demonstrates, unchecked, comprehensive, unsustainable egg harvest eventually results in declines in numbers of nesting female sea turtles (Santidrián Tomillo et al. 2008).

The Shift from Exploitation to Protection: The National Park

As is the case in many local conservation stories, the paradigm shift from unsustainable human behavior threatening biodiversity to responsible human behavior to conserve and protect it began as a combination of outside influences and internal transitions. Doña Esperanza Rodríguez was one the “landlords” of Playa Grande who not only collected eggs but also “rented” to the “tenants” of the 100-m sections of beach, patrolling each night’s activities on horseback. In the late 1980s, Doña Esperanza began to accompany a biologist from San José, Doña María Teresa Koberg, on María Teresa’s daily censuses of turtle tracks and nests poached, because Esperanza wanted to ensure María Teresa’s safety. Through her efforts, and those of others like Dr. Peter Pritchard (see the foreword to this volume), María Teresa was the first to begin the shift from egg harvest to beach protection.

Over time, María Teresa befriended Esperanza to the point that when María Teresa had to return San José, she enlisted Esperanza to continue counting turtle tracks and the proportion of nests whose eggs had been taken and sold. Esperanza began performing morning beach censuses on horseback using two hand counters—one to tally the number of turtles that nested the previous night, and the other to tally the number of nests that were poached. Upon returning from her censuses, Esperanza gave the counters to record keepers who transcribed each night’s counts for each season and each year; Esperanza could neither read nor write. Interestingly, the data recorded by Esperanza in the early years (1988–1992) actually composed the baseline for analyses published in a seminal study in one of the world’s premiere scientific journals, *Nature*, that projected the eventual extinction of leatherbacks at Playa Grande based on the exponential decline in the number of nesting turtles from 1988 through 1999 (Spotila et al. 2000).

It was her involvement in the monitoring efforts and her friendship with María Teresa that eventually led Esperanza to eschew her occupation as egg harvester and “landlord” at Playa Grande in exchange for a position of protection of nesting females and their nests. While some affectionately refer to Esperanza as “the first national park ranger” at Playa Grande (fig. 8.2), she was not alone in the momentum to mitigate the threats to the leatherback population and shift the focus from exploitation to conservation.



FIGURE 8.2. Doña Esperanza Rodríguez on horseback, donning her Park Guard uniform shirt and cap (photo courtesy of B. P. Wallace). Note the counter in her left hand, which she used to do daily nest tallies on Playa Grande and Playa Ventanas. Her morning censuses provided the baseline data for tracking the population trend for nesting leatherbacks at Parque Nacional Marino Las Baulas.

At the same time that María Teresa and Esperanza began to work together, the first significant conservation actions by the Costa Rican government occurred in 1987, with the creation of the Tamarindo National Wildlife Refuge, which included Playa Grande, Playa Ventanas, and the Tamarindo mangrove estuary. This mangrove system was declared a wetland of international significance by the RAMSAR Convention in 1993. The creation of the Parque Nacional Marino Las Baulas by executive decree in 1991 and later by law in 1995 was the result of many years of efforts by several people, including María Teresa Koberg, Peter Pritchard, Louis Wilson, Mario Boza, Clara Padilla, Jim Spotila, and Frank Paladino. For a more thorough account of this process and the important players, see Spotila and Paladino (2004).

Unfortunately, despite the protection afforded to the leatherbacks, their eggs, and their nesting habitat by the creation of PNMB, the latent effects of the historic egg harvest, compounded with high levels of mortality due to fisheries bycatch, manifested in the inevitable collapse of the population from more than 1,000 individual females annually in the late 1980s to fewer than 100 individuals in recent years (fig. 8.1; Santidrián Tomillo et al. 2007). However, the establishment of the national park, administered by officials and park rangers of the Área de Conservación Tempisque (ACT) and SINAC/MINAET, and a long-term research and monitoring program led by Spotila and Paladino at Playa Grande and by Elizabeth Vélez and Rodney Piedra at Playa Langosta (Piedra et al. 2007) have ensured the comprehensive protection of leatherbacks and their nesting habitat to prevent complete extinction of this population (Santidrián Tomillo et al. 2008).

Meanwhile, the leatherback population nesting on the Pacific coast of México has suffered a similar decline in numbers due to the effects of similar threats of egg harvest and fisheries bycatch (plates 11 and 12), but also including harvest of nesting females (Sarti Martínez et al. 2007; see chapter 9 in this volume). In contrast to PNMB, leatherback nesting beaches in México are extremely long and difficult to patrol and police. Without the infrastructure for enforcement of conservation regulations provided by a national park in a discrete area, threats to leatherbacks have been much more difficult to address on Mexican nesting beaches than in PNMB, despite enormous, admirable efforts by Mexican biologists and conservationists for the past two decades (Sarti Martínez et al. 2007; see chapter 9 in this

volume). For these reasons and because of the integrated efforts of the people described below, PNMB is recognized as the most plausible site for eventual recovery of leatherbacks in the eastern Pacific.

The New Threat: Coastal Development

Despite PNMB's advantages, it is an anomaly in many ways: it includes a fairly large marine component extending twelve nautical miles from shore, a coastal mountain, and a complex of mangrove estuaries, but the protected nesting beach zone extends only 125 m from the mean high tide line, and development is fast encroaching on existing open beachfront land. The land within this narrow strip of beach and bordering vegetation is currently the subject of an intense struggle between conservationists and developers, pitting the future of the endangered leatherbacks that nest there against the economic interests of the tourism and development industries in Costa Rica.

In recent years, unsustainable coastal development has replaced egg harvest as the principal threat to the present and future sanctity of critical leatherback nesting habitat at PNMB. In the town of Tamarindo, located across Tamarindo Bay from Playa Grande, impacts associated with beachfront development, including pollution from artificial light as well as solid and chemical wastes, unsustainable water consumption, increased number of scavenging domestic and feral animals (e.g., dogs), beach erosion, deforestation, and loss of mangrove estuary habitat, have occurred within the past two decades. Playa Tamarindo once hosted significant leatherback nesting in the 1970s and 1980s but now hosts only numerous hotels directly on the beach, as well as thousands of residents and tourists. Not a single leatherback has nested at Playa Tamarindo since the beach was robbed of its sand for construction of paved roads and new buildings and became bathed in artificial light about fifteen years ago.

In stark contrast to the brightly lit Tamarindo beachfront, much of Playa Grande's beach habitat remains relatively pristine, maintaining a "green curtain" that creates a dark, natural backdrop for nocturnal leatherback nesting. However, in response to the thousands of tourists that visit PNMB each year, development is increasing rapidly at the northern and southern ends of Playa Grande, as well as in the park's buffer zone and im-



FIGURE 8.3. Juxtaposition of high levels of coastal development in Tamarindo, where leatherbacks no longer nest (left), and essentially pristine nesting habitat on Playa Langosta, where leatherbacks continue to nest (right). Lights and noise from Tamarindo flood Langosta at night, because the two are separated by the narrow mouth of the Langosta mangrove estuary.

mediately surrounding areas; dozens of hotels, houses, and restaurants are already in use, and there are new plans to construct more than 300 additional housing units in the upcoming years. This specter of development, having already extirpated leatherback nesting from Playa Tamarindo and other beaches in the region, has cast a new shadow on the prospect of successful recovery and persistence of leatherbacks at PNMB. Figure 8.3 illustrates this stark contrast: Tamarindo is just across the narrow mouth of the Langosta mangrove estuary from Playa Langosta, and lights and noise from Tamarindo flood the otherwise wild beach habitat of Langosta at night.

In 2002, an environmental impact statement was sought by an enormous development project proposing to build 186 condominium residences in the middle of Playa Grande, also the principal nesting hotspot for leatherbacks in the park, as part of its requirements to obtain building permits from the Costa Rican government. This proposal, with its potentially

disastrous results for leatherbacks and their nesting habitat, was rejected because of strong opposition from local communities, park rangers, scientists, and conservationists. This episode served as a wake-up call for several groups involved in conservation at PNMB, including the PNMB administration, community groups, scientists, and nongovernmental organizations (NGOs).

Beginning in 1991 with the establishment of PNMB, Costa Rica declared its commitment to the protection of the leatherback and its critical nesting habitat. Today, many years after the park's creation, its consolidation has become the flashpoint for an intense struggle among developers and investors, conservationists and scientists, the local community and the government. To facilitate consolidation of the open land within the national park, Drs. Spotila and Paladino formed the Leatherback Trust in 2000, a nonprofit organization registered both in the United States and in Costa Rica, including administration and participation by Costa Rican citizens. One of the first actions of this organization was to fund the development of the management plan for PNMB by the Tropical Science Center and the ACT. The Leatherback Trust's Costa Rican arm, directed by Mario Boza, has also supported park activities and various local communities through capacity-building initiatives and environmental education projects. In addition, the Leatherback Trust has executed an energetic public relations campaign to keep the public informed about how various activities and actions will help or hurt PNMB. The primary activity of the trust has been to raise funds to facilitate the Costa Rican government's expropriation of contested open land within PNMB. The Leatherback Trust and other allies of PNMB, including PRETOMA (Programa Restauración de Tortugas Marinas) and the Costa Rican National Network for the Conservation of Marine Turtles, have persisted in the urgent need to consolidate the PNMB against intense and relentless resistance from investors and developers with interests in the area.

Despite monumental legal and philanthropic efforts by the Leatherback Trust, as well as ample available funds, most of the expropriations have not been undertaken at the time of this writing. This lack of action has occurred for many reasons, including insufficient government funds, but principally because expropriation of land from private landowners, despite the land being within a national park area, is a complicated, delicate, tenu-

ous, and extremely contentious process for the government to execute, especially for a democratic country friendly to foreign investment like Costa Rica. However, in 2008 the Costa Rican Supreme Court ruled that because national law calls for absolute protection of biodiversity, the government is obligated to proceed with the acquisition of this land to carry out the consolidation of PNMB. Despite the complications, the expropriation process is continuing, with the imminent acquisition of eleven plots of land (pending a final judicial resolution) in critical areas for leatherback nesting within PNMB.

In addition to the terrestrial consolidation efforts, complementary efforts by other governmental organizations and NGOs, such as UNESCO, Conservation International, and MarViva, have strengthened the network of marine protected areas under the jurisdiction of the governments of Costa Rica, Panamá, Colombia, and Ecuador, within the Eastern Tropical Pacific Seascape (Shillinger 2005). Fortunately, the consolidation of PNMB is also being bolstered by the collective work of a diverse group of conservation-minded people also working to ensure a future for PNMB and its leatherbacks.

Equipo Baulas: An Integrated Team for Leatherback Conservation at PNMB

Successful conservation in PNMB has occurred because of a dynamic, collaborative relationship between groups of people with different backgrounds and experiences. Among the players are park rangers, who are well trained and experienced; local community guides for turtle tours, who work day jobs and take tourists onto the beach at night to see nesting leatherbacks; biologists, who patrol the nesting beach nightly for nesting leatherbacks and conduct scientific research on all aspects of leatherback ecology to inform conservation efforts; and a broad spectrum of others, including local residents and business owners (specifically Carlos Enrique “Kike” Chacón and Yanira Vargas), volunteers from Costa Rica and other countries, administrators, lawyers, and tourists. Although getting all of the pieces to work together effectively has taken several years and continues to require substantial efforts, these seemingly disparate groups currently comprise an effective *equipo*, or team, focusing on leatherback conservation at PNMB.

Park Rangers

Park rangers manage all activities within PNMB each night during the nesting season, including vigilance of tourists for turtle viewing and tours, control of entry to the beach during nocturnal hours, and oversight of research activities. Several of the park rangers are themselves biologists, not only offering support and advice to the permanent research team but also conducting research and monitoring in the park. Since 2006, park rangers have also conducted patrols of the marine sector of PNMB, which is a no-take reserve, in cooperation with MarViva, a nonprofit organization that supports marine protected area management throughout the eastern Pacific. During this time, a cooperative agreement between MarViva and MINAET established marine patrols that involve MarViva personnel and resources, PNMB park rangers, and Costa Rican Coast Guard officials. Conservation International and UNESCO have facilitated the acquisition of a new boat and radar for ACT to allow patrols to continue in the marine sector of PNMB. Through these combined efforts, fishing and boating impacts have been dramatically reduced within PNMB. Additionally, this initiative has led to collaborative research in ecosystem function in PNMB between park rangers and Costa Rican National University researchers.

In addition to the oversight and enforcement of national park rules during turtle nesting on the beach and in the marine sector, park rangers also deal with issues of land use (e.g., construction) in and around the park. PNMB rangers document and cite violators of illegal vegetation clearance and filling of mangrove estuaries for purposes of building. Rangers also assist in development and implementation of environmental education programs, solid waste management, community outreach, and general protection efforts. Thus, the cumulative responsibilities of a PNMB ranger are year-round, rather than just during leatherback nesting season, as is the case for all of the other groups involved in leatherback conservation in PNMB. Unfortunately, due to the aforementioned shortage of people and funding available to PNMB, park rangers are typically stretched thin and are unable to prevent all infractions at all times. In fact, budget limitations at the beginning of 2009 resulted in a decrease in PNMB staff from six or more park rangers to only four, which presents yet another significant challenge for effective management of the complete protected area.

Local Community Guides

In addition to the strong influence and important roles played by people from outside Playa Grande and outside of Costa Rica, many members of the local community also have recognized the importance of conserving the leatherbacks nesting on the beaches in their "backyards." Before the formation of the national park, Don Idanuel Contreras, Don Santos Arrieta Arrieta, and Don Luzgardo Rosales Gutiérrez recognized that a healthy population of nesting leatherbacks represented more consistent income for the community than an extirpated one, and they formed a local guide association based in the town of Matapalo, about 7 km from Playa Grande. Today, the Matapalo Local Guide Association is composed of long-term members who had previously participated and benefited economically from harvesting eggs, as well as their children and grandchildren, members of a younger generation with a perception of turtles as a source of income only through tourism, not egg harvest. Similarly, another local guide association from Tamarindo also leads turtle and mangrove tours in PNMB. The Tamarindo Guide Association, originally created by the merger of three local associations committed to conservation in the PNMB area, has been led by Warren Chacón, Franklin Barrantes, Gerardo Santana, and Enrique Chavarría, and like the Matapalo guide association, its membership includes former egg harvesters as well as younger community members. This paradigm shift holds tremendous promise for a sustained conservation effort from the local community for the leatherbacks and PNMB.

Together, the Matapalo and Tamarindo guide associations administer to thousands of tourists per nesting season, both from Costa Rica and from several other countries and continents, using the income garnered from tourist fees for community development projects. Examples of such projects in Matapalo include a fence around the elementary school to keep children out of street traffic, a public address system for the town church, and renovation of the town meeting hall. In addition, nearly half of the Matapalo Local Guide Association's members are women, which is an intentional attempt to take advantage of the disproportionately large influence women have on children in Costa Rican society and thereby effectively instill a conservation ethic in the next generation. The guide associations have

also broadened their scope to raising environmental awareness and promoting sustainable resource use with respect to other relevant local issues, such as slash-and-burn agriculture and water consumption.

In addition to the Matapalo Local Guide Association, the Matapalo Women's Association was created in 2004 in support of the PNMB. The women's association performs public awareness campaigns in their town, informing their neighbors about the plight of the leatherbacks and the benefits of the national park to conservation and to their community. The association also provides home-cooked food and coffee as well as souvenirs and other items for sale to the tourists who wait for their chance to go onto Playa Grande to view a nesting turtle. This group is another example of opportunities for community empowerment provided by the existence of PNMB.

Biologists

Boza (1993) and Spotila and Paladino (2004) noted the important role that foreign scientists and conservation groups have played in international conservation issues, especially in Costa Rica. PNMB's history is no exception. The permanent research and monitoring presence began in 1988, when Spotila and Paladino, on a recommendation from Boza, began conducting physiology studies at Playa Grande and Playa Langosta. Within three years, Spotila and Paladino had initiated a population monitoring project, supported by volunteers from the Earthwatch Institute's Center for Field Research. Today, Spotila and Paladino continue to oversee the Playa Grande Leatherback Conservation and Research Project, as dozens of Earthwatch volunteers assist the team of field biologists, mostly undergraduate and graduate students, in nightly patrols and daily activities on Playa Grande and Playa Ventanas during the leatherback nesting season.

The third nesting beach in PNMB, Playa Langosta, is monitored by biologists, park rangers, and volunteers associated with PNMB and is in close contact with the project at Playa Grande. The monitoring at Langosta began in 1991–1992, when Anny Chaves and colleagues from the University of Costa Rica recorded the first leatherback nesting data for the site. The monitoring temporarily ceased until 1994, when Stanley Rodriguez, Guiselle Monge, Elizabeth Vélez, and Rodney Piedra (the latter three biolo-

gists from the National University of Costa Rica) established nest protection efforts. Two years later, Monge, Vélez and Piedra initiated the research and monitoring project with support from Paladino and Spotila and the Wildlife Conservation Society-Costa Rica. Since 1997, the project has been supported by Dr. Peter Dutton from the U.S. National Marine Fisheries Service and Earl Possardt from the U.S. Fish and Wildlife Service, and since 2008 financial assistance from the U.S. Marine Turtle Conservation Act's Conservation Grant Program has also played an important role. Vélez and Piedra have continued to manage the research and conservation project at Playa Langosta since 1998, and the help of countless volunteers has contributed greatly to the success of this project (Piedra et al. 2007).

The work of the biologists consists of monitoring and protection of nesting females, their eggs, and their hatchlings during nightly foot patrols and daytime activities such as nest excavations and beach hatchery work. In addition to the monitoring and protection efforts, the biologists conduct research studies on aspects of leatherback life history, nesting ecology, at-sea behavior and movements, physiology, and population demography. Over the course of almost 20 years, the research project has produced more than thirty graduate and honors students and at least fifty scientific publications, and it has become one of the best-known and respected sea turtle research projects in the world. In addition, the information generated by the biologists is disseminated not only in peer-reviewed scientific literature but also to park rangers and local guides in information workshops and written reports. Like the park rangers and local guides, the biologists play an inextricable role in the overall conservation work at PNMB, especially because of the long-term nature of the research efforts and the valuable information they have generated.

The Role of Research and Monitoring in Conservation Efforts at PNMB

Research and monitoring are strategically integrated with efforts to establish and enforce priorities for management within PNMB. At its core, the research conducted at PNMB allows continuous assessment of the leatherback population's status. A saturation tagging program began in 1993–1994 (Steyermark et al. 1996) and has resulted in identification of

passive integrated transponders, or PIT tags) of more than 19,000 individual turtles (Santidrián Tomillo et al. 2007), which has enhanced the understanding of the dynamics of this nesting population (Reina et al. 2002; Santidrián Tomillo et al. 2007, 2008). For example, Spotila et al. (1996) combined data from PNMB with nesting population information from other beaches around the world and concluded that the global leatherback population had declined by almost 70 percent in fewer than twenty years. Moreover, Spotila et al. (2000) used a simple population demographic model based on monitoring data from PNMB to project extinction of Pacific leatherbacks within a few decades if threats continued unabated. These dire projections have justified complete protection of the nesting beach, nesting females, and their eggs and hatchlings. Among these efforts is an egg relocation program and beach hatchery that have been supported by MINAET and the park for almost a decade, resulting in 21,000 hatchlings produced from nests that had been laid below the natural high tide line and presumably would not have survived without intervention (Santidrián Tomillo et al. 2007). However, because protection of eggs and the resulting increased production of hatchlings have limited ability to strengthen the resilience of PNMB's leatherbacks to extinction (Santidrián Tomillo et al. 2008), continued vigilance at PNMB and effective reduction of at-sea threats to leatherbacks are necessary long-term conservation strategies. Thus, information from long-term monitoring at PNMB has allowed biologists, park rangers, and local guides to embrace a strategy of consistency, patience, and optimism with respect to the nesting beach conservation efforts because of the time necessary for the leatherback population to recover.

Although nesting beach conservation has received the majority of the research attention, research on environmental conditions (see chapter 2), at-sea movements, behavior, and migration have also contributed greatly to understanding of leatherback biology and to conservation strategies. Over four seasons from 2004 through 2007, a team of biologists, park rangers, and volunteers led by Dr. George Shillinger, then of Stanford University, deployed satellite transmitters on forty-six leatherbacks (Shillinger et al. 2008, 2010). This research aimed to elucidate a previously described leatherback "migration corridor" (Morreale et al. 1996), as well as spatial habitat use by leatherbacks during their interesting periods in and around PNMB.

This satellite telemetry program has been one of the most successful research initiatives ever realized at PNMB for several reasons. Importantly, the results have directly informed leatherback conservation strategies at local, national, and multinational scales. Because leatherbacks tend to spend much, but not all, of their interesting periods within the boundaries of PNMB (Shillinger et al. 2010), park managers have solidified support for consistent and continued boat-based patrols and have successfully reduced threats to leatherbacks (and other marine animals) from small-scale fishing practices and boat traffic within the marine sector of the park. Furthermore, MINAET and ACT have leveraged the findings that leatherbacks utilize marine habitat along the entire coast of the Nicoya Peninsula during the nesting season to promote the consolidation of a network of marine conservation areas that include existing official marine protected areas as well as coastal communities that will voluntarily participate in marine conservation focused on leatherbacks. The purpose of this initiative is to coordinate management of fishing activities within key marine areas in the region.

In addition to the conservation applications of the interesting habitat use, the new data confirmed and expanded on previous reports of a relatively defined migration route for leatherbacks (fig. 8.4). This detailed description of leatherback migration through the eastern Pacific Ocean underscores the importance of multinational conservation frameworks, such as the Eastern Tropical Pacific Seascape Initiative (Shillinger et al. 2008). Leatherbacks are considered a flagship species of the region, which makes PNMB a particularly important site in the region, considering the eastern Pacific's broad geographic scope and high marine biodiversity.

Additionally, the satellite telemetry work in 2007 represented the most integrated research initiative ever conducted at PNMB with respect to the composition of the research team. Biologists and park rangers first held training workshops to share methods for attaching tracking instruments to sea turtles, especially satellite transmitters to leatherbacks. Biologists then also provided information from all tagging studies conducted at PNMB and engaged park rangers in preparation of research permits and reports. In addition, biologists delivered information to local guides about the tagging work and past results and made presentations to tourists at PNMB. During transmitter deployments, tagging teams always consisted of biologists and park rangers, and sometimes worked in front of tourists and local guides.

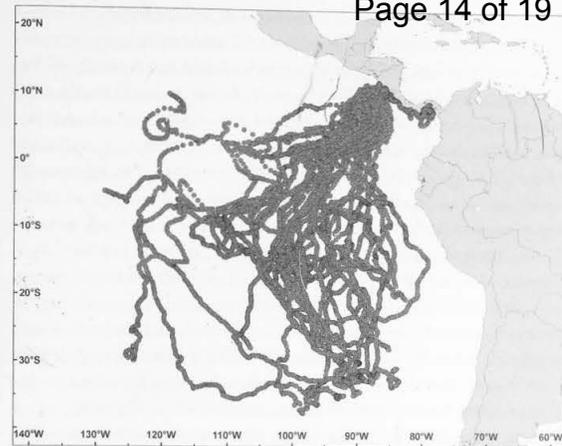


FIGURE 8.4. Postnesting migrations of forty-six leatherbacks from PNMB during 2004–2007. Figure courtesy of G. L. Shillinger.

This level of interaction and cooperation would have been unthinkable in the first years of the research project, but in recent years the close communication between research and management has provided the glue to keep integrated conservation efforts together in PNMB.

A New Group in the Mix: Local Residents of Playa Grande and Playa Ventanas

A recent and encouraging development in the struggle to consolidate the national park has been the organization of a motivated and concerned group of local community members toward effective conservation of this protected area and the biodiversity—especially leatherbacks—that it hosts. This group of residents has formed the *Comité Bandera Azul Ecológica* (Ecological Blue Flag Committee) to support the PNMB administration in management of the protected area, in large part because they

recognize the value of responsible development and conservation of natural resources in and around the protected area. Specifically, the committee concentrates on four issues: (1) an action plan for controlling domestic animals (e.g., dogs) on the park's beaches, especially during the leatherback nesting season; (2) a plan for reforestation and restoration of altered areas, particularly beachfront areas lacking natural vegetation, or "green curtains," using native plant species; (3) development of a program for managing solid wastes; and (4) a plan for comprehensive signage throughout the park to improve orientation and information delivery to visitors. Through these activities, this group of local community members is trying to join forces with the park administration to maintain community development in harmony with the national park and conservation of its natural resources, and, in particular, its turtles. In addition, the Playa Grande Association for Community Development was formed in early 2010 to promote community improvement projects and is becoming increasingly integrated with activities of the Comité Bandera Azul Ecológica and the park administration. In a concrete example of this collaboration, the park administration together with the Comité Bandera Azul Ecológica, local residents, biologists, and other local groups participated in a joint social event in June 2010 during which participants planted native vegetation in front of existing houses on Playa Grande, marking the beginning of an ongoing reforestation initiative for PNMB.

Equipo Baulas: The Leatherback Team

Although understanding that people with roles as distinct as park rangers, local guides, local community members, and biologists share a common goal of protecting leatherbacks and their habitat is easy in concept, integrating these roles in a cohesive, effective way is much more difficult in practice. Since the park's inception, the relationship between these groups has fluctuated between tension and overt conflict, indifference toward one another, and even harmonious cooperation. However, after time and through much effort, each group has come to understand and embrace its unique role, leading to the current situation in which the collective energy and enthusiasm for conservation is palpable.

How did this *equipo*, or team, come to be? As in many comparable cases, open dialogue, information dissemination, and joint participation in

various activities facilitated the cohesion of the different groups around the common conservation cause. To strengthen the working relationship, the park rangers have asserted their role and increased their visibility, responsiveness, and effectiveness as administrators. The biologists, being foreigners predominantly from the United States, have increasingly reached out to the park rangers, local community, and local guides to earn the trust and support of their Costa Rican colleagues. For example, workshops are held before the start of the nesting season where the biologists provide a status report on the leatherback population, results from the previous season's research, and plans for the present season's research objectives to the local guides and park rangers. Similar meetings take place intermittently throughout the season as well, for all groups to discuss progress and solve any problems that might have arisen. This important work, which started in earnest in the early to mid-1990s by Tony Steyermark, Richard Reina, and Philippe Mayor, has been continued by Pilar "Bibi" Santidrián Tomillo, Vince Saba, Bryan Wallace, Gabriela Blanco, and Tera Dornfeld, among many others.

In addition to work-related efforts, various social activities have also taken place. Several *fiestas* to celebrate the end of the nesting season, holidays, and other special events have involved all groups in informal, more personal settings. Additionally, the annual Leatherback Festival, organized by Elizabeth Vélez and park ranger Carlos Díaz, involves the local communities, especially schoolchildren, private property owners, local businesses, NGOs, artists, universities, and visitors to PNMB to celebrate the turtles and the efforts to protect them. The social networking efforts even manifested in a PNMB soccer team composed of park rangers, local guides, residents, and biologists that has participated in a full season as well as several weekend tournaments since 2004. Through this combination of work-related and social activities, the *Equipo Baulas* has consolidated itself as several people from diverse backgrounds and experiences have recognized and rallied around the common purpose of protecting leatherbacks and leatherback habitat for future generations—turtle and human.

The Struggle for the Land Rages On: The Future of PNMB

PNMB, with its collaboration among park rangers, local guides, local communities, and scientists, has successfully achieved elimination of

egg harvest, absolute protection of nesting leatherbacks, and a safe haven for leatherbacks in the ocean within the national park's marine sector. It is a place where scientific research and conservation as well as burgeoning tourism thrive. However, given the imminent—but not inevitable—threat of unsustainable coastal development, the future of leatherbacks and their nesting habitat at PNMB is uncertain. We envision three possible scenarios, and urge careful consideration of their respective advantages and disadvantages.

The Rise of Unchecked Development and the Downfall of PNMB

Under the first scenario, the government undertakes no further expropriations to consolidate the open land within the PNMB, which leads to continued construction of houses, condominiums, hotels, and restaurants. Developers and real estate agents make enormous profits, and the residential (and largely foreign) population of Playa Grande swells to several hundreds, even thousands. Tourists flock to the area in the thousands to take advantage of its many amenities and beautiful scenery. However, as development increases, so do the number of lights, the amount of waste produced, and the volume of freshwater consumed. The water table suffers saltwater intrusion, drinking water becomes contaminated by human wastes, and local communities' artisanal wells dry up. (All of the above have already happened in the area, particularly in Tamarindo.) Loss of beach vegetation related to beachfront construction leads to increased beach erosion and light pollution, and an increased number of domestic and feral animals (e.g., dogs) freely roam the beach eating leatherback eggs and hatchlings. Leatherback nesting continues to decrease due to this litany of impacts; tourism for observation of leatherback nesting declines in tandem. Soon, Playa Grande resembles its neighbor to the south, Playa Tamarindo: lots of lights, lots of hotels, lots of people, lots of tourism, but no turtles and no associated benefits to local communities. Regrettably, Costa Rica suffers significant damage to its image as a model for biodiversity conservation because of its failure to prevent the extirpation of one of its flagship species.

Unfortunately, there have been indicators of this first scenario becoming reality. Toward the end of President Oscar Arias's second presi-

dential term (2006–2010), a new proposal was put forth—initiated by people with development interests—with the intention of redefining the current boundaries and land use regulations of the protected area and the disputed land. This maneuver followed previous failed attempts to introduce proposals in the Costa Rican Legislative Assembly to reduce or change current PNMB boundaries and development regulations. Specifically, this new proposal would have freed the privately owned land within the current limits of the park from the expropriation process, and instead—in a change from previous proposals—would convert the land's official status to Mixed Category Wildlife Refuge, which would include a 150-m-wide strip of land running parallel to the 50-m national park boundary along the beaches. Thus, this revised protected area would have included the public (i.e., national park) and public-private (i.e., mixed refuge) sections, but it would also theoretically have grown in total area with the inclusion of the private land. According to the proposal's proponents, owners of these properties would keep their rights to develop these properties but could only do so under guidelines to maintain low-density, low-impact development.

At first glance, this proposal might have appeared to be an attempt to resolve the conflict over open land within park boundaries that has plagued PNMB for several years. However, careful scrutiny reveals that this scenario would drastically jeopardize the sanctity of PNMB and the persistence of leatherbacks, and could inadvertently and wrongly set a dangerous precedent for diminishing protected status of other national parks in Costa Rica, especially in other situations where private in-holdings within park boundaries have yet to be compensated. In addition, PNMB park rangers, local guides, biologists, NGOs, and some current residents and neighbors of the Playa Grande area all voiced strong opposition to this proposal. These stakeholders object for several reasons: the proposal lacks support of scientific studies of environmental impacts; it is not a solution that considers the ecosystem in its entirety; it fails to adequately address the potential negative impacts of high-density, unsustainable development in the area; and rare coastal dry forest areas would lose their protected status.

In a surprising—and alarming—chain of events, the proposal reached Costa Rica's Legislative Assembly floor for a vote just days before the new administration of President Laura Chinchilla took over, despite the numerous legal precedents clearly in favor of consolidation of PNMB and

against previous attempts to downgrade its status. Fortunately, the vote was deferred due to lack of sufficient information about environmental impacts and other concerns. The proposal now falls to the new legislative period, during which we hope that further analysis of existing arguments against it will force it to be shelved once and for all. However, the simple fact that the proposal made it through the legislative process to the point of an imminent floor vote underscores the urgency and high stakes of the current threats to PNMB represented by the first scenario.

Consolidation of PNMB: A Victory for Leatherbacks and Conservation in Costa Rica

Alternatively, under a second scenario, the Costa Rican government, led by MINAET's efforts, demonstrates its dedication to biodiversity conservation as well as to Costa Rican communities by executing the expropriations of the remaining open land in PNMB, thereby consolidating the park in perpetuity. With the threat of development within PNMB removed, the powerful integration of other human components, including national park administrators, international and national researchers and conservationists, local community members (e.g., ecotourism guides, local associations, other local residents), and volunteers from within and outside of Costa Rica, continues to create hospitable conditions for recovery of leatherbacks in the eastern Pacific. Development in areas adjacent to PNMB is strictly regulated to low-density, low-impact projects that assure protection of natural areas, resources, and biodiversity and thus preserve ecological integrity within the region. (In 2009, the Constitutional Chamber of the Costa Rican Supreme Court issued a resolution ordering the government to study the potential environmental impacts of development within the buffer zone of PNMB. The results of this effort could be extremely beneficial for promoting harmony between future development and the environment in and around PNMB.) Over the next few decades, leatherback nesting numbers increase steadily. The strength and permanence of the national park and its leatherbacks continue to provide opportunities for empowerment of the local community through turtle tours and sales of souvenirs and

crafts and authentic foods and drinks to the consistent tourist influx, generating reliable revenue for local communities.

An Effective Compromise: Adaptive Management of a Consolidated PNMB

Considering the dire consequences of the first scenario, as well as the persistent obstacles (e.g., legal actions, lack of resources) to realizing the second scenario, it is worth considering a third scenario that would still achieve the most fundamental protections for PNMB while not executing the full expropriation and consolidation process. A tiered strategy could be adopted that addresses the differences in current land use within PNMB; in addition to the undeveloped land areas, at least thirty-three houses and two hotels exist within park boundaries. Under this third scenario, because the Costa Rican government lacks the monetary resources to undertake the expropriations envisioned under the second scenario, open or undeveloped areas become the primary target of PNMB's consolidation. Furthermore, this scenario would exclude from expropriation land with buildings, but these areas would be managed within a strict regulatory framework to minimize environmental impacts on the nesting beaches and adjacent natural areas. Clearly, this adaptive management scenario would require a rigorous analysis incorporating many factors, such as existing and potential future environmental impacts, mitigation of such impacts, the management process, the conditions of such an agreement, and costs of its implementation. Moreover, it would require implementation of a new legal precedent for the PNMB, due to the fact that Costa Rican law currently does not permit any private property within national parks, which are under complete protection and administration by the government.

Along these lines, and in response to the developers' proposal described above, local residents have articulated that, while they support some form of a compromise approach of a protected area that would safeguard the sanctity of the national park, they do not support unchecked development within PNMB. However, the official stance of the local Association for Community Development maintains that complete consolidation of all prop-

erties within PNMB boundaries—although an ideal outcome—is unlikely due to a lack of resources to undertake expropriations, thus making a more tenable solution necessary. Therefore, multiple opinions of how best to balance development and conservation interests are present within the Playa Grande community, clearly making resolution of this situation extremely challenging. Nonetheless, a compromise scenario that safeguards the park and the natural areas and species it protects and reflects realities of the current impediments to consolidation is emerging as the most likely candidate to break the impasse regarding PNMB.

Conclusions

We emphatically contend that the first scenario—which was nearly realized through the developers' proposal—would be disastrous for the PNMB and other national parks, for the turtles, for local communities who currently benefit directly from the relative serenity, scenic beauty, and associated tourism of PNMB, and for Costa Rica's reputation as a global leader in conservation. In contrast, we vigorously support efforts to realize the second scenario, in which PNMB is consolidated to protect leatherback nesting habitat and associated coastal ecosystems in perpetuity. However, we acknowledge efforts to explore a compromise to the first two scenarios, wherein open disputed land would be expropriated and consolidated as part of the national park while existing structures within the current boundaries of the PNMB are allowed to remain under a special management category, but must comply with certain strict conditions that minimize their impact on the protected area and biodiversity (e.g., beach vegetation, minimization of light pollution, etc.). While the Costa Rican government's lack of financial resources has been mentioned as an obstacle to executing PNMB's consolidation, a coordinated, strategic international initiative involving NGOs, foundations, and other partners, all with necessary governmental oversight, could be carried out to raise and implement sufficient funds to finance the consolidation of the open land within park boundaries.

Future discussions must include full participation of stakeholders with various interests, including government (e.g., MINAET, members of the Costa Rican Legislative Assembly), scientists, conservation, the local community, and the private sector, to ensure a solution that will benefit

conservation efforts and human interests, but we emphasize that the former is at the expense of the latter. In any case, we emphasize that complete protection of leatherback turtles and their nesting habitat should remain the primary objective when considering *any* development in the area. While the future remains unclear, the situation for leatherbacks at PNMB, as for sea turtles in the eastern Pacific, depends on how the human groups involved respond to the challenges and opportunities. In light of the long history of humans and leatherbacks in PNMB, we hope that future generations of people and turtles will continue to call the area home.

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