# SWOT

report

Volume VII

## The State of the World's Sea Turtles

# THE WORLD'S **MOST (*AND LEAST*) THREATENED** SEA TURTLES

**INSIDE**

**BEST PRACTICES FOR TURTLE TOURISM | NEW TECHNOLOGY TO REDUCE BYCATCH**
**STAMP OUT EXTINCTION WITH NEW POSTAGE | AND MORE …**

A loggerhead turtle enters the surf after nesting on Masira Island, Oman.

# Editor's Note

## Reflections

One of the greatest challenges that conservationists face is deciding how to commit scarce resources of money and manpower in the best possible ways to achieve their goals. In response to this challenge, the science of priority-setting has advanced by leaps and bounds, fueled in recent years by rapid improvements in remote sensing, geographic information systems, and other technical tools for analysis and planning.

British ecologist Norman Myers published two journal articles on threatened biodiversity hotspots in 1988 and 1990: looking back at those classic papers today, one cannot help but see how far we have come in our understanding of priority-setting for Earth's terrestrial life and landscapes. His simple concept of quantifying and comparing the threat and uniqueness of terrestrial ecosystems was built on by groups like Conservation International, whose work sparked a renaissance in conservation priority-setting over the past two decades, yielding veritable mountains of books and numerous scientific papers on hotspots, major wilderness areas, megadiversity countries, key biodiversity areas, and other such frameworks. Those tools and concepts have become immensely valuable for guiding conservation investments at all levels—from multilaterals, to governments and foundations, and down to local communities and individual researchers.

The past few years have also seen a renaissance in priority-setting for the sea turtle conservation movement, and this new emphasis is the focus of the "Special Feature" section in this issue, which is the first such feature since we completed our six-volume series highlighting the seven sea turtle species. "Getting Our Priorities Straight" (pages 20–31) tells the story of how the International Union for Conservation of Nature's Marine Turtle Specialist Group conducted a multiyear process to create the first lists of the world's most and least threatened sea turtle populations. And it would not have been possible without SWOT.

The SWOT Team can take great pride in the role it has played in this process. Before the creation of SWOT in 2004 and the publication of our first global map of leatherback nesting in *SWOT Report, Vol. I* (2006), no source existed for current, global-scale information on sea turtle distribution and abundance, thus making informed global assessments of conservation priorities for sea turtles nearly impossible. Together, over the past eight years, we have built a foundation for effective conservation planning—the most comprehensive and current database on sea turtle biogeography in the world—that is already guiding investments in sea turtle conservation and will continue to do so for years to come. Although the results are imperfect, little by little data quality is improving, and we are developing a system that will enable us to eventually monitor trends over the long term through the continued contributions of the SWOT Team.

As we reflect on the past and celebrate the accomplishments that have advanced our movement, we must remember to keep looking to the future, reassessing and revamping our conservation tools, and always focusing on putting the tools to use in concrete ways that will ensure healthy populations of sea turtles forever.

Roderic B. Mast

AT LEFT: © KLEIN-HUBERT / KIMBALLSTOCK

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# meet the turtles

The seven sea turtle species that grace our oceans belong to a unique evolutionary lineage that dates back at least 110 million years. Sea turtles fall into two main subgroups: the unique family *Dermochelyidae,* which consists of a single species, the leatherback; and the family *Cheloniidae,* which comprises the six species of hard-shelled sea turtles.

**Flatback** *(Natator depressus)*
IUCN Red List status: Data Deficient

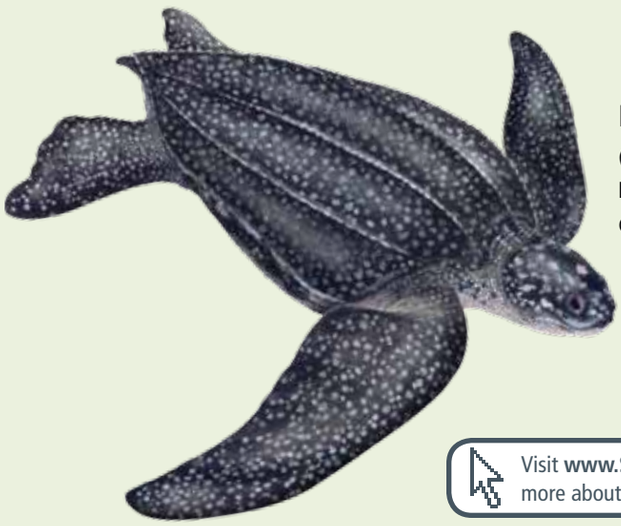
**Kemp's ridley** *(Lepidochelys kempii)*
IUCN Red List status: Critically Endangered

**Green** *(Chelonia mydas)*
IUCN Red List status: Endangered

**Loggerhead** *(Caretta caretta)*
IUCN Red List status: Endangered

**Hawksbill** *(Eretmochelys imbricata)*
IUCN Red List status: Critically Endangered

**Olive ridley** *(Lepidochelys olivacea)*
IUCN Red List status: Vulnerable



**Leatherback**
*(Dermochelys coriacea)*
IUCN Red List status:
Critically Endangered

Visit **www.SeaTurtleStatus.org** to learn more about all seven sea turtle species!

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THIS PAGE, FROM TOP TO BOTTOM: © KELLY STEWART; PHOTO: THE YOMIURI SHIMBUN; © FELIPE VALLEJO / WWW.EQUILIBRIOAZUL.ORG FRONT COVER: A green turtle glides over a wasteland of dead coral near Kanton Island in the Phoenix Islands. Even in remote areas such as the Phoenix Islands, human impacts on marine life are evident. © BRIAN J. SKERRY / NATIONAL GEOGRAPHIC STOCK AT LEFT: © DAWN WITHERINGTON

**Find Mr. Leatherback!** How many times can you spot Mr. Leatherback's distinctive silhouette in this issue of *SWOT Report?* Check the SWOT website at www.SeaTurtleStatus.org for the correct answer!

# research & status

# Seeing the Big Picture

## LEATHERBACK MIGRATIONS IN THE PACIFIC

By SCOTT R. BENSON

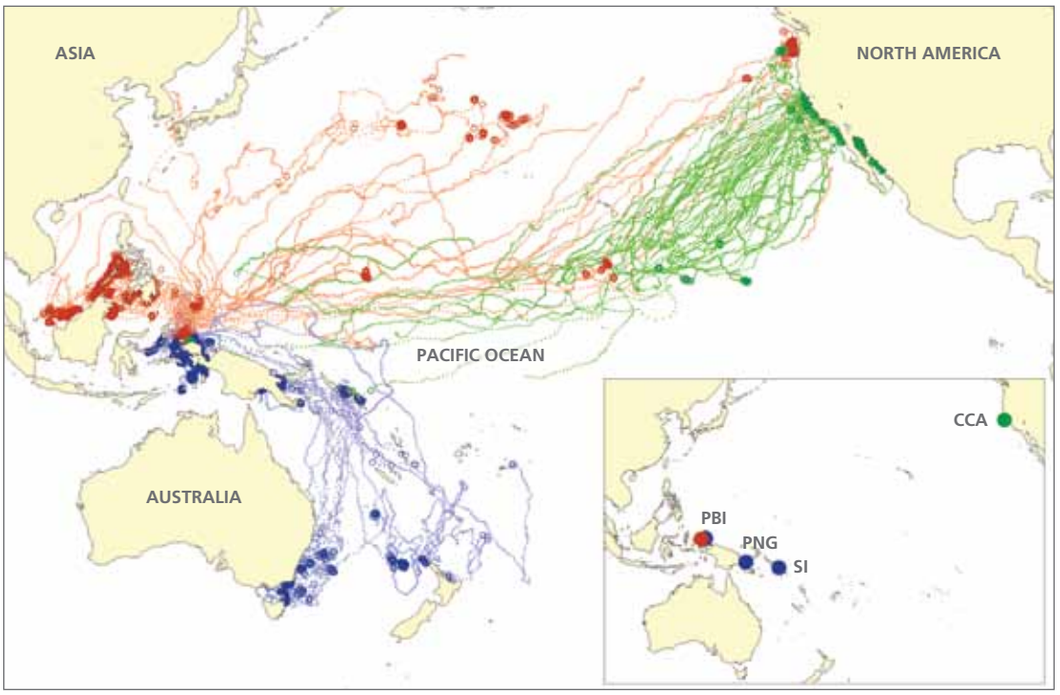
In the Pacific Ocean, leatherback turtles routinely make epic journeys of tens of thousands of miles between tropical breeding areas and frigid-water feeding areas. A newly completed, multiyear satellite tracking study provides the best picture yet of the jaw-dropping migratory abilities of these animals.

Leatherbacks that feed in the central North Pacific Ocean and off the West Coast of the United States also nest year-round in several western Pacific Island nations. To connect the leatherback dots across the vast Pacific, a large-scale research program was undertaken to study western Pacific leatherback movements, high-use areas, and habitat associations by tracking leatherbacks with telemetry devices during both their east-west and west-east migrations. This program conducted a massive deployment of more than 100 satellite transmitters over the course of nearly a decade on nesting and feeding leatherbacks; then it used sophisticated statistical modeling to process location data and to interpret movements and behavior patterns for each turtle. When all the data came together, several startling discoveries came into focus.

One of the biggest surprises was the clear separation of migratory destinations by nesting season (see map). Leatherbacks that nested during summer (indicated by the red lines on the map) moved into large marine ecosystems (LMEs) of the temperate North Pacific Ocean, including areas of open ocean in the central Pacific, as well as into coastal areas off the United States, into the tropical waters of the South China Sea, and around Malaysia and the Philippines. Meanwhile, turtles that nested during winter (indicated by the blue lines on the map) moved into temperate and tropical LMEs of the Southern Hemisphere, around southeastern Australia and New Zealand, and into tropical Indonesian seas. Foraging behaviors (indicated by the colored dots on the map) occurred in temperate and tropical waters and in numerous pelagic and coastal regions that showed a wide range of oceanographic features known to aggregate leatherbacks' favorite prey—jellies.

For turtles to access the most distant foraging ground—the California Current LME—required a 10- to 12-month trans-Pacific migration of up to 11,400 kilometers (7,000 miles) and commonly involved multiple years of migrating between high-latitude summer foraging grounds and low-latitude eastern tropical Pacific wintering areas without returning to their western Pacific nesting beaches (green lines show turtles tracked from feeding areas in the United States). In contrast, tropical foraging destinations were reached within 5 to 7 months and appeared to support year-round foraging. This difference between time—and energy—spent during these two migratory strategies (to distant temperate foraging areas and to closer tropical foraging areas) could result in differences in biological traits such as body size and reproductive output among nesting females of this western Pacific population.

What do these statistics mean for conservation? The variation in movements and foraging strategies that leatherbacks show actually underscores the importance of oceanwide and ecosystem-based management (see "Turtles Need a Pacific Oceanscape as Much as People Do," this issue). As their Pacific peregrinations show, leatherbacks are indifferent to time zones, national borders, and other geopolitical boundaries, making them effective maritime ambassadors for conservation partnerships throughout the Pacific. We should follow their lead and create conservation strategies that reflect their wide-ranging, boundary-crossing ways. ■




Satellite tracks of western Pacific leatherback turtles showing feeding areas (large, darker circles) and migrations (small, lighter circles). Track colors indicate deployment season: red = summer nesters, blue = winter nesters, green = deployments at central California foraging grounds. Inset shows deployment locations; PBI = Papua Barat, Indonesia; PNG = Papua New Guinea; SI = Solomon Islands; CCA = central California. AT LEFT: Off the coast of Peru, Joanna Alfaro of ProDelphinus scans a leatherback turtle in search of an implanted microchip tag. © JEFFREY MANGEL

# Tracking Turtles off Mexico's Yucatán Peninsula

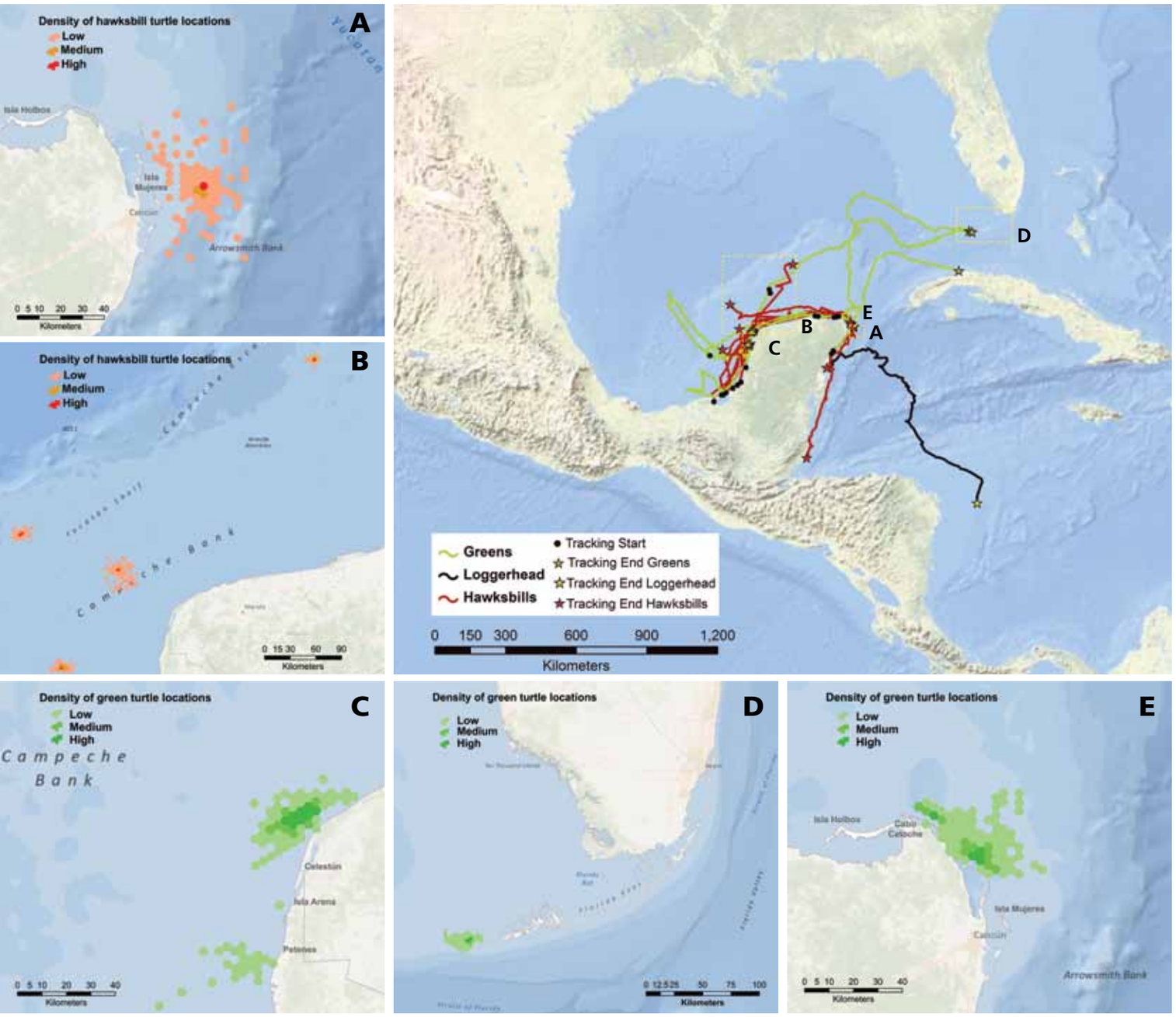
By EDUARDO CUEVAS, BLANCA I. GONZÁLEZ-GARZA, VICENTE GUZMÁN-HERNÁNDEZ, ROBERT P. VAN DAM, PEDRO GARCÍA-ALVARADO, F. ALBERTO ABREU-GROBOIS, and PATRICIA HUERTA-RODRÍGUEZ

Like most sea turtle monitoring projects around the world, sea turtle work in Mexico's Yucatán peninsula has focused on nesting beach surveillance since the end of the 1970s and has paid very little attention to the basic in-water biology and ecology of sea turtles.

By the 1990s, however, researchers had started to turn their attention toward turtles at sea. Although they laid the groundwork for future research, early tracking efforts studied only a handful of turtles, so findings were insufficient for drawing broad conclusions about migration and foraging patterns. In the early 2000s, sea turtle specialists, in collaboration with Mexican authorities and with national and international funders, ramped up their efforts to describe migration corridors and foraging habitats for greens and hawksbills in the Yucatán.

In 2006 and 2007, in an effort funded by Mexico's Consejo Nacional de Ciencia y Tecnología (CONACYT); the state government of Campeche, Mexico; the U.S. National Fish and Wildlife Foundation; and the U.S. National Oceanographic and Atmospheric Administration Fisheries Service, a total of 10 postnesting hawksbill turtles were tracked by satellite from nine different nesting beaches on the peninsula. Turtles traveled around the Yucatán as if on a two-way road, as those nesting on the western side migrated to the east while those nesting on the eastern side migrated to the west, though always staying within Mexican waters.

In 2011, funded by CONACYT and Mexico's Secretaría de Medio Ambiente y Recoursos Naturales, another study tracked nine green turtles from eight different nesting beaches, along with one loggerhead and two hawksbills. The study provided the first available information on green turtle migratory corridors in the Yucatán and showed hawksbill




Sea turtle movements from nesting sites on the Yucatán peninsula, Mexico. Main map shows tracks of hawksbills, green turtles, and a loggerhead. Inset maps show core habitats used by hawksbills (A and B) and green turtles (C, D, and E). AT LEFT: Green turtle hatchlings race to the sea on Mexico's Yucatán peninsula. © CLAUDIO CONTRERAS

migrations that were different from those observed in previous studies, with one female migrating north to the border of the continental shelf and a male staying close to the nesting beaches.

The analysis of all 22 sea turtles tracked since 2006 made it possible to identify what appear to be 12 different feeding grounds. Two main feeding grounds were identified for hawksbills and another two for greens. Hawksbills appear to forage principally at East Isla Mujeres, an area that ended up hosting 55 percent of the tracked hawksbill females (inset image A), and the Campeche Banks, which hosted 17 percent of the tracked hawksbill females (inset image B). Greens appear to prefer the region known as Petenes-Celestún at the northwestern corner of the Yucatán for foraging, which hosted 42 percent of all tracked green turtles (inset image C), as well as the U.S. Florida Keys, which hosted 22 percent of the tracked green turtles (inset image D). The anaylsis also confirmed a well-known feeding and mating area for greens in the region, the Catoche-Contoy area (inset image E). Overall, the vast majority of turtles used waters to the north and west of the Yucatán peninsula within approximately 15 kilometers (9.3 miles) from shore as migratory corridors, while the remainder used the east coast, showing the high relevance of these zones for sea turtle conservation in the region.

This information not only is important for understanding sea turtle movements in the Mexican Caribbean but also has components that have already been used by Mexican authorities as part of the National Recovery Plans for these species and for the zoning criteria inside protected areas in the Yucatán peninsula. This last effort is particularly significant because the Yucatán hosts a booming tourism industry that could affect sea turtles and their habitats if not managed responsibly.

As projects around the world move from nesting beaches to the ocean in pursuit of new discoveries about sea turtle movements and habitat use, we should keep in mind that integrating management needs in designing, executing, and reporting research studies is fundamental to effective conservation of turtles and their marine environments. ■

# Revealing

## the Secrets of Sea Turtle Migrations in the Southwest Indian Ocean

By JÉRÔME BOURJEA, MAYEUL DALLEAU, and STÉPHANE CICCIONE

Sea turtles do not recognize political boundaries, nor do they have regard for Exclusive Economic Zones (EEZs), cooperative agreements, international conventions, or memoranda of understanding between countries. They don't know the political and socioeconomic situation of the countries whose borders they cross nor the world economic crises that shape our human destiny. They migrate only to live. Tirelessly and mysteriously, they have migrated for millions of years between nesting sites and feeding grounds, sometimes swimming thousands of kilometers, passing through several countries and ecosystems, and interacting with human activities along the way—sometimes to their advantage but sometimes resulting in a premature end of their lives' journeys.

So it is in the Southwest Indian Ocean (SWIO). That region hosts some of the most important green turtle nesting sites in the world, most of which are isolated on remote islands (for example, at Europa [Îles Eparses, France], Aldabra and Cosmoledo [Seychelles], and Moheli [Union of the Comoros]). Nesting also occurs in significant numbers along the coasts of East Africa and Madagascar, which are better known for their vast seagrass pastures where green turtles graze. Mayotte (France), Grande Comoros, and Mauritius also have noteworthy foraging areas adjacent to their shores. However, very little is known about the migratory pathways that sea turtles ply between their nesting and feeding grounds—and even less is known about how they spend their time among the various countries in the SWIO.

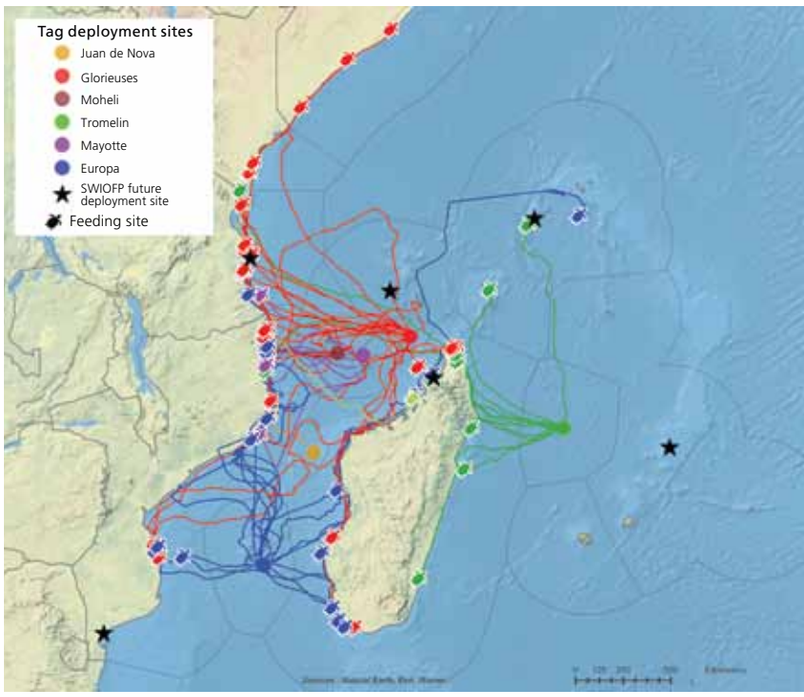
Adding to the migratory and spatial dynamics mysteries of SWIO turtles, recent studies show compelling genetic evidence (a) that green turtles nesting on the rookeries in the Southern Mozambique Channel belong to separate stocks from those nesting in the Northern Mozambique Channel and, moreover, (b) that Seychelles green turtles are likely an entirely different, third stock. So as our view of sea turtle biology becomes clearer, the solutions to the mysteries of SWIO turtles become harder to see.

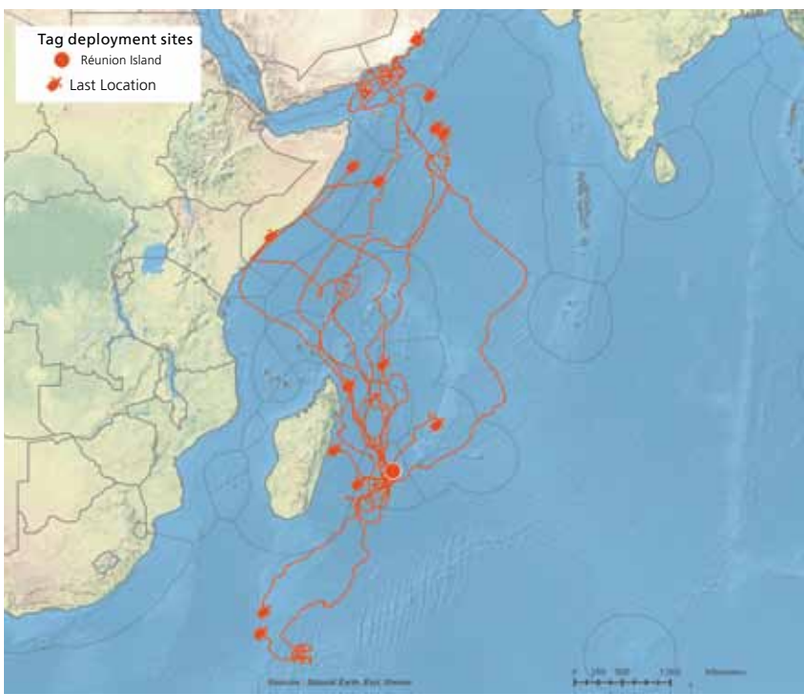
How can we implement effective management in such a situation? To shed additional light on these complex issues, the French Research Institute for Exploration of the Sea (IFREMER) and the Observatory of Marine Turtles (Kélonia), both based in La Réunion, began an ambitious satellite tagging project in 2009 to better understand the spatial dynamics and connectivity of SWIO marine turtle populations. The project will ultimately deploy 129 satellite tags on green turtles during and after the peak of the nesting season at Europa, Juan de Nova, Mayotte, Glorieuses, Moheli, and Tromelin. The first 64 tagged turtles were recorded traversing as many as nine different EEZs before reaching their foraging grounds, which themselves are shared by six countries (see top map).

Fourteen tags were also deployed on subadult loggerheads accidently caught by the French longline fishing fleet (see bottom map). Although one might expect these individuals to have come from the nearest loggerhead breeding site in South Africa, we were surprised to see that upon their release, the majority of the loggerheads crossed up to nine EEZs on their way north into the EEZs of Oman and Yemen, a globally important, but much more distant, reproductive area for this species.

Building on these initial efforts, IFREMER and Kélonia extended the tagging efforts to a regionwide cooperative program designed to describe patterns of regional connectivity, not only from islands to continental coasts, but also from the East African and Malagasy coasts to foraging grounds not yet identified. Their goal was to identify potential areas of interaction between fisheries and marine turtles. The opportunity to expand arose thanks to a large Global Environmental Facility/World Bank fisheries project called the South West Indian Ocean Fisheries Project (SWIOFP), a unique cooperative effort among Comoros, Kenya, Madagascar, Mauritius, Mozambique, Réunion Island (France), Seychelles, South Africa, and Tanzania with the goal of improving the regional management of shared migratory species, namely, sea turtles.

Project activities were initiated in 2010 at a regional meeting and telemetry training session supported by SWIOFP in La Réunion. SWIOFP also funded three tags per country, with the understanding that each country would provide complementary funding to increase the number of tags. To this end, Comoros, Mozambique, and Tanzania have now successfully obtained five additional tags each for the project. This initiative is an essential contribution to the excellent work already being done by the Marine Turtle Task Force of the Southwest Indian Ocean and the IOSEA Marine Turtle Memorandum of Understanding. We hope that this is a major step for a new generation of international collaborations in research and management in the SWIO and beyond. ■




TOP: Movements and feeding sites of 64 green turtles tracked after nesting throughout the Southwest Indian Ocean. Track colors correspond to the tag deployment sites, which are shown as colored dots. Black stars represent future deployment sites. BOTTOM: Movements of 14 subadult loggerhead turtles released from Réunion Island after being accidentally captured by the French longline fishing fleet. AT LEFT: A satellite-tagged subadult loggerhead swims off the coast of Réunion Island after being released by scientists. The turtle was caught by a longliner and brought to Kélonia for surgical hook removal and rehabilitation before its release. © ERIC LANCELOT

# SEA TURTLE CSI

## IT'S ALL IN THE GENES

By KELLY R. STEWART and PETER H. DUTTON

By now, we've all seen a television show or movie featuring clever police detectives using high-tech laboratory analyses of microscopic tissue samples to catch criminals. But in a new twist of that familiar story, today scientists are using similar forensic approaches to solve long-standing mysteries about sea turtles—and male sea turtles, in particular.

Unlike female sea turtles, which are evolutionarily obliged to haul themselves onto sandy beaches to lay eggs, male sea turtles get to spend their entire post-hatchling lives in the comfy confines of the ocean. Because female turtles—and their hatchlings—are so readily available to humans for study, they have been the focus of monitoring and conservation projects worldwide for decades. But with virtually no information about males (see "Unsolved Mysteries" in *SWOT Report, Vol. II*), our understanding of how sea turtle populations really work is severely limited. Here's where the sea turtle detectives come in.

Hidden in a hatchling's DNA is its entire family history, including who its mother is, who its father is, and to what nesting population it belongs. By applying DNA fingerprinting—the same procedure used to prove human paternity—we can answer many elusive questions about sea turtle mating and reproduction patterns and, in particular, about what male sea turtles are up to.

The method is simple but requires experience. First, we quickly collect a tiny skin sample from hatchlings as soon as they emerge from the sand, taking care to minimize disruption of the natural emergence process. Though sampling every emerging hatchling from a clutch is ideal, only approximately 20 samples are sufficient and, with experience, can be done quickly. Mother turtles are also sampled the first time they nest on a particular beach, and their unique genetic fingerprint (genotype) is also determined.

Back at the lab, relatively routine methods are run for each hatchling and adult female sample using genetic markers that are species-specific. Then we compare the genotypes from a clutch of hatchlings with their mother's genotype (see figure). From there, it's a process of elimination to deduce the genotype of the father (or fathers) responsible for all hatchlings in that clutch. Each hatchling's genotype reflects alleles from both of its parents, so by knowing which alleles come from its mother, we can determine the genetic identity of its father from the remaining alleles. This procedure is the key to unlocking several sea turtle mysteries that are fundamental to understanding sea turtle population biology.

## **MYSTERY #1:** Age to maturity

Population recovery goals are based on how long turtles take to reach maturity, making this factor among the most fundamental for conservation. With this factor in mind, we have been sampling leatherback hatchlings for three years (17,087 hatchlings sampled to date) at Sandy Point National Wildlife Refuge, St. Croix, U.S. Virgin Islands. Each year, the hatchling fingerprints are compared to those of new nesting females. Eventually, we hope to match a turtle that left the nesting beach in a known year with a first-time nester. This information would give us direct evidence of the age to maturity, at least for a leatherback on that beach.

## **MYSTERY #2:** Paternity patterns and male identity

DNA fingerprinting also allows us to deduce mating patterns, such as multiple paternity, in sea turtles. Once we have identified genotypes of the hatchlings and mothers, we can deduce the paternal genotypes—from one to many fathers per clutch—and can identify individual males that are actively breeding in the population (see figure). This procedure means that we can sample males in the population from the nesting beach without ever having seen them or sampled them in the field. In 2009 at Sandy Point, we examined 38 clutches from 12 females and found that 17 different males were responsible for those nests; 5 of the 12 females had each mated with 2 different males.

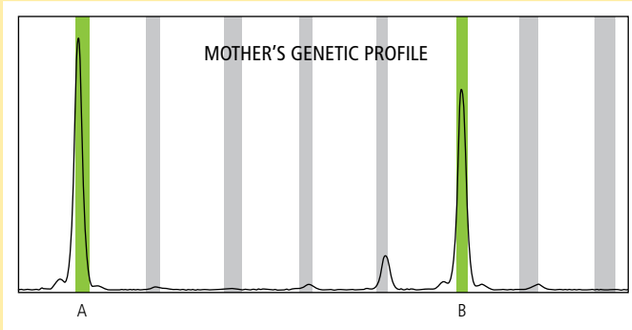
## **MYSTERY #3:** Ratio of males to females

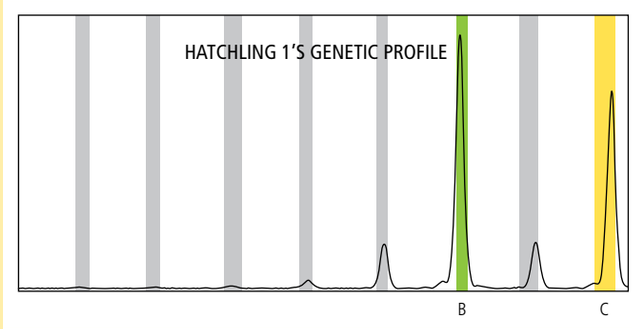
Until now, we have been able to count only females (on nesting beaches), while males remain out of reach. In 2010, we assessed hatchlings belonging to 46 nesting females at Sandy Point and found that 47 different males had mated with those females. One male had mated with three different females, and several others had mated with two females. Some researchers have hypothesized that there is a shortage of males and that sex ratios might be too highly skewed toward females for populations to remain viable in the future, especially considering the warming impacts of climate change and the feminization of sea turtle populations that is speculated to occur as a result. However, our results show that this is clearly not the case, at least at Sandy Point, where plenty of males are actively breeding in the population; breeding males may actually outnumber breeding females in a given year. In fact, we identified one male that had been actively breeding in both 2009 and 2010 (with different females).

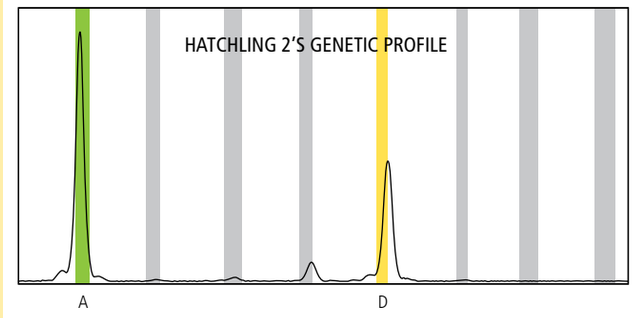
## **MYSTERY #4:** Male reproductive success

Paternity analysis allows us to assess the individual reproductive success of males in addition to that of females on nesting beaches. Once we identify individual males through the hatchlings they have sired, we can track the success of those individual fathers. For each male, we can investigate how many hatchlings he produced, how many females he mated with, and how many years he has been reproductively active.

Unlike beach-going female sea turtles, males are usually beyond the reach of our research, so we have to apply some ingenuity to reveal their secrets. Genetic analysis is a practical but powerful approach to fill voids in our understanding of sea turtle biology and to improve how we assess sea turtle populations. And we think it would make a pretty compelling television show too. ■




At each locus in the DNA of every individual are two alleles—one inherited from the mother and one from the father. The mother turtle's genetic profile (top panel) and genotypes for two hatchlings (middle and bottom panels) are shown above. Once we account for the maternal alleles (A and B) in the hatchlings' genetic profiles, the remaining alleles (C and D) must belong to the father turtle. This method allows us to identify the hatchlings' father without having to sample him directly. ABOVE: A researcher organizes DNA samples collected on the beach in St. Croix, U.S. Virgin Islands. © JEREMY W. SMITH AT LEFT: A leatherback hatchling emerges from the sand on St. Croix, U.S. Virgin Islands. Scientists analyzed DNA from more than 17,000 hatchlings to answer important questions about population demography and life history. © KELLY STEWART

# & outreach action


# Two-Way Radios Save Turtles and Help Peruvian Fishermen

By JOANNA ALFARO-SHIGUETO and JEFFREY C. MANGEL

Peruvian small-scale fisheries capture many thousands of small cetaceans, marine turtles, and seabirds every year. Some of those species, such as the waved albatross and leatherback and hawksbill turtles, are listed as Critically Endangered by the International Union for Conservation of Nature. Despite the collateral damage they do, such local operations form the backbone of Peru's fishing sector and are the main source of income for more than 200,000 coastal families. In its High Frequency (HF) Radio Program, ProDelphinus, a Peruvian not-for-profit organization, uses real-time, two-way radio communication with fishermen at sea to help reduce the incidental capture (bycatch) of marine fauna and to promote long-term fishery sustainability. By using low-cost, widely available HF radio, project personnel can reach out to fishermen over a massive geographic area to warn them about areas with high bycatch (turtles, seabirds, dolphins, manta rays, whales) and to train them step-by-step in real time about how to safely handle, resuscitate, and release animals that may fall into their nets or become ensnared by their lines. Fishermen are also provided with useful information such as temperatures, currents, wind directions, sea state, and severe weather alerts that can affect their catch and benefit their safety.

The fishermen who partner with ProDelphinus are helping voluntarily and proactively to make their fisheries more sustainable by reducing the bycatch of threatened and protected species, thus signaling the growing awareness of the huge negative impacts of fisheries on marine fauna. During the first year of ProDelphinus's HF Radio Program, fishermen reported and subsequently released alive about 1,300 sea turtles, while only 5 percent drowned or were retained for food. With successes like this, threatened populations of sea turtles, as well as seabirds and small cetaceans, can benefit greatly, and we can hope to see improvements in the overall health of the southeastern Pacific ecosystem.

> ProDelphinus … uses real-time, two-way radio communication with fishermen at sea to help reduce the incidental capture (bycatch) of marine fauna and to promote long-term fishery sustainability.

The program also allows ProDelphinus to identify those vessels and their crews who are ready to go a step further in conservation. These partners receive mitigation tools that help them in releasing animals from their gear, such as line cutters, dehookers, and other devices that fishers gratefully receive. The ProDelphinus HF Radio Program has begun to provide fishers with prices by port for fish products to ensure that they are receiving fair market value for their products. Moreover, the program provides first-aid tips and training and other valuable information that can ensure the safety and success of local fishers while simultaneously promoting the long-term sustainability of Peru's small-scale fisheries and reducing their negative impact on marine biodiversity. ■

THIS PAGE: Staff from ProDelphinus communicate with Peruvian fishermen over two-way radio as part of a novel project to reduce sea turtle bycatch. © NADIA BALDUCCI AT LEFT: Fishermen off Peru's coast release a leatherback turtle that was incidentally captured and then tagged by researchers. © JOANNA ALFARO

# Building a Better Pound Net

By TAKASHI ISHIHARA, YOSHIMASA MATSUZAWA, JOHN WANG, and HOYT PECKHAM

Accidental capture, or bycatch, in fisheries is among the greatest threats to sea turtle populations globally. Bycatch in Japanese pound nets represents a major obstacle to the recovery of the endangered North Pacific loggerhead population. A pound net consists of a leader net that is run from the seafloor to the surface and that is set perpendicular to the coast to direct fish into a system of standing nets, which, in turn, entrain the fish into an enclosed trap. When mounted underwater, these traps prevent incidentally captured sea turtles from reaching the surface to breathe, thereby resulting in high numbers of drowning mortalities. Numbering in the thousands and varying greatly in size and design, some Japanese pound nets can be massive, with leaders up to two kilometers long, traps measuring in excess of 10,000 cubic meters (13,000 cubic yards), and initial construction costs exceeding US$2 million per net.

Although modifications to trawls and longlines—such as turtle excluder devices and circle hooks—have been shown to greatly reduce sea turtle bycatch, until recently no bycatch mitigation technology had been designed for pound nets. That began to change in 2006 when pioneering work by Osamu Abe (National Far Seas Fisheries Institute) and Daisuke Shiode (Tokyo University of Marine Science and Technology) discovered that trapped turtles consistently search pound net roofs. Taking advantage of this behavior, their studies indicated that specially designed hatches on pound net roofs could facilitate turtle escape.

Building on those findings, in 2009 we launched an international, multidisciplinary program to develop pound net escape devices (PEDs) that could enable turtles to escape while retaining target fish. From the outset, we engaged fishermen, fisheries managers, marine scientists, gear manufacturers, and journalists from three countries—Japan, Mexico, and the United States—that host the Japanese nesting loggerhead population. To design, test, and promote the adoption of PEDs, we convened a series of collaborative workshops at Suma Aqualife Park and Minamichita Beachland Aquarium in Kobe and Mihama, Japan, respectively. During each workshop, we assembled a model pound net in a massive aquarium with an adjacent underwater viewing area from which turtle and fish behavior could be observed (see image). Participants collaborated during the workshops to design, build, and test PEDs, thus running multiple trials for each experimental PED by introducing a turtle into the trap and observing if and how the animal encountered the PED and successfully escaped.

Workshop participants collaborate to modify the prototype for a pound net escape device (PED) as part of experimental trials in Kobe, Japan. © SEA TURTLE ASSOCIATION OF JAPAN AT RIGHT: A loggerhead turtle successfully escapes a model pound net trap through a prototype PED inside the exhibition tank of Suma Aqualife Park in Kobe, Japan. During experimental trials, several PED designs that ensured both turtle escape and target fish retention were developed. Field trials are planned for 2012–2013. PHOTO: THE YOMIURI SHIMBUN

During the first two workshops, we designed several types of PEDs that proved to be highly successful for turtle escapes. Although we were all pleased with these promising results (*PEDs can release loggerheads from pound nets!*), the fishermen among us emphasized that turtle escape was only half the goal. PEDs still needed to be engineered to ensure retention of target fish.

In the most recent workshop (October 2011), we tested a range of PED designs for fish retention as well as turtle escape. For those trials, we introduced juvenile hamachi, an important target fish, into the trap along with the turtles. Extensive trials were run on numerous PED designs, with additional fish retention trials on the most promising of the designs. Ultimately, several PED designs demonstrated both ease of turtle escape and effective fish retention. In 2012, we plan to begin field trials in conjunction with Japanese fishermen.

Beyond developing a range of promising PED designs, the workshops were quite effective in raising awareness among the first—and perhaps most important—audience: fishermen. By seeing firsthand that schools of hamachi were retained in the nets while turtles escaped through the PEDs, fishermen realized that turtle-safe pound nets will not diminish their fisheries' profitability. Members of the public and press also joined workshop participants to observe the trials from within the aquarium, thereby offering them firsthand views of turtles struggling and escaping the pound net traps to reach the surface to breathe.

The experience was transformative for many and resulted in extensive press coverage of the bycatch problem and the collaborative efforts to develop PEDs. Prominent stories appeared in national newspapers and on television, reaching tens of millions of readers and viewers. Public and official commentary on the workshop focused on the development of solutions, which was a considerable departure from prior debate of the problem. In the end, the awareness raised throughout this program has been as influential as the PED research itself. Collaborative refinement and eventual adoption of PEDs by pound net fishermen could eliminate one of the gravest threats to the endangered North Pacific loggerhead. ■

# Best Practices for Sea Turtle Conservation Tourism

By BRAD NAHILL

Conservation tourism has benefited sea turtle programs and local communities in a few places, yet it remains relatively underused as a sea turtle conservation methodology. Although an estimated 10 million people spend more than US$1.25 billion every year to see whales and dolphins, the World Wildlife Fund study titled *Money Talks: Economic Aspects of Marine Turtle Use and Consumption* documented fewer than 200,000 annual tourist visits to sea turtle sites worldwide, roughly half of which were to only five sites.

Tourism can offer people firsthand experiences with nature and with the people and organizations working to protect it. Revenues generated by such tourism can greatly benefit conservation efforts and local economies when developed successfully. Such benefits include securing revenue for conservation programs through visitor fees and donations, providing alternative sources of income for residents as guides, increasing community goodwill and support for conservation because of the patronage of local businesses by tourists, using volunteer tourist humanpower (many tourists like to help out) to monitor nesting beaches and other habitats, and moving people toward more sustainable lifestyles and involvement in conservation efforts through life-changing experiences with wildlife.

Turtle-based tourism can also have negative impacts if not properly controlled. Those effects include habitat degradation through tourism development; an increase in trash, particularly plastic bags; boat strikes from marine-based tours; and harassment of nesting and

Tourists look on as a leatherback turtle nests on Bioko Island, Equatorial Guinea.
© JOEL SARTORE / JOELSARTORE.COM

basking turtles, which can affect natural behaviors. Furthermore, tourism to turtle habitats can generate relatively little financial support for conservation programs in places where legal protections and direct connections between tourism operators and local organizations are lacking. Those unintended effects are important to consider when developing a tourism program.

One of the most crucial steps in developing a tourism program is to pick the right tourist markets on which to focus, because not all tourists have the same interests and needs. Successful turtle tourism projects aim to attract the most appropriate types of tourists for their site and capacity. Types of tourist markets and their needs include the following:

- **ADVENTURE TRAVELERS.** A fast-growing but competitive market, adventure travelers look for hands-on participation and small groups. Those travelers often look for places with a diversity of activities. They will pay higher prices but require higher-quality accommodations and service.
- **VOLUNTEER TOURISTS.** Such travelers tend to be younger and more active, and they require a lower level of service and accommodations than other travelers but are very sensitive to price. Setting accurate expectations is key. Some organizations have found they get higher-quality volunteers if they are open about the challenges at the location. Groups who offer daily rates of US$30 and below tend to be more successful at recruiting volunteers.
- **DOMESTIC TRAVELERS.** Some turtle projects have developed successful programs for local markets, including Nature Seekers in Trinidad. Those travelers tend to come just for one activity, such as a night beach walk, and they spend less money in the community, which limits the benefits. However, such programs are easier to set up and maintain and can help build political support for conservation efforts. The key is that the turtle project needs to be accessible to major population centers.
- **EDUCATIONAL TRAVELERS.** Student groups can be an effective market because they tend to stay multiple days and can adapt to lower-quality accommodations. Several companies have successfully marketed to schools for turtle tourism, including EcoTeach and Ecology Project International. Working with companies is important because education groups require more supervision and a strong focus on safety; finding schools is also challenging. This area is very competitive, so offering additional services such as educational curriculum or other service activities can give you an edge. Be careful when negotiating with student travel companies; some offer very low payments in exchange for volunteer support.

In addition to choosing the right market, the following best practices can help ensure success in developing or growing a conservation tourism program:

- **FORM STRATEGIC PARTNERSHIPS.** Work with companies that have strong records of supporting conservation, including tour operators, hotels, transportation companies, and tourism offices.
- **SET REALISTIC EXPECTATIONS.** Be accurate in your descriptions of how much tourists can participate in your work and about the level of accommodations and meals.
- **USE LOW-COST MARKETING TOOLS.** Social media networks such as Facebook are increasingly important in tourism marketing and are very cost-effective. Also, many ecotourism and volunteering websites (including www.seeturtles.org) will post information about conservation tourism programs for free.
- **SET GUIDELINES AND MONITOR.** Determine what rules work best for your site (for example, group size and length of time with a turtle) and make sure you have enough staff members to manage the group. Consider setting aside both areas and times of night in which no tourists are allowed and studying the impacts of tourists on nesting activities.
- **FOSTER LOCAL INVOLVEMENT.** Use local businesses and services to allow tourism benefits to be spread widely and to provide a more authentic experience.
- **FOLLOW UP.** Get contact information from tourists, and encourage them to join your group on Facebook and to share your information with their friends. ■

# Getting our Priorities Straight

By RODERIC MAST

Nobel chemist Paul Crutzen regards the influence of humans on the biosphere at this moment in Earth's history to be so systemic and widespread as to constitute a new geological era: the *Anthropocene epoch*. To succeed in the Anthropocene, sea turtle conservationists must view our goals at the global, as well as local, scales. We must recognize the relative threat and risk factors that influence our decisions, and we must have our eyes open to both present and future priorities simultaneously.

The mission of our movement, in a nutshell, is to prevent extinctions and to safeguard healthy populations of sea turtles. But where do we start? How can we be certain that the limited amounts of money and personnel at our disposal are being invested most wisely to ensure long-term success? Setting priorities that take into account the best available science, expert knowledge, and lessons learned from past successes and failures is critically important so that our conservation actions use the *most* effective techniques to achieve our goals. Beyond keeping a keen eye on urgencies such as preventing extinctions, conservation priority-setters must aim to sustain healthy populations and habitats as insurance policies for the future, so they do not become tomorrow's urgencies.

To achieve this mission, we need to reconcile the ways in which we have done assessments and conservation priority-setting with the complicated realities of sea turtle biology and conservation. For example, let's consider the mighty leatherback, largest of all living turtles on land or sea. Leatherback turtles are among the most migratory of all animals and are found in the territorial waters of virtually every coastal and island nation. In each of those nations, they face different threats and are subject to disparate policy and regulatory regimes. Environmental conditions in different ocean basins also make some leatherback populations naturally smaller, less fecund, and more vulnerable to human threats. However, the International Union for Conservation of Nature (IUCN) Red List—the only globally recognized system for assessing conservation status of species—categorizes *all* leatherbacks, *everywhere* they occur, as Critically Endangered, which is the highest threatened category available.

Given the aforementioned regional variations among populations around the world, there can be no plausible, global-scale strategy that conserves leatherbacks while accurately identifying all the appropriate local interventions necessary to prevent extinctions of individual populations. Furthermore, a strategy that seeks only to conserve the species at the global scale does not consider the inherent and irreplaceable ecological importance of the regional populations: the loss of leatherbacks in the Pacific Ocean would have significant and irreversible ecological consequences even if at the global scale the species continued to exist because populations remained in the Atlantic and Indian Oceans.

Since 2003, the Burning Issues (BI) Working Group of the IUCN Marine Turtle Specialist Group (MTSG) has directed its efforts at addressing the complicated yet critical issues illustrated in the preceding leatherback example. The BI process has developed priority-setting tools to help our movement ensure that no species of sea turtle goes extinct on our watch. The global SWOT Team has laid the groundwork for the MTSG's analyses by building the most comprehensive global data set on sea turtle biogeography in existence and by sharing BI results in *SWOT Report* since 2005. Two seminal papers describing the BI Working Group's priority-setting efforts were recently published and made publicly accessible. The first of those outlined a framework for delineating sea

AT RIGHT: A green turtle glides over seagrass off the coast of Brazil. Brazilian green turtles rank among the world's healthiest sea turtle populations thanks to long-term conservation efforts in the region. © LUCIANO CANDISANI
PREVIOUS SPREAD: The track from a turtle's aborted nesting attempt in Florida, U.S.A., provides stark evidence of the impacts of coastal development on sea turtles' natural behaviors. © MARK CONLIN / SEAPICS.COM

turtle populations globally (Regional Management Units, or RMUs), and the second described an effort that evaluates, compares, and organizes sea turtle RMUs within the context of a conservation "priorities portfolio." Together, those achievements have vast potential for focusing the sea turtle conservation movement on its most important tasks.

The RMU framework breaks down globally distributed, widely migrating sea turtle species into smaller, biogeographically defined units above the level of a single nesting beach yet below the level of species. RMUs are functionally independent subpopulations that include breeding adults, as well as juveniles. RMUs vary in their levels of risk and threat, as well as their conservation status, and thus provide a more suitable scale for developing strategies for research and conservation than do global-level species assessments.

Defining RMUs for sea turtles has been no easy task. Over the past few years, MTSG scientists amassed and georeferenced data from more than 1,200 studies, including (a) information from more than 4,200 nesting beaches from the SWOT database, (b) population genetics, (c) movement and habitat use patterns from mark-recapture and satellite telemetry, and (d) other biogeographical parameters to delineate the RMUs. Global experts then reviewed and improved RMU maps and metadata during deliberations at BI workshops in 2008 and 2009. The U.S. National Fish and Wildlife Foundation generously backed this effort, and the maps and descriptions of 58 RMUs were subsequently published in *PLoS ONE* as "Regional Management Units for Marine Turtles: A Novel Framework for Prioritizing Conservation and Research across Multiple Scales" (www.plosone.org).

The next challenge was to devise a method that would allow conservationists to characterize the nuanced conservation needs of each RMU, to define the relative urgency and opportunities for intervention, and to identify where information gaps exist. The BI team developed a robust yet flexible "conservation portfolio" approach that assesses all RMUs in a way that allows conservationists to identify

priorities that best suit their respective goals and mandates. This conservation priorities portfolio method and the results were published in *PLoS ONE* as "Global Conservation Priorities for Marine Turtles" (www.plosone.org) and received a good deal of attention from global media and conservationists alike.

The framework described in the 2011 paper plots each RMU's risk (i.e., population viability) against threats (a score derived by quantifying the impacts of the "five hazards" to sea turtles: fisheries bycatch, human consumption of turtles and eggs, coastal development, pollution and pathogens, and climate change [see *SWOT Report, Vol. I*, 5]). This task also required an exhaustive review of the literature (more than 1,300 references) and lengthy discussions among experts to best define terms and to apply them in a consistent manner across RMUs, some of which are poorly known with respect to others. To reflect this lack of information, a "data uncertainty index" was applied to every criterion score, which highlighted places where more and better research was needed to strengthen assessments (in fact, one RMU was not included in analyses because of its high levels of data uncertainty). Ultimately, consensus among the BI Working Group experts was achieved; indeed, the results were reviewed by the full membership of the IUCN MTSG, representing about 230 experts from more than 70 countries.

A speared olive ridley is hauled aboard by a local fisherman in Kei Islands, Maluku, Indonesia. Although direct take of sea turtles has been reduced substantially at the global level, it remains a significant threat to some regional populations.


The risk and threat scores, when plotted, placed each RMU roughly in one of four categories:

1. High Risk and High Threats (19 of 58 RMUs)
2. High Risk and Low Threats (9 of 58 RMUs)
3. Low Risk and Low Threats (12 of 58 RMUs)
4. Low Risk and High Threats (17 of 58 RMUs)

RMU scores were then mapped in a variety of ways to analyze the results by species, ocean basins, MTSG regions, and international management regimes (i.e., regional fisheries management organizations). In the pages that follow, the lists of the world's *most* and *least* threatened RMUs are presented, allowing the reader to draw some broad conclusions about the status of the world's sea turtles from a quick glance at this information.

For instance, when considering the seven species, we begin to immediately see what the most urgent conservation priorities are. Only 4 (leatherback, hawksbill, olive ridley, and loggerhead) of the 7 sea turtle species have populations among the world's 11 most threatened; among all those ranked "high risk" and "high threat," we find 40 percent of loggerhead and leatherback RMUs, as well as more than half of hawksbill RMUs.

As we look across regions, we see that 5 of the 11 most threatened RMUs are in the northern Indian Ocean, specifically on nesting beaches and in waters within the Exclusive Economic Zones of countries like India, Sri Lanka, and Bangladesh. Turtles in this region are severely affected by a combination of depleted populations, weak or poorly enforced regulations, unsustainable mortality caused by fisheries bycatch and human consumption, and extensive coastal development. The high data uncertainty associated with those RMUs may further contribute to their high risks and threats. Other areas that proved to be risky for sea turtles are the East Pacific Ocean (from the United States to South America) and the East Atlantic Ocean (off the coast of West Africa).

But not all results were negative; the conservation priorities portfolio also highlights the world's healthiest sea turtle populations. Australia, Brazil, and the Pacific Islands region appear to be pretty good places to be a sea turtle, generally because of relatively large populations, long-term monitoring and protection, and low or reduced threats. The results also show some within-region patterns that are confusing at first glance but that may reveal interesting stories about conservation efforts. For example, several RMUs (leatherbacks, hawksbills, loggerheads) that occur in the East Pacific Ocean were assessed as high risk and high threat, but East Pacific olive ridleys (arribadas) and green turtles in that region were ranked among the world's healthiest populations. Those variations in status within regions suggest that threats or biological factors might influence certain populations differently, or perhaps that conservation interventions directed toward particular RMUs have not resulted in similar recovery trajectories for all. Such variations further highlight the value of the RMU framework in developing conservation strategies across RMUs under similar jurisdictions and may offer insights into which conservation efforts work (or do not work), which factors contribute to a population's vulnerability, or which RMUs are most affected by specific threats.

Certain threats were more pervasive than others in all RMUs, in particular fisheries bycatch, as well as human consumption of turtles and their products. Commonalities were also present with respect to data quality; specifically, effects of climate change, as well as pollution and pathogens, were data deficient so frequently that they were considered critical data needs at the global scale.

Together, the RMUs and conservation priorities portfolio are a noteworthy advancement that helps set a global agenda for sea turtle conservation; indeed, they provide the most well-rounded and appropriately scaled conservation status assessments for marine turtles ever produced. Yet those efforts are just a first step in what must become a dynamic, long-term process of regular reviews to ensure that our collective conservation priorities take into account all that they ought to. For example, a logical next step in the BI process will be the development of a "conservation capacity" overview that, when combined with the existing risk and threat assessments, will consider the legal, political, and social factors that contribute to conservation success. The BI Working Group is committed to improving data quality and innovating new ways to fine-tune assessments. Our work as conservationists must continue to be driven by a sense of urgency and characterized by the highest possible efficiency and precaution. ■

# THE 11 MOST THREATENED SEA TURTLE POPULATIONS

## Hawksbill turtles (*Eretmochelys imbricata*)

### East Atlantic Ocean

KEY NESTING SITES: REPUBLIC OF THE CONGO, SÃO TOMÉ AND PRÍNCIPE

This poorly studied, small population nests at only a few sites scattered along the West African coast. It is under severe threat from coastal net bycatch and consumption of eggs and meat, as well as from exploitation of shell material for handicrafts and jewelry.

### East Pacific Ocean

KEY NESTING SITES: EL SALVADOR, NICARAGUA, AND ECUADOR

Until a few years ago, marine turtle experts knew virtually nothing about this population. Thanks to recent collaborative efforts by regional conservationists to locate and protect them, hawksbills appear to be hanging on in the East Pacific. However, their use of habitats previously unknown to scientists (mangrove estuaries), extremely low numbers, and severe threats of coastal bycatch and egg consumption earn them a spot on this list.

### Northeast Indian Ocean

KEY NESTING SITES: INDIA, SRI LANKA, AND BANGLADESH

Like loggerheads and olive ridleys in this region, this hawksbill population has been depleted by severe threats. Compounding these problems, the size and status of this population is poorly known, making monitoring and conservation work very important for its continued survival.

### West Pacific Ocean

KEY NESTING SITES: MALAYSIA, INDONESIA, AND THE PHILIPPINES

Hawksbill populations worldwide have declined, in large part because of enormous demand for their beautiful shells, which provide "tortoiseshell" material used to make highly valuable handicrafts and jewelry. This hawksbill population, in particular, has suffered greatly because of exploitation of its shell material. Although international trade of hawksbill products is illegal, it continues to be a major threat to hawksbills around the world, especially in this region. In addition, future climate change effects could be another serious issue for this population.

## Leatherback turtles (*Dermochelys coriacea*)

### East Pacific Ocean

KEY NESTING SITES: MEXICO, NICARAGUA, AND COSTA RICA

This population is one of the most well studied in the world, so its 90 percent decline in the past 20 years is very well known. However, despite decades of conservation efforts at key nesting sites, leatherbacks remain scarce in the East Pacific. Historic egg consumption, as well as coastal and high-seas bycatch, caused this population's fall; now coastal development looms as the newest threat to its survival.

# Loggerhead turtles (*Caretta caretta*)

## Northeast Atlantic Ocean

KEY NESTING SITE: CAPE VERDE

Although relatively abundant, Cape Verde loggerheads have a limited distribution and have been threatened for decades by consumption of meat and eggs, as well as bycatch in Cape Verde and in feeding areas along the African mainland coast.

## Northeast Indian Ocean

KEY NESTING SITES: SRI LANKA, BANGLADESH, AND MYANMAR

This very small population has not been monitored consistently, so we do not know much about it. These turtles make this list because they are under high threat, mostly because of fisheries bycatch in trawls and nets, as well as ongoing development of coastal areas where they nest.

## North Pacific Ocean

KEY NESTING SITE: JAPAN

The trans-Pacific migrations of loggerheads between reproduction sites in Japan and feeding areas in Hawaii and Mexico are among the best known for ocean going animals. However, bycatch throughout their range—especially in Japan and Mexico—coupled with coastal development at nesting sites in Japan has caused this population to decline. International conservation efforts give hope for the future of loggerheads in this region.

# Olive ridley turtles (*Lepidochelys olivacea*)

## Northeast Indian Ocean (arribada population)

KEY NESTING SITE: INDIA

AND

## Northeast Indian Ocean

KEY NESTING SITES: INDIA AND SRI LANKA

Given the massive numbers of olive ridleys that nest in a few locations in India each year, the place of olive ridleys among the most endangered populations in the world might seem hard to believe. However, because of extremely intense pressures from trawl bycatch and consumption of turtle eggs and meat, the seemingly abundant ridleys have declined dramatically regionwide—both at mass nesting sites and at beaches where turtles nest in smaller numbers. More recently, development of major shipping ports along the coast of India has become a major cause of concern for these populations.

## West Indian Ocean

KEY NESTING SITES: INDIA AND OMAN

Although olive ridley nest sites are scattered all along the western coast of India and in other countries, olive ridley turtles nest only in small numbers throughout the region. They have been declining because of intense trawl bycatch and consumption of turtle eggs and meat, especially in India. In addition, these ridleys are threatened on land and in the water by coastal development and shipping.

PREVIOUS PAGE: Bycatch was consistently ranked as one of the greatest threats to sea turtle populations globally. Here, several green turtles were accidentally captured by a single net off the coast of Brazil. © PROJETO TAMAR BRAZIL – IMAGE BANK

# THE 12 HEALTHIEST SEA TURTLE POPULATIONS

## Green turtles (*Chelonia mydas*)

### East Pacific Ocean

KEY NESTING SITES: GALÁPAGOS ISLANDS (ECUADOR) AND MEXICO

This population underwent a perilous decrease in numbers in past decades because of substantial turtle harvest for their meat and eggs throughout the region, but especially in Mexico. However, because stricter controls on trade of turtle products were enforced, green turtles have made a remarkable comeback in this region. Although still a fraction of their historic population size, green turtles in the East Pacific are no longer in danger of disappearing any time soon.

### Southwest Atlantic Ocean

KEY NESTING SITE: BRAZIL

Green turtles, like other sea turtle species in Brazil and the southwest Atlantic in general, are a conservation success story. Once depleted because of extensive consumption of eggs and meat, as well as accidental capture in fisheries, green turtles are on the rise in this region. Although coastal net bycatch is still a threat, collaborative conservation efforts throughout the region are ensuring a positive outlook for this population.

### Southeast Indian Ocean

KEY NESTING SITE: AUSTRALIA

Although they have not been monitored for long, these green turtles are abundant and fairly isolated. They nest along the rugged and remote coast of Western Australia; although consumption of eggs and turtles by humans poses a threat to them on beaches and in the water, the chances are good that these turtles will be around for a while.

### South Central Pacific Ocean

KEY NESTING SITES: FRENCH POLYNESIA AND SEVERAL PACIFIC ISLAND NATIONS

Although population trends are not well known, the population is not facing many serious threats. Future monitoring and conservation work will provide a better view of this population's status, but for now, things are bright for these Pacific Island green turtles.

### West Central Pacific Ocean

KEY NESTING SITES: PALAU, GUAM, AND MICRONESIA

These green turtles are spread across this vast oceanic island region, with nesting sites dotting isolated beaches and remote coral atolls. But they also share islands with humans, and traditional cultures in this region value turtles, sometimes for consumption. At the moment, this population is healthy, but better assessments of their status will help future conservation efforts.

# Hawksbill turtles (*Eretmochelys imbricata*)

## Southeast Indian Ocean

KEY NESTING SITE: AUSTRALIA

As for green turtles in this region, nesting in isolated places gives these hawksbills an advantage that allows them to thrive. Although monitoring has been occurring only in recent years, threats to this population appear mild, making its future bright.

## Southwest Indian Ocean

KEY NESTING SITES: SEYCHELLES AND BRITISH AND FRENCH OVERSEAS TERRITORIES

Unlike their cousins in other parts of the world, these hawksbills benefit from solid long-term monitoring and good protection at major nesting sites and in their coral reef habitats. As with all hawksbills, exploitation of their shells for handicrafts and jewelry is a constant threat; although this population is historically depleted as a result, it is healthy and recovering at present.

## Southwest Pacific Ocean

KEY NESTING SITE: AUSTRALIA

Nesting sites for this population are confined to Australia, but hawksbills are thriving along the continent's shores and in its coral reefs. Exploitation of hawksbills for their shells remains a threat, and impacts from future climate changes might be problematic, but at present, these are healthy hawksbills.

# Leatherback turtles (*Dermochelys coriacea*)

## Northwest Atlantic Ocean

KEY NESTING SITES: TRINIDAD, GUYANA, FRENCH GUIANA, SURINAME, COSTA RICA, AND PANAMA

In contrast to their cousins on the other coast of the Americas, this leatherback population is huge and increasing nearly everywhere. With the exception of the declining nesting colony in Costa Rica and Panama, leatherbacks are swarming nesting beaches and feeding areas throughout the wider Caribbean and North Atlantic. Conservation efforts to maintain beach protection and to address significant bycatch issues are the keys to keeping these leatherbacks on this list.

## Southeast Atlantic Ocean

KEY NESTING SITE: GABON

Recent studies of the major nesting sites in Gabon have established this population as the biggest in the world for leatherbacks. Despite threats from bycatch and oil exploration in parts of their distribution, conservation efforts are under way to foster cooperative, international management in Gabon and neighboring countries to protect leatherbacks and other sea turtles in this region.

AT TOP: Green turtles haul ashore to bask on the remote coast of western Australia. The green turtle population in this relatively undeveloped region is thriving thanks to low levels of threat from human activities and strong protections by the Australian government. © KELLIE PENDOLEY

# Loggerhead turtles (*Caretta caretta*)

## Northwest Indian Ocean

KEY NESTING SITE: OMAN

Despite being the largest loggerhead nesting population in the world, monitoring efforts have become consistent only recently, which means that we still know relatively little about this population. Threats from fisheries bycatch appear to be severe, but the sheer abundance of nesting loggerheads in this region seems to have the upper hand for now.

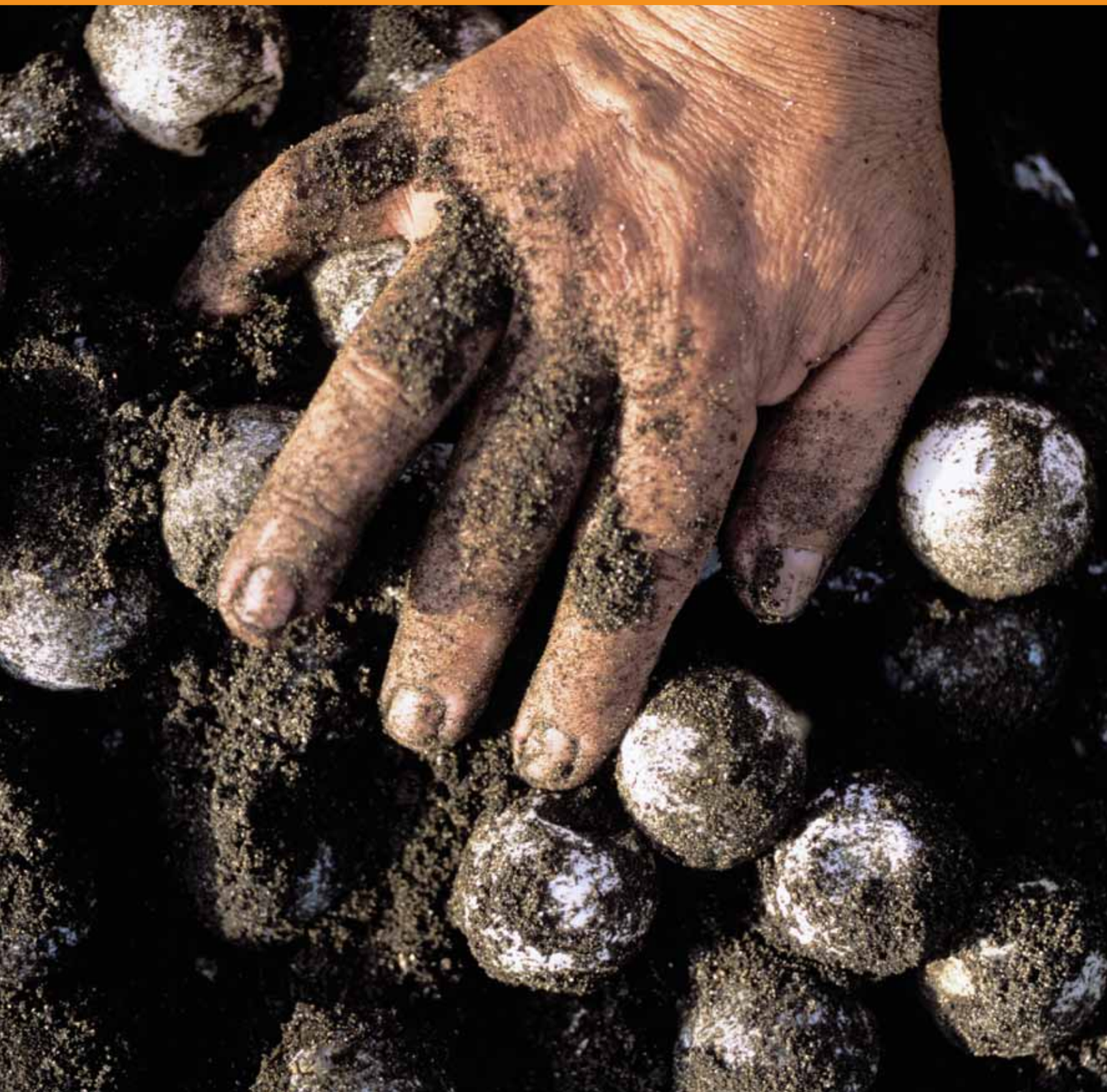
# Olive ridley turtles (*Lepidochelys olivacea*)

## East Pacific Ocean (arribada populations)

KEY NESTING SITES: MEXICO, NICARAGUA, AND COSTA RICA

Harvest for meat, eggs, and skin was rampant in the past and resulted in shocking declines in the seemingly endless abundance of olive ridleys in the East Pacific. Although some mass nesting sites have not recovered, others have held strong and remained incredibly abundant. The biggest rookery in the world hosts hundreds of thousands of nesting females each year! Serious threats still exist in this region, especially because of fisheries bycatch, but this population of sea turtles is presently the most abundant on the planet.

# policy & economics



# Stamp Out Extinction with the Save Vanishing Species Stamp

By TRACY O'TOOLE and EARL POSSARDT

What's the connection between marine turtle grants and postage stamps? In this time of increased need for support of sea turtle conservation, Americans can now easily help turtles and many other much-loved species … by simply buying a postage stamp.


Thanks to the Conservation Community Multinational Species Coalition and bipartisan support in the U.S. Congress, the Save Vanishing Species Stamp Act was signed into law by President Obama on September 30, 2010, and was launched by the U.S. Postal Service on September 20, 2011. In the 164-year history of the Postal Service, it is the first U.S. postage stamp with the express purpose of generating revenue for international wildlife conservation. Proceeds from the sale of the stamps will directly benefit the Wildlife Without Borders Multinational Species Conservation (MSC) Funds administered by the U.S. Fish and Wildlife Service. The five MSC Funds enacted by Congress channel support to key initiatives for African elephants (enacted in 1988), rhinoceroses and tigers (1994), Asian elephants (1998), great apes (2000), and marine turtles (2004).

The Save Vanishing Species stamp is now available at post offices across the United States, giving the public an easy and inexpensive way to help conserve the endangered species. Each stamp costs 55 cents, just slightly above the cost of first-class postage (44 cents). By purchasing the stamps, which feature the image of an Amur tiger cub, the public can directly contribute to the on-the-ground conservation programs overseen by the U.S. Fish and Wildlife Service's Wildlife Without Borders programs.

THIS PAGE: Green turtles fitted with satellite tracking devices are released from the Huidong National Gangkou Sea Turtle Reserve in China. © BRIAN J. HUTCHINSON AT LEFT: A villager collects olive ridley eggs during an arribada at Ostional Beach, Costa Rica. The eggs are part of a controlled legal harvest that allows villagers to collect and sell the eggs to the public. © JEFF ROTMAN

Since 1989, the Wildlife Without Borders program has awarded more than 2,500 grants providing vital funding for community-based efforts to protect wildlife as well as traditional actions such as antipoaching patrols, population monitoring, and research. For sea turtles alone, the Marine Turtle Conservation Act (MTCA) has funded 183 grants totaling US$7,105,000 since 2005. Those funds support carefully focused, cost-effective, on-the-ground conservation programs for the target species.

The Wildlife Without Borders' 2011 MTCA grants have focused primarily on priority sea turtle populations identified by the International Union for Conservation of Nature's Marine Turtle Specialist Group Burning Issues process. MTCA grants have focused on (a) East Atlantic leatherbacks in Angola, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, Côte d'Ivoire, Liberia, the Republic of Congo, and Sierra Leone; (b) East and West Pacific leatherbacks in Costa Rica, Indonesia, Mexico, Nicaragua, Papua New Guinea, the Solomon Islands, and Vietnam; (c) Caribbean and East Pacific hawksbills in Barbados, the Dominican Republic, El Salvador, Honduras, Mexico, Nicaragua, and Panama; (d) olive ridley arribada populations in Costa Rica, India, Nicaragua, and Panama; and (e) loggerhead populations in Cape Verde, Japan, Mexico, and Oman.

The U.S. Fish and Wildlife Service looks forward to its 2012 grant-making cycles for marine turtle projects and is optimistic that the new Save Vanishing Species stamp will make a significant contribution to support even more on-the-ground projects. To learn more about the Wildlife Without Borders MSC Funds and the Save Vanishing Species stamp, visit www.fws.gov/international/semipostal or http://Tigerstamp.com. ■

# The Making of a New Marine Protected Area in Uruguay

By KARUMBÉ

Sea turtles are found throughout Uruguay's waters, but because the country hosts no nesting, little attention had been paid to these animals until the formation of the nongovernmental organization Karumbé in 1999. Karumbé is a group of scientists, teachers, fishermen, and students working together toward the conservation of sea turtles in Uruguay through research, rehabilitation, outreach, education, and sustainable development.

After its establishment, members of Karumbé spent four years studying the occurrence and conservation status of sea turtles in Uruguayan waters to inform future research and conservation efforts. The studies were done in collaboration with local community members (including fishermen, politicians, artisans, teachers, military groups, traders, tourist guides, and farmers) in the various areas of study. Not only did these collaborations make the work possible, but also they laid a foundation for future collaboration around conservation efforts. Karumbé's research found that juvenile green turtles are the most common sea turtle species in Uruguay and then identified the area of Cerro Verde and La Coronilla Islands as a critical foraging and developmental habitat. The studies revealed that green turtles are subject to a number of ongoing threats in Uruguayan waters, particularly by fisheries bycatch.

Beyond hosting important habitat for sea turtles, the area of Cerro Verde and La Coronilla Islands hosts great biodiversity, including many migratory and endangered species such as Franciscan and bottlenose dolphins, right whales, sea lions, and seabirds. Despite the fact that the area is part of the Bañados del Este y Franja Costera Biosphere Reserve, which was established in 1976 and has been on the Ramsar List of Wetlands of International Importance since 1982, it lacks a management plan to ensure its sustainable development. Given the area's importance for sea turtles and other biodiversity, Karumbé decided to make Cerro Verde and La Coronilla Islands its primary target for sea turtle conservation.

Following the completion of preliminary research in 2004, all of the information that had been generated by Karumbé and other research groups was published in two bachelor's theses that detailed the area's great importance for biodiversity. Those publications enabled Karumbé to write a report to Uruguay's National Environmental Agency in 2005, thereby asserting the importance of Cerro Verde and La Coronilla Islands and urging the agency to include the area within Uruguay's National System of Protected Areas (Sistema Nacional de Áreas Protegidas, or SNAP). The justification was based on the area's biogeographical, ecological, scientific, economic, and social relevance; unique landscapes; and overall importance at national and international levels.

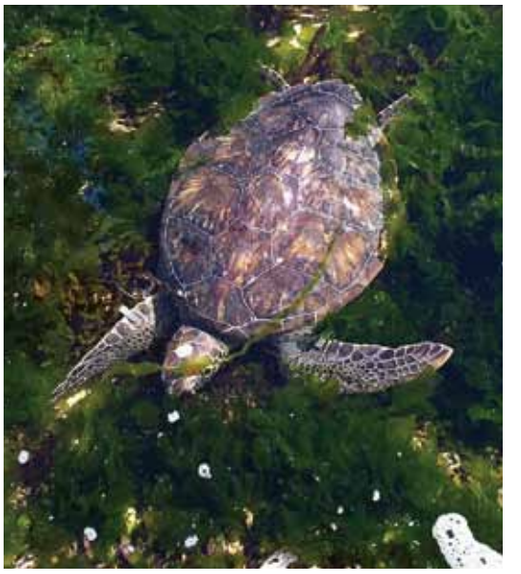
After the report was presented to SNAP, Karumbé began carrying out additional research that would be needed to develop an effective management plan should the area be declared a protected area. The studies found that this foraging ground hosts a mixed stock of turtles originating from 10 distinct nesting beaches in the Atlantic Ocean. Thus, mortality of turtles in Uruguayan waters may be depleting endangered nesting populations elsewhere in the Atlantic, which further highlights the area's conservation importance.

Recent studies found that although incidental capture by artisanal and recreational fisheries is an important threat to green turtles in Cerro Verde, interaction with solid marine debris is the main cause of mortality that has been increasing since 2008. To a lesser extent, meat consumption and carapace trade also threaten Cerro Verde's green turtle populations. To address those threats and to build long-term support for the possible protected area, Karumbé has been working to promote economic alternatives and to increase the participation of local people in conservation activities. A new Marine Turtle Center was constructed in the town of La Coronilla, which is adjacent to Cerro Verde, and Karumbé has been carrying out public awareness efforts at the area's main tourist sites along with environmental education activities in local schools. Such efforts, which include an annual sea turtle festival, have served as key elements to build community support for the development of the protected area.

In the end, Karumbé's many years of work have paid off. In August 2011, the government of Uruguay declared Cerro Verde and La Coronilla Islands a Coastal-Marine Protected Area. Although the work is far from over, thanks to the groundwork laid by Karumbé over the prior 12 years, the forthcoming management plan will be well informed, and the protected area will benefit from strong participation by local communities. This result, in turn, will benefit not only the regional sea turtle population but also the entire local ecosystem. ■

AT RIGHT: Green turtles from throughout the region flock to Cerro Verde, Uruguay, to dine on its abundant algae. Last year the area was declared a Coastal-Marine Protected Area by Uruguay's government, paving the way for improved long-term conservation of this important habitat. CLOCKWISE FROM TOP LEFT: © KARUMBÉ; © GABRIELA VÉLEZ-RUBIO; © SWOT; © KARUMBÉ; © KARUMBÉ; © KARUMBÉ


Brazil
Uruguay
Cerro
Verde
Atlantic Ocean
Argentina



# Turtles Need a Pacific Oceanscape as Much as People Do

By MICHAEL DONOGHUE, SUE TAEI, and LUI BELL

For millennia, people have depended on the ocean and its resources. But with declining fishery resources, rising sea levels, warming ocean temperatures, ocean acidification, and pollution, the oceans are changing rapidly. Those changes will affect us all but are particularly threatening to the way of life for Pacific Islanders; indeed, the changes jeopardize the very existence of some Pacific Island nations. Addressing the extensive threats to the health of the Pacific Ocean and of those who depend upon it most directly requires immediate, collective, and concerted action at a large scale.

Ulu (President) of Tokelau, Foua Toloa (foreground), and other leaders from throughout the Pacific Islands meet to discuss plans for the Pacific Oceanscape. © ADRIAN MALLOCH AT LEFT: A diver swims through a huge school of yellowstripe scad in tight formation. © JEFF YONOVER

The concept of the Pacific Oceanscape—a framework for long-term, sustainable, cooperative management of a vast marine area in the Pacific Islands—has rapidly advanced over the past three years and now has the full support of all 16 Pacific Island states, having been endorsed by their heads of state at the past two meetings of the Pacific Islands Forum. Scattered over a vast expanse of ocean, the roughly 1,400 islands of the Pacific Islands are (with the noteworthy exception of Papua New Guinea) mostly tiny land masses with small populations, but they are also large ocean states with management authority over enormous Exclusive Economic Zones.

Covering an ocean area of nearly 40 million square kilometers (16 million square miles, or larger than the areas of Canada, Russia, and the United States combined), the Pacific Oceanscape hosts globally significant populations of several species of marine turtles—notably greens, hawksbills, and leatherbacks, as well as smaller populations of olive ridleys and loggerheads. As ocean voyagers connecting these specks of land in a vast ocean, marine turtles have become an integral part of the culture of the Pacific. They are widely regarded as flagship species for Pacific marine ecosystems and often feature prominently in promotional tourist materials for many Pacific Island countries. Maintaining healthy stocks of turtles and facilitating the recovery of depleted populations will be an important indicator of the health of the Pacific Ocean itself.

Through the efforts of the Secretariat of the Pacific Regional Environment Programme (SPREP), concern about declining turtle populations and interest in sea turtle conservation have grown in the region in recent years. SPREP has developed a five-year regional action plan for marine turtles (2008–2012), which will shortly come up for renewal. A regional turtle database has also been recently reestablished with funding from the Western Pacific Regional Fishery Management Council. The SPREP action plan highlights the most significant threats to turtles throughout this vast region, including unsustainable harvest, predation by feral animals, habitat loss, boat strikes, pollution, and climate change. The plan also identifies significant barriers to turtle conservation in the region, including information gaps, inadequate laws and policies, limited capacity for monitoring, and inadequate involvement of local communities in conservation efforts.

The Pacific Oceanscape will aim to address such threats directly and to improve capacity for sea turtle conservation through its "Ocean Voyagers" component, which deals specifically with sea turtles and other migratory species. In addition, the Oceanscape concept has brought together high-level political leaders from throughout the region who appreciate the need for concerted and coordinated action to improve ocean health as a means of providing sustainable livelihoods to the region's inhabitants. Such high-level political engagement is likely to lead to greater efforts to curb traditional consumption of turtle products and other unsustainable behaviors that have been previously difficult to address. As the Pacific Ocean-scape continues to develop, SPREP, Conservation International, and other regional partners intend to play an important role in helping Pacific Island states achieve those ambitious goals and are optimistic that the Oceanscape will bring great benefits to the people—and turtles—of the Pacific Islands. ■

# the SWOT team

# The Future of SWOT

## WHAT DO YOU THINK?

By PATRICIA ELENA VILLEGAS

The SWOT Program was created in 2004 with the goal of creating a dynamic, global, georeferenced database of the seven sea turtle species; a network of people who generate and use the data for conservation; and a targeted communications effort built around an annual *SWOT Report*. Seven years later, SWOT has received data from more than 550 providers, has given more than 25 small grants for field-based research and conservation, has published and distributed six annual reports (this is the seventh) in multiple languages, has developed a new approach to standardizing minimum data needs, and has done much more.

To help determine the next steps for the SWOT Program, SWOT is currently conducting a comprehensive program evaluation that is focused around an online survey among SWOT contributors and the broader sea turtle community. The goal of the survey, conducted in August–September 2011, was to assess the degree to which SWOT has been effective in advancing sea turtle research and conservation and to identify areas of expansion (or contraction) of the program to make it most useful as a conservation tool. The survey sought to identify specific ways in which SWOT's tools are being used and to determine which aspects of SWOT are most (and least) valuable to the community.

More than 170 surveys were completed by respondents from 33 countries. Survey results show that more than 90 percent of respondents were aware of the SWOT Program and that 64 percent had used one or more of the SWOT tools. Such tools include *SWOT Report*, SWOT network, maps, database, website, TurtleVision, *Outreach Toolkit*, small grants program, and Minimum Data Standards. Respondents indicated that they used SWOT tools mainly to learn about global distribution and abundance of sea turtles and to assess the progress of conservation efforts.

THIS PAGE: A boy swims with a newly hatched leatherback turtle in West Papua, Indonesia. © JÜRGEN FREUND / WWW.JURGENFREUND.COM AT LEFT: A staff member of Sabah Parks collects data on a green turtle nest on Selingan Island in Turtle Islands National Park, Sabah, Malaysia. © KEITH A. ELLENBOGEN

Of those respondents who have used SWOT tools, 86 percent feel that SWOT has helped their organization, research, or project. Respondents reported that their increased awareness of sea turtle research and conservation projects and the information gained from data and maps are among the most beneficial ways in which SWOT has helped their organizations and projects.

Of the nine SWOT tools, *SWOT Report* is the most popular and is used to conduct outreach and education programs, to raise awareness, and to aid in assessing the conservation status of sea turtles. Similarly, *SWOT Report* ranked highest on a five-point scale assessing the usefulness of each tool.

Users are most familiar with the reports, maps, database, and website. In turn, they use those four tools most often and consider them the most helpful in contributing to the advancement of sea turtle research and conservation. Conversely, they reported that the least-used tools are TurtleVision and the *Outreach Toolkit* and—to a lesser degree—the small grants program and Minimum Data Standards. Generally, 84 percent of respondents agree that the SWOT Program has been successful in its mission to diffuse information on sea turtle conservation and science through a global network of researchers and conservationists and its database.

When asked to select potential new SWOT tools that they would be most likely to use, respondents most often listed information on foraging areas, reports on specific threats and regions, and updated SWOT maps. Respondents' recommendations for future improvements of the SWOT Program included increasing awareness of SWOT resources; focusing on specific regions; improving access, consistency, and reliability of data; expanding the SWOT small grants program; and developing maps showing foraging areas and in-water sites.

A full analysis of the survey results and of the program is still under way and will provide ideas for how to enhance and develop tools that can help the SWOT Program better serve its members and their conservation efforts. ■

# Acting Globally

## SWOT Small Grants 2011

Visit **www.SeaTurtleStatus.org** to apply for a 2012 SWOT small grant!

Since 2006, SWOT small grants have helped field-based partners around the world realize their research and conservation goals. To date, we have given 37 grants to partners in 23 countries. SWOT grants are awarded annually to projects in each of SWOT's three areas of focus: networking and capacity building, science, and education and outreach. The following are updates from each of our six grantees in 2011.

### COSTA RICA

## Ecology Project International

A 2011 SWOT grant will be used by Ecology Project International (EPI) to implement an Alumni Leadership Program for Costa Rican youth who have participated in EPI's field program. Up to 10 youths will be selected to participate in a two-day leadership workshop facilitated by EPI. A subset of those teens will return to the nesting beach as volunteer researchers for a full week. Small grant awards (US$50–100) will be made to participants who propose viable plans for conservation, education, or awareness projects in their communities. From this newly minted group of conservation leaders, EPI will nominate one individual to serve as a sea turtle research assistant in 2013.

Participants in Ecology Project International's field training program excavate a sea turtle nest. © ECOLOGY PROJECT INTERNATIONAL

### GHANA

## Wildlife Division (Forestry Commission)

Local community members in coastal Ghana practice measuring a turtle carapace during a community workshop. © ANDREWS AGYEKUMHENE

Sea turtles in Ghana face many threats, both on the beaches and in their coastal habitats, and the threats are increasing because of inadequate community participation. To build local support for sea turtle conservation, the Wildlife Division of Ghana's Forestry Commission has developed a community-based education and outreach program. With the help of a 2011 SWOT grant, an education program was conducted in 30 schools and 15 communities in coastal Ghana. As part of the program, wildlife clubs were formed in schools to encourage students to protect sea turtles, and 20 local community members were trained to become turtle protection volunteers. Sea turtle informational booklets, brochures, and T-shirts were also developed, and five education billboards were designed to educate the communities and visitors about turtle laws.

Children from the fishing community of El Ñuro, Peru, line up along the town dock to "meet" and learn about sea turtles. © ECOCEANICA

### PERU

## ecOceanica

Since 2010, ecOceanica has been developing a marine conservation program in the north of Peru. In close collaboration with the fishing community of El Ñuro, the program has been studying the local foraging population of green turtles, as well as conducting an outreach program with local children. During November 2011, ecOceanica gave several talks in the community and brought nearly 50 kids to the local pier to meet the turtles. The program also developed a poster to highlight the positive relationship between the people and turtles of El Ñuro. That poster has been used to raise awareness about the community for residents of Lima, the country's capital and largest city. With support from a 2011 SWOT grant, ecOceanica will commission a mural in El Ñuro to celebrate the area's marine life and to further encourage community engagement in conservation.

KENYA

## Local Ocean Trust: Watamu Turtle Watch

Local Ocean Trust: Watamu Turtle Watch (LOT-WTW) has been actively protecting Kenya's sea turtles and nesting beaches since 1997, as well as collecting data that form the basis of an extensive database on Kenya's sea turtles. A 2011 SWOT grant helped LOT-WTW continue to advance its research program by supporting its efforts to study the effects of (mostly human made) changes to the coastline on nesting turtles, the behaviors and habitat use patterns of bycaught turtles in the Mida Creek area, and the potential causes of fibropapillomatosis. Support from SWOT is also helping cover satellite tag-related costs as part of LOT-WTW's studies on the behavioral effects of long-term sea turtle rehabilitation.

Watamu Turtle Watch program coordinator, Fikiri, records data on one of the 7,000 turtles rescued through the project's bycatch net release program. © LOCAL OCEAN TRUST: WATAMU TURTLE WATCH


Staff from Akazul pose with children during the first Sea Turtle Festival in the town of La Barrona, Guatemala. © AKAZUL

GUATEMALA

## Akazul

A 2011 SWOT grant is helping nonprofit organization Akazul develop its education and outreach programs in the area of La Barrona in Guatemala. Akazul staff members have been busy developing the new Akazul Sea Turtle Center, which will be used to raise awareness of local and global conservation issues. They have also been leading a group of 22 local children through an extensive sea turtle education curriculum, as well as training a group of local egg harvesters in a sea turtle stewardship program. In December, the first La Barrona Sea Turtle Festival was held for local egg-harvesting communities, which included educational talks and materials, games, art activities, films, and a youth football tournament.

NEW ZEALAND

## Coastal Marine Research Group of Massey University

The Chatham Islands region east of New Zealand may constitute an important seasonal temperate foraging ground for Pacific leatherback turtles. Despite only one documented record of a leatherback, recent interviews with local fishermen and community members have turned up at least 30 records over the past 30 years. To further investigate the significance of this potential foraging habitat, a community-based research initiative was established with the support of a 2011 SWOT grant. The project aims to raise awareness about the plight of Pacific leatherbacks while engaging the local community to report sightings. The grant was used to produce information packs for distribution to local fishermen and the community.

Boats anchored off the coast of Chatham Islands, New Zealand. © DAN GODOY

# SWOT Team Member Spotlight

## Jérôme Bourjea (France—La Réunion)

I was born in France but have spent most of my life living and working overseas in Brazil, Madagascar, and Senegal; I currently reside on the French Indian Ocean island of La Réunion. For the past 10 years, I have been studying marine turtles and large pelagic fishes within the West Indian Ocean region as a researcher for IFREMER, the French Research Institute for Exploration of the Sea. My goal is to provide useful and reliable scientific information to managers to improve efficiency in the conservation of endangered or exploited species. *SWOT Report* provides a perfect portal for communicating about sea turtles, because it combines quality scientific information with emotion in a way that allows us to see nature for its beauty while not losing sight of the practical realities of research and conservation.

## Eduardo Amir Cuevas Flores (Mexico)

For the past 14 years, I have been working on sea turtle conservation and research in Mexico's Yucatán peninsula, where I have lived my whole life. I currently work for Pronatura Península de Yucatán where I am responsible for strategic planning of the organization's coastal conservation efforts; I also lead the sea turtle conservation program. In my time working with sea turtles, I have been continually inspired by their strength and resilience. Even when faced with adversity, they always fight for their objective, such as a nesting female that comes out to lay her eggs in spite of lights, predators, sand berms, or other obstacles. One of the things I like about SWOT is that it makes technical information accessible to a broader audience, which can influence decision makers and projects alike.

## George Meyer (United States)

I grew up in Tucson, Arizona, where sea turtles were as common as leprechauns. But seeing pristine desert ripped up for golf courses made me determined to protect what's left. As a comedy writer, I managed to work on "Late Night with David Letterman," "Saturday Night Live," and many seasons of "The Simpsons." Now I'm trying to share my good fortune by supporting conservation. It's encouraging to see kids learning to value nature, especially in Seattle, Washington, where I live with Maria Semple and our daughter, Poppy Meyer. I support SWOT and serve on its Editorial Advisory Board because I believe it can help enlighten people worldwide to the beauty and mystery of sea turtles.

## Miya Su Rowe (United States)

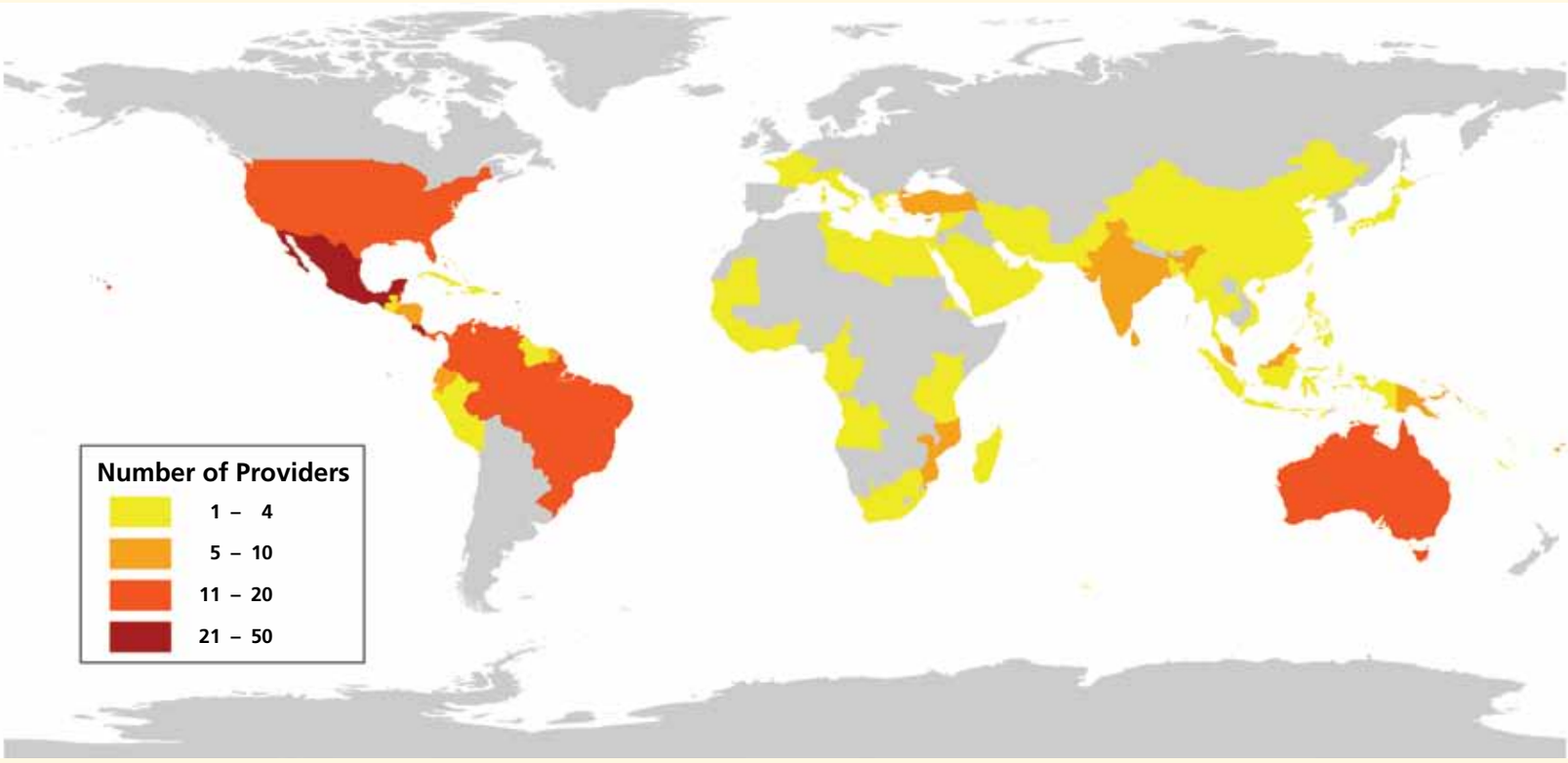
As a graphic designer, I have the great pleasure and opportunity to work with some exciting people and subjects, including *SWOT Report*, which I have designed since volume I. I am the creative director at Rowe Design House, which I started 10 years ago and where I have built a niche working primarily with environmental, wildlife, and humanitarian organizations. My goal as a conservationist—but also as a parent—is to teach my children to think of the world around them, whether that pertains to people, animals, or the environment. When my children tell people they meet that their mom helps saves sea turtles, I'd like to think that in some way I do play a small part. Since designing the first issue of *SWOT Report*, I have learned from and developed respect for all the people who make each report a success.

## Michele Westmorland (United States)

I am a freelance photographer and Founding Fellow of the International League of Conservation Photographers, specializing in travel, resort, lifestyle, and environmental photography. Although the bulk of my portfolio consists of commercial imagery, I am also passionate about conservation. Some of my most recognized images are those of the ocean environment, which were the focus of my 2006 book, *Ocean Duets*. Several of my images have appeared in past volumes of *SWOT Report*, and I have been pleased to contribute to sea turtle conservation efforts in this way. In addition to photography, I am an active public speaker and am involved in a variety of projects and professional associations. You can see my images and follow my work at www.westmorlandimages.com.

# SWOT Data Contributors

## A growing, global movement




SWOT's global network of volunteer data providers is the lifeblood of the SWOT initiative. Last year's green turtle maps were the culmination of six years of data collection efforts, which have yielded data from more than 3,000 nesting sites worldwide. The map above shows the full global spread of data providers by country, and the list of providers by country since 2004 is given below. To all of you who have contributed to making SWOT a success: THANK YOU!

**AMERICAN SAMOA**
Irene Kinan Kelly
Kimberly Maison

**ANGOLA**
Conrad Brian
Tamar Ron

**ANGUILLA**
James Gumbs
Jeanne A. Mortimer
Stuart Wynne

**ANTIGUA AND BARBUDA**
Cheryl Appleton
Tricia Lovell
Peri Mason
James Richardson

**ARUBA**
Edith Van der Wal
Richard Van der Wal

**ASCENSION ISLAND**
Annette Broderick

**AUSTRALIA**
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Tamra Chapman
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Kirstin Dobbs
Mick Guinea
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**BANGLADESH**
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**BARBADOS**
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Belize Audubon Society
Friends of Nature
Gales Point Wildlife Sanctuary Management Team
Janet Gibson
Glovers Reef Marine Reserve
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South Water Caye Marine Reserve
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**BERMUDA**
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**BRAZIL**
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Maria Angela Marcovaldi
Alexsandro Santos
Luciano Soares
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Mervin Hastings
Bertrand Lettsome
Arlington Pickering

**BRUNEI DARUSSALAM**
Kartik Shanker

**CAMEROON**
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Jules Ngunguim

**CAPE VERDE**
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Nuno de Santos Loureiro
Luis Felipe Lopez Jurado
Paula Sanz

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**FRANCE—RÉUNION ISLAND**
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Stéphane Ciccione
Claire Jean

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Amana Nature Reserve
Association Kulalasi
Association Kwata
Association Sépanguy
Benoit de Thoisy
Laurent Kelle

**FRENCH POLYNESIA**
Irene Kinan Kelly
Kimberly Maison

**FRENCH SOUTHERN TERRITORIES**
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Kélonia / IFREMER TORSOOI Database
Jean-Yves Le Gall
François René

**GABON**
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Bas Verhage

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**GRENADA**
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Xavier Delloue
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Alain Goyeau
Sophie Guilloux-Glorieux
Fortuné Guiougou
Thierry Guthmuller
L'Association Eco-Lambda
Cécile Lallemant
Alexandra Le Moal
Franciane Le Quellec
Laurent Malglaive
Pauline Malterre
Simone Mege
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Caroline Rinaldi
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Olivier Tartaglino

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**GUATEMALA**
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Ana Beatriz
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