Olive Ridleys: The Quirky Turtles That Conquered the World

Shanker, Kartik; Abreu-Grobois, Alberto; Bezy, Vanessa; Briseno, Raquel ; Colman, Liliana; Girard, Alexandre; Girondot, Marc; Jensen, Michael Paul; Manoharakrishnan, Muralidharan; M. Rguez-Baron, Juan; Valverde, Roldan; West, Lindsey

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Volume XVI

The State of the World's Sea Turtles

SPECIAL FEATURE

Olive Ridleys of the World

INSIDE:

BEHIND THE LENS OF THOMAS PESCHAK

OCEAN PLASTIC POLLUTION | SEA TURTLES AND COVID-19 | AND MORE ...

A loggerhead turtle and its fish companion ride the warm waters of the Gulf Stream off the Azores. This little slice of ocean is bursting with life—an aquatic Eden for dolphins, fish, and even the giant blue whale. © Cristina Mittermeier/@Mitty; **FRONT COVER:** Olive ridley turtles mate in Papagayo Gulf on Costa Rica's Pacific Coast. © EdwarHerreno.com

Ostional, Costa Rica – The legal egg harvest during olive ridley arribadas at Ostional, Costa Rica, is controversial, and past images have misrepresented the people, depicting them as environmental terrorists. Given that, it was surprising how warmly I was welcomed into the community. I wanted to make a picture that reflected the direct link between sea turtles and the community, so I adjusted my altitude by perching on a ladder. Thereby I framed the shot so that the people and turtles occupied the same space, with neither species dominating the other. © Thomas P. Peschak

→ SEE MORE PHOTOS AND STORIES FROM TOM ON PAGES 14–23.

Editor's Note

Capturing Moments

Nestling into the chilly beach at midnight, waiting for a turtle to emerge, brought back fond memories of many such peaceful nights that I spent as a researcher—the rhythmic crashing of waves, the smell of moist sand, and the sounds of the jungle nearby. But on this night the goal was not to count, tag, or measure but rather to capture a moment. At my side was Thomas Peschak, crouched behind the tool of his trade, a tripod-mounted camera specially modified by National Geographic engineers to capture the invisible ultraviolet light of night. Tom had the image he sought in his mind, facing west with clouds obscuring the moon, framed by forest to the left, and with the upturned hull of a shipwreck to the right. There we waited for the space between to be filled by a nesting leatherback that was certain to appear. At Grand Riviere, Trinidad, as many as 400 females can nest in a night. There were already several females around us—coming, going, digging, laying, covering—but none were yet inside the frame of the photograph to be. We had to wait with patience, another tool of Tom's trade, for the moment in which the physical setting, the invisible light, the movement of the waves, and the subject herself conspired to match his mind's vision. While we waited, we talked about his quest to photograph sea turtles differently than any photographer before. His compelling story and photos come to life herein (pp. 14–23).

Capturing moments with our far-flung sea turtle colleagues has been hard during the COVID-19 pandemic that upended the world just days after our last volume of *SWOT Report* was shipped to Colombia for the 38th Annual Sea Turtle Symposium that, sadly, never happened. Our global clan—accustomed to gathering in throngs each year to meet friends; to share science and stories; and to hug, laugh, dance, and recharge—was denied that joy in 2020 by a deadly virus.

Nevertheless, we were able to cope and to pivot. Our SWOT team found new ways to package and share content online, from Volume XV itself, to Expert Q&A articles, webinars, and more. We helped build new networks such as 'Team BEACH' to more effectively influence the human behaviors that result in healthy oceans and sea turtles. We even had some fun with things such as Seaturtleology, an online quiz game that ranks sea turtlers' experiences and challenges us all to do and see more. Visit www.SeaTurtleStatus.org today, and you will find a more vibrant SWOT hub than ever before. Many of our SWOT team members worldwide also adapted to meet the challenges of COVID-19, and we have shared some of their stories on pp. 40–45 of this volume.

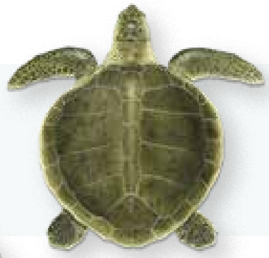
SWOT was not cowed by COVID-19 to shy away from our audacious goals—such as a global overview and the first comprehensive maps in more than a decade of the world's most abundant sea turtle species, the olive ridley (see pp. 24–33), an effort that brought together dozens of top experts and hundreds of data contributors. We are also proud to have continued our annual small grants program in this challenging year, providing much needed support to a dozen conservation programs worldwide (pp. 48–51).

The past year brought pain and setbacks, including the loss of dear friends and loved ones (pp. 58–59), but we were inspired by the incredible resilience of our global sea turtle community in meeting these challenges, and we have renewed optimism for sea turtles and for those of us who work to conserve them on a healthy planet.

Roderic B. Mast
Chief Editor

meet the turtles

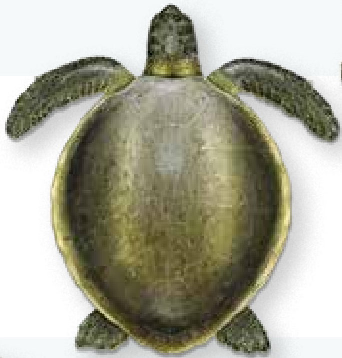
The seven sea turtle species that grace our oceans belong to an evolutionary lineage that dates back at least 110 million years. Sea turtles fall into two main subgroups: (a) the unique family *Dermochelyidae*, which consists of a single species, the leatherback, and (b) the family *Cheloniidae*, which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



Kemp's ridley
Lepidochelys kempii
CR

Olive ridley
Lepidochelys olivacea
VU

Hawksbill
Eretmochelys imbricata
CR



Flatback
Natator depressus
DD

Loggerhead
Caretta caretta
VU

Green
Chelonia mydas
EN

Leatherback
Dermochelys coriacea
VU

IUCN RED LIST STATUS:

- CR Critically Endangered
- EN Endangered
- VU Vulnerable
- DD Data Deficient

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

ILLUSTRATIONS: © Dawn Witherington

contents

SWOT REPORT

VOLUME XVI

SWOT
The State of the World's Sea Turtles

To request a copy of the latest issue of *SWOT Report* or to make a tax-deductible contribution to SWOT, contact:

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Oceanic Society
P.O. Box 844
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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!

Masirah Island, Oman – Although still considered one of the largest loggerhead rookeries in the world, this population is declining rapidly. I patrolled the beach at first light each day, hoping to encounter a straggling nester still on the beach at sunrise. Finally we found this giant, barnacle-encrusted, ancient-looking female. I knew as she entered the waves that my shot was in the surf, so I followed her in, ultimately sacrificing some of my gear to capture this image. © Thomas P. Peschak

→ SEE MORE PHOTOS AND STORIES FROM TOM ON PAGES 14–23.

ADDRESSING BYCATCH IN A Global Leatherback

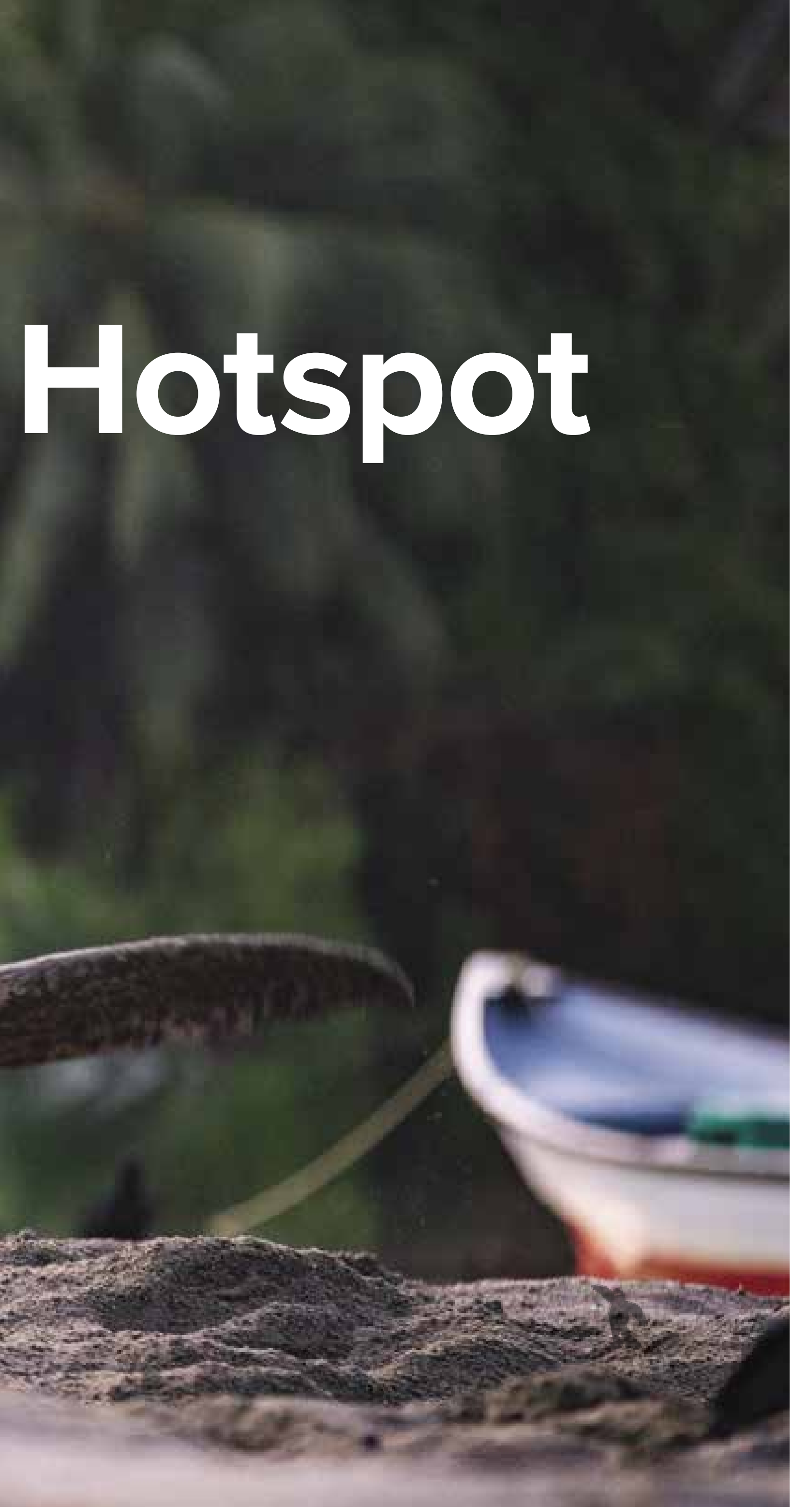
By Ganesh Thannoo, Kyle Mitchell, and Scott Eckert

The dual-island nation of Trinidad and Tobago supports one of the world's largest nesting colonies of leatherbacks, with 40,000 or more nests annually. Most nesting occurs on the northeast coast of Trinidad and is centered near the communities of Grande Riviere, Matura, and Fishing Pond. At Matura (one of three index beaches), turtle populations are declining at approximately 5 percent per year, which likely represents a trend for the entire leatherback population.

Incidental capture by fisheries is a major source of mortality for all sea turtle populations globally, and artisanal fishers have a disproportionately high impact in Trinidad, especially near nesting beaches and during nesting season. Trinidad supports a large artisanal gillnet fishery near its leatherback beaches. That fishery uses a variety of gear including bottom-set monofilament gillnets, pots, various hook and line methods such as bottom-set longlines, and multifilament drift gillnets. The latter gear type sustains the

A leatherback turtle nests just steps away from the fishing village of Grande Riviere on Trinidad's north coast. © Ben J. Hicks/benjhicks.com

Hotspot



highest levels of leatherback entanglement, estimated to exceed 3,000 adult leatherbacks yearly with a mortality rate of about 30 percent.

Efforts to reduce Trinidad's bycatch were undertaken during 2006–2010, beginning with a planning workshop hosted by the Wider Caribbean Sea Turtle Conservation Network (WIDECAST) and the Trinidad Ministry of Agriculture, Land, and Marine Resources. The workshop brought together representatives from government, artisanal fishing groups, conservation nongovernmental organizations (NGOs), and scientists with both fisheries and sea turtle expertise. The resulting plan called for a series of experiments in bycatch reduction methods aimed at reducing leatherback entanglement significantly while not reducing fisher incomes. Most of the studies focused on changes to nets. Only new nets were used, and onboard observers ensured compliance, consistency, and accuracy in data acquisition. Results indicated that nets no more than 50 meshes deep—instead of the more traditional depth of 100–150 meshes—provided the highest rate of reduction in turtle entanglement. However, a small reduction in target species catch was also a result. Entanglement rates also were influenced by turtle density. When the costs of net repair caused by damage sustained by entanglement events were included in an economic evaluation, the 50-mesh nets provided a 33 percent higher economic return despite a slightly lower fish catch. Anecdotal reports by fishers also noted that the 50-mesh nets allowed for easier extraction of turtles without harm to either the turtle or the net.

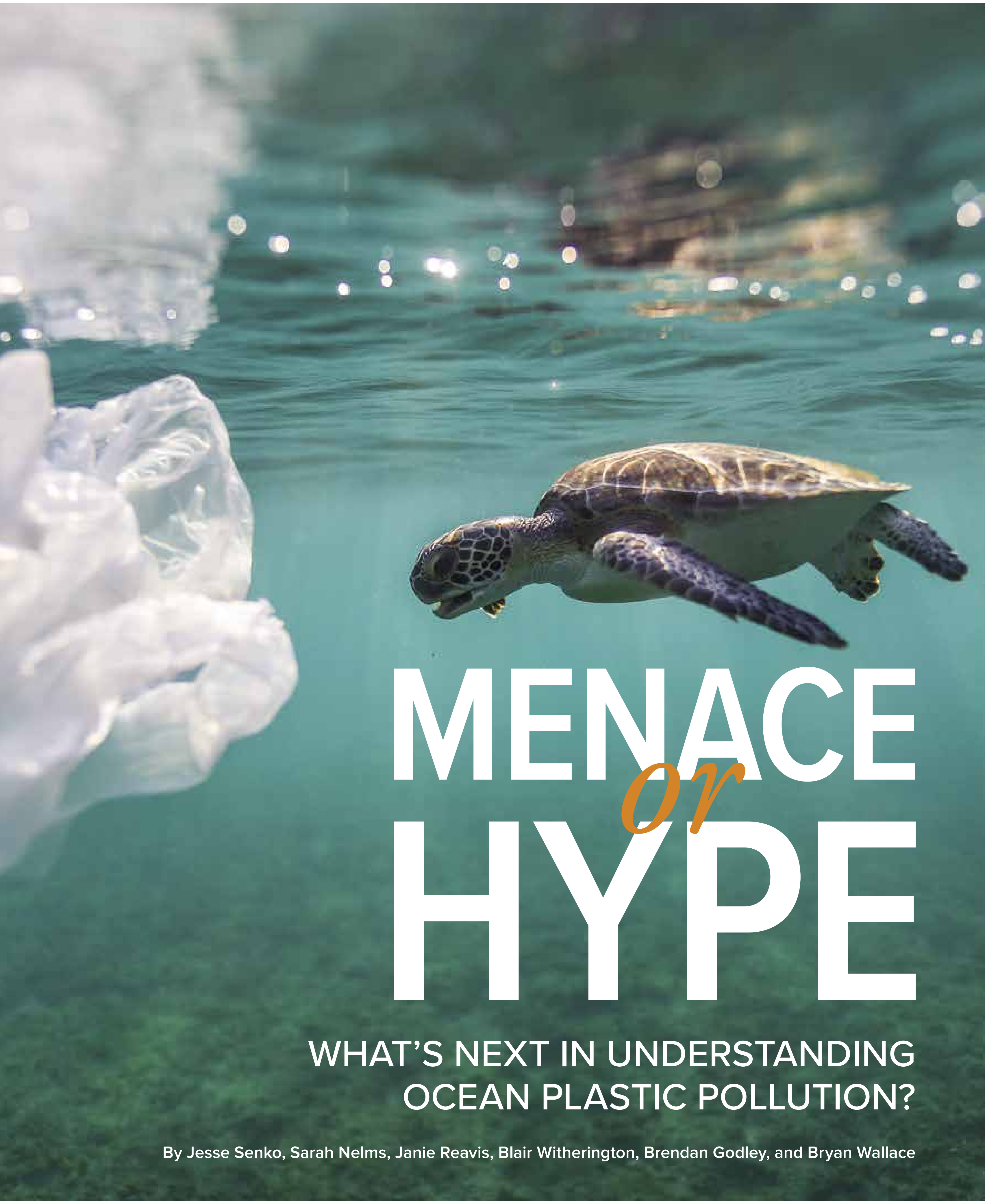
Fishing methods were also evaluated for their bycatch impacts. The most promising method for reducing entanglement was troll fishing, which, while common in Tobago, is rarely practiced in Trinidad. Trolling had a significantly higher rate of economic return for fishers, and it yielded no turtle bycatch. However, trolling required greater fisher expertise and effort, making it a less feasible replacement for gillnets. Other experiments looked at the effect of marking nets with colored LED marker lights; this effort yielded no reduction in entanglement rates.

Sadly, despite success in developing the bycatch-lowering alternatives to historic fishing practices, and notwithstanding initial support for the program from both fishers and regulatory agencies, there was a strong reluctance to adopt such methods after the program ended. A lack of financial resources, the complexity of introducing new regulations, and tradition were all given as reasons for this reticence.

Ultimately, a final project had 29 fishers deploy Vessel Monitoring Systems, which recorded fishing locations and turtle captures to identify hotspots for probable leatherback entanglement. From those data, a regulatory scheme was designed to set time or area closures for certain gear types, and model fisheries legislation was proposed. The regulations called for the north and east coasts of Trinidad to be divided into fishing gear exclusion zones, with (1) high leatherback interaction areas limited to the use of turtle-safe fishing methods such as trolling, (2) moderate interaction areas limited to shallow set drift gillnets and trolling, and (3) low-probability interaction areas allowed to follow standard gear practices. Although Trinidad has yet to adopt those bycatch reduction methods (either officially or in practice), policy changes at the national level are underway.

Conservation of Trinidad and Tobago's important leatherback rookery has been constantly evolving over the years, starting with efforts led by concerned villagers to curtail beach-based slaughter of turtles for community subsistence. That movement led to the research, policy, and conservation efforts at the national and international scales described herein. The government of Trinidad and Tobago has created a National Sea Turtle Recovery Plan and a cabinet-appointed Sea Turtle Taskforce, which is directly overseen by Parliament. Those groups have ensured deep community engagement at all levels. The country's sea turtles are now recognized for their global importance, and efforts to study and protect them have drawn international attention.

Changing the livelihoods of fishers, which are long-steeped in culture, history, and tradition, will not be easy, but it is possible. Thanks to a long-term awareness program led by the community-based nonprofit Nature Seekers, the citizenry is learning about the symbiotic relationship between sea turtles and fishes, as well as about the dual truths not only that sea turtle bycatch is harmful to a healthy sea turtle population, but also that an unhealthy sea turtle population is harmful to the fishing industry. •



MENACE *or* HYPE

WHAT'S NEXT IN UNDERSTANDING OCEAN PLASTIC POLLUTION?

By Jesse Senko, Sarah Nelms, Janie Reavis, Blair Witherington, Brendan Godley, and Bryan Wallace

A green turtle mistakes a plastic bag for food off the coast of Florida, U.S.A. © Ben J. Hicks/benjhicks.com

SCALE OF THE MENACE

In 2009, Dr. Nicholas Mrosovsky, an iconic sea turtle specialist, declared that a new menace to sea turtles had arisen: plastic pollution. Yet, despite a growing number of studies citing the negative interactions between marine turtles and ocean plastics and the abundant media coverage of dead or suffering turtles and their polluted habitats, the big picture effects of such plastic pollution on marine turtles remain largely unknown. Is plastic truly a *menace* to turtle populations, or has it been overhyped?

We conducted a global review of published studies relating to plastics and their effects on sea turtles over the past half century (published in *Endangered Species Research* 43: 234–52) in which we show that such effects (typically from ingestion or entanglement) have yet to be adequately assessed. At the time of our review, only seven studies had considered the effects of plastic pollution on marine turtle populations; five studies needed more data to draw definitive conclusions, two lacked evidence showing any effects, and none of the seven were able to definitively link plastics with sea turtle declines or even with reductions in growth at the population scale. The findings stand in stark contrast to myriad studies that document the negative effects that ocean plastic pollution imparts on individual animals, from drowning to starvation, gastrointestinal damage, malnutrition, physical injury, reduced mobility, and physiological stress.

Critical questions were left unanswered in our review. We know that plastic kills marine turtles, but does it kill enough turtles to cause population declines or to impede population growth? As marine habitats face increasing amounts of plastic pollution over time, population-level impacts may increase and become easier to detect, but only if researchers exert meaningful efforts toward measuring those impacts. That said, no amount of study will be able to detect all possible population-level effects from plastic pollution given the challenging nature of such broad-scale monitoring; underreporting is to be expected. This challenge to threats assessment in the oceans is not uncommon. For example, fisheries bycatch is generally underreported in fleets operating without extensive observer coverage.

UNDERSTANDING THE MENACE

Notwithstanding the challenges, it is crucial that researchers, managers, and communicators understand plastic pollution in a population-level context so that they can more effectively prioritize the limited conservation resources that address competing threats. The following research priorities will help improve researchers' understanding of how plastic affects marine turtles:

- **Engage in controlled studies.** Controlled studies, in the wild and in the laboratory, can improve researchers' understanding of how plastic ingestion and entanglement affect marine turtles, though such studies in the lab would require great attention to animal welfare concerns. Such studies could control the amounts and types of plastic ingested, including chemical-laden plastic, while tracking weathering, dosage, and other components of ocean plastics. Researchers can concurrently track changes in feeding, weight, growth rates, and other behaviors of turtles with regard to plastic interactions.
- **Report both positive and negative results.** Researchers should report not only when plastic is present in marine turtles (positive results) but also when it is not (negative results). Presenting only the former can result in gross overestimations.
- **Standardize plastic collection techniques.** Differences in plastic collection techniques from dead (e.g., necropsy) or live (e.g., esophagus lavage or feces) animals can make it difficult to draw meaningful comparisons within and among studies. For example, a turtle that is found dead (e.g., stranded) with plastic in its stomach may have been sick and not feeding normally due to its compromised health, potentially contributing to its having consumed plastic.
- **Study sublethal effects.** It is important to better understand how sublethal effects (those that do not immediately kill) may influence the health, reproduction, and survival of marine turtles. For example, studies are needed to learn more about how the drag from entanglement in plastic influences turtles' ability to swim or how plastic in the stomach of a turtle affects its growth. A handful of exemplar studies have suggested tracking animals after they have interacted with plastic so researchers can understand survival probability, growth rates, reproductive output, and health status for individual animals. With advances in tagging technology, it will become easier to assess how sublethal effects may influence marine turtle health, survival, and reproduction.
- **Model the turtle exposure to plastic pollution.** It is essential to understand how many turtles interact with plastic. Modeling the level of exposure to plastic pollution could represent the spatiotemporal overlap between plastic pollution and marine turtle distributions. As the effects on individuals become known, this modeling could be scaled up to help us better understand such effects at population levels.

MENACE, HYPE, AND OPPORTUNITY

Is plastic truly a *menace* to marine turtles, or has it been overhyped? Without question, plastic causes pain and suffering in marine turtles and is clearly a serious animal welfare issue, making it a menace to *individual* marine turtles. However, scientific evidence to suggest broad-scale effects on marine turtle *populations* is still lacking, in contrast to other well-known threats facing marine turtles.

The powerful visual imagery of plastic pollution that is widely circulated by the media elicits visceral emotional responses in people, representing an enormous opportunity to connect more people to ocean conservation and broader sustainability issues. Yet such stories, though well-intentioned, may be inadvertently misleading. In a 2002 editorial in the *Marine Turtle Newsletter*, Mrosovsky wrote, "Perhaps worse are the insidious consequences of enveloping conservation biology in exaggeration and unsubstantiated assertions.… Hype perniciously downgrades precisely what one should wish to encourage in scientists: an overriding respect for the truth." It is thus incumbent upon the marine turtle community to do a better job assessing and communicating the effects of this emerging threat. We think Mrosovsky would agree, the possible menace of plastic notwithstanding. •

MANAGING THE WORLD'S LARGEST GREEN TURTLE ROOKERY

By Owen Coffee, Katharine Robertson, Mark Read, Andrew Dunstan, Scott Smithers, David Booth, Mark Hamann, Colin J. Limpus, Tina Alderson, the Wuthathi People, and the Meriam Nation People

On the remote outer edge of Australia's northern Great Barrier Reef (GBR) lies Raine Island, a 27-hectare (67-acre) vegetated coral cay that hosts what is arguably the world's largest green turtle nesting population. Up to 20,000 densely packed females have been recorded coming ashore nightly. Declining reproductive success has been reported there for decades, signaling the possibility of impending rookery collapse. To stem this loss, the Raine Island Recovery Project (RIRP) was launched in 2015. The RIRP is a five-year collaboration between the Queensland government, BHP (a global resources company), the GBR Marine Park Authority, the GBR Foundation, and the Wuthathi and Meriam Nation (Ugar, Mer, and Erub) Traditional Owners. Over thousands of years, the Traditional Owners have held enduring links to Raine Island. They use its resources and hold cultural connections to the land and sea through song lines, stories, and voyages to the island.

The RIRP studied three key issues as possible contributors to rookery loss at Raine Island: (1) tidal inundation of the nesting beach, (2) mortality of nesting females (from multiple causes), and (3) influences of nest density (e.g., either nests being so close to one another that they adversely affect embryonic development, or the destruction of older nests by later nesting females). The RIRP developed innovative monitoring and adaptive management for each of those issues through research about nests, island geomorphology, turtle migration, and inter-nesting behavior.

REDUCING NESTING TURTLE MORTALITY

One of the first management actions of the RIRP was to complete the installation of 1.75 kilometers (1.08 miles) of cliff-top fencing around parts of Raine Island's raised central phosphate cliff to block access and thereby reduce cliff-fall turtle mortalities and entrapments under the cliff line. Earlier studies had shown that such factors caused roughly one-third of Raine Island's nesting turtle mortality. Because of this intervention, turtle mortalities from cliff falls over the life of the project were reduced from 30 percent to 5 percent.

Nesting turtles that remain on the nesting beach after sunrise because of exhaustion or disorientation may perish from heat stress. A rescue program was instigated to ensure that as many turtles as possible were returned to the water before sunrise by a team equipped to free animals from virtually any form of entrapment and to transport them safely by vehicle to the water's edge. The lives of nearly 700 female greens were saved in this fashion.

IMPROVING NEST SUCCESS

The most significant intervention at Raine Island thus far has been beach reprofiling to raise the level of the nesting environment so that the beach and natural clutch depth are both above the peak tidal water table. Heavy equipment was used to move sand in 2014, 2017, and 2019. All told, the effort shifted roughly 40,000 cubic meters (43,744 cubic yards) of material on 35,000 square meters (38,276 square yards) of beach, effectively doubling the island's viable nesting habitat (about 21 percent of the nesting habitat remains at risk of inundation). Each of the alterations has been associated with increased incubation success and hatchling emergence when compared with control sectors. An estimated 4.6 million more hatchlings will be produced on Raine Island over the next 10 years because of this important beach reprofiling effort.

These management actions were informed by a series of innovative research projects that sought to increase RIRP's understanding of this remarkable cay. These projects studied the following:

- The composition, accretion, and future projections of the cay's sandy nesting habitat through fine-scale geomorphology and sea-current modeling
- The nesting, inter-nesting and migratory behaviors of nesting turtles by using satellite telemetry
- The use of drone technology to monitor the population
- The characteristics of nesting environments that may contribute to reduced hatchling emergence and nesting success

ONGOING AND FUTURE CHALLENGES

Despite the partial successes of such intervention efforts, new and enduring issues continue to threaten the nesting turtles of Raine Island, and much work remains to be done to improve the long-term prospects for the island's green turtles. Recent research on temperature-dependent sex determination estimates that more than 90 percent of all hatchlings emerging on Raine Island are female. Given that it is the largest nesting aggregation of the 60 or so nesting beaches for the northern GBR turtle genetic stock, it is believed this population of green turtles may be heading toward a potentially dangerous feminization. Moreover, although RIRP observed increases in hatching and nesting success on Raine Island's reprofiled habitats, those seasonal figures remain highly variable and frequently fall below the average of other rookeries in the stock. The fluctuations indicate that there may be other factors contributing to the decline in the reproductive success of this rookery; such factors warrant continued investigation.

Finally, and most pressing as Earth's global climate changes, low-lying turtle rookeries such as the one on Raine Island fall under greater than average threat from rising sea levels and more frequent extreme weather events. Turtle preservation efforts must now consider whether those islands or their turtle populations have the capacity to adapt to the changes, which are likely to occur within one or two marine turtle generations. If not, what new interventions or strategies will be needed to safeguard the islands and their nesting populations against an uncertain future? •

AT LEFT: Hundreds of green turtles can still be seen nesting into the early morning on Raine Island. © Queensland Government

WHAT MAKES A SEA TURTLE a Sea Turtle?

By Blair P. Bentley, Peter H. Dutton, and Lisa M. Komoroske

Deep within the cells of sea turtles are signals of their evolutionary past, indications of their ability to adapt to changing environments, and fundamental building blocks that make them what they are. The DNA that composes the genetic blueprint for making a sea turtle is called its *genome*. Until recently, scientists had been able to gain only glimpses of important aspects of sea turtle biology from small pieces of DNA, leaving much still unknown in humans' deeper understanding of those animals.

But genetic science has advanced at a lightning pace; new and emerging technologies now allow the rapid and affordable sequencing of entire genomes. The first draft human genome cost an estimated US$300 million and took more than a decade to complete. Today, you can swab your cheek, have your genome sequenced for less than US$1,000, and see the results in a few days! Although trickier for wild organisms, collaborative efforts to sequence the world's biodiversity are making amazing strides. The Vertebrate Genome Project (VGP) is one such effort; it aims to create near error-free genomes for approximately 70,000 wild animal species. VGP's reference genomes for the leatherback and green sea turtles were completed in 2020, with downstream analyses now underway.

HOW DO YOU MAKE A GENOME?

A key feature of today's genetic technology is the ability to sequence very large stretches of DNA (100,000+ long nucleotide segments). Sea turtle genomes have around 2.1 billion base pairs to assemble, so piecing those complex genome puzzles together is still a laborious and expensive task. It requires the collaboration of field biologists and veterinarians to collect the samples, of laboratory molecular scientists to extract and sequence the DNA, and of data analysts (bioinformaticians) to put all the pieces together.

Genome construction starts with an extremely high-quality tissue sample—one in which the DNA is intact in very large segments; thus, acquiring such a sample for an

IT TAKES A VILLAGE TO MAKE A GENOME

Many people and organizations have contributed to the sea turtle genome effort. Thanks to project co-leader Camila Mazzoni, as well as to collaborators Yaron Tikochinski, Gene Myers, and Erich Jarvis and the VGP Consortium. Tissue collection was facilitated by the NOAA-SWFSC California in-water leatherback team (especially Scott Benson and Heather Harris), the NOAA PIFSC-MTBAP team and Thierry Work, the Israel Nature Park Authority, the New England Aquarium, and the St. Croix Leatherback Project at Sandy Point National Wildlife Refuge (especially Kelly Stewart, Claudia Lombard, Shreya Banerjee, and Justin Perrault). Funding was provided by the National Science Foundation, the NOAA, the University of Massachusetts, the VGP, and the individual donors. The authors and their partners also wish to acknowledge the contribution of Alan Bolten, whose recent passing is an immeasurable loss for the global sea turtle community. We hope to honor him by sharing the genomes with the world.

endangered species in the wild is no small feat. Tissues must be collected under challenging field conditions and without causing any negative effects to living animals. For the leatherback genome referenced herein, blood was collected from a male turtle sampled as part of the National Oceanic and Atmospheric Administration (NOAA) in-water research efforts in Monterey Bay, California. To fully annotate the genome, RNA from key organs was also needed. Such tissues are even more sensitive to degradation; because they cannot ethically be taken from live turtles, RNA was obtained from recently deceased animals at the St. Croix Leatherback Project at the Sandy Point National Wildlife Refuge in the U.S. Virgin Islands and at the New England Aquarium in Boston. The figure below shows how the work of molecular scientists and bioinformaticians complete the process of genome definition once high-quality DNA samples have been collected in the field.

WHAT CAN WE LEARN FROM SEA TURTLE GENOMES?

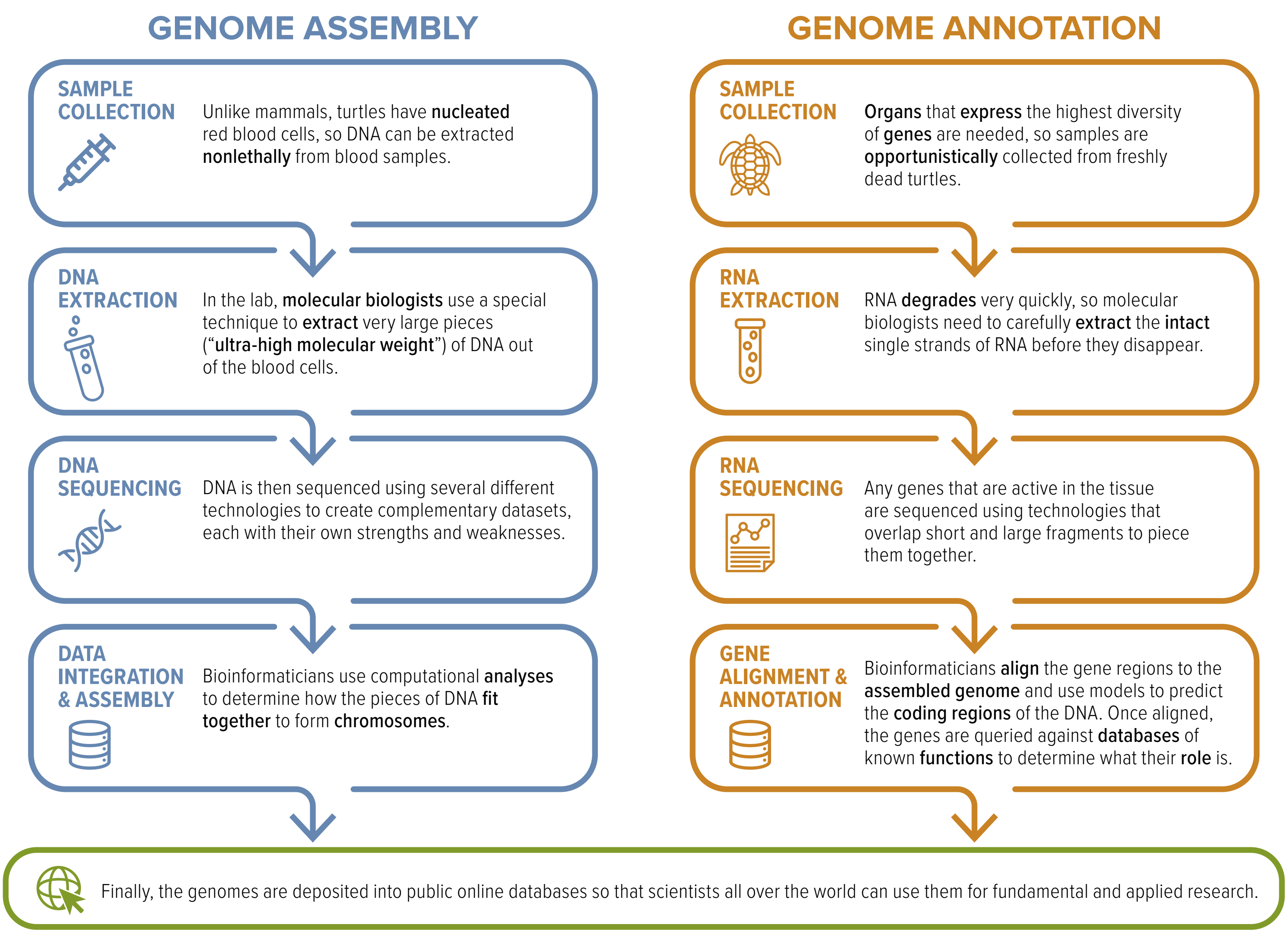
The new whole genomes provide mountains of information about leatherback and green turtles and can help scientists understand how (and which) genes help to fight diseases, to facilitate temperature-dependent sex determination, or to assist turtles as they navigate across entire oceans. Genomes can also help scientists to track the history of the species over millennia, to map past population expansions and contractions, and to monitor genetic erosion (a loss of genetic diversity that occurs when a species' population declines). Knowing the latter can help scientists to determine how vulnerable a species may be to climate change, disease, and other threats; how much inbreeding is occurring; and whether deleterious genes that can affect survival rates of the species may have accumulated over time.

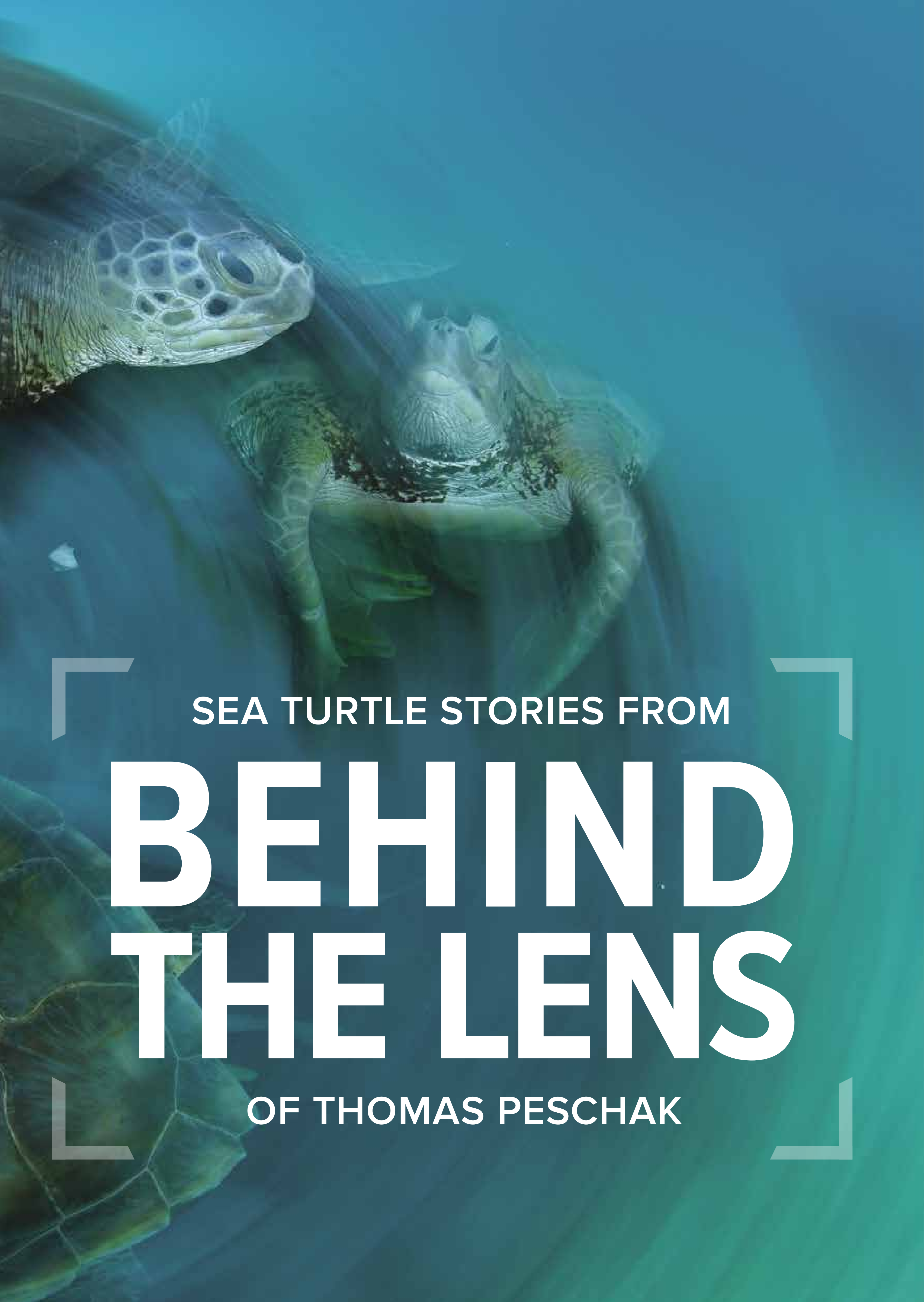
These new, high-quality genomes will allow for the comparison of multiple sea turtle species and will help scientists to understand what differentiates them. The genomes will also provide future studies with an immensely useful reference that can allow investigation into population comparisons within a given species; such investigations could be of enormous benefit to conservation efforts worldwide.

Modern leatherbacks have unique characteristics accumulated over the ~75 million years of evolution since they diverged from the other sea turtles. They lack the hard carapace typically associated with green turtles and their cousins. They are also able to dive to great depths, migrate vast distances, and tolerate much colder conditions than can other turtle species. All of the genetic code that makes such behaviors possible is now in the hands of genetic scientists! By comparing the new leatherback and green turtle genomes with other freshwater turtle genomes, it is now possible for scientists to delineate the genes associated with adaptations to salt water, thereby getting to the heart of what makes a sea turtle a sea turtle. •

BELOW: Conceptual overview of how sea turtle genomes are created.

AT LEFT: A leatherback hatchling crawls to sea on Grande Riviere Beach, Trinidad. © Ben J. Hicks/benjhicks.com





SEA TURTLE STORIES FROM

BEHIND THE LENS

OF THOMAS PESCHAK

The majesty, beauty, and fragility of the world's oceans and coasts is uniquely brought to life on the printed page through the images and stories of National Geographic photographer Thomas Peschak. Educated in South Africa as a marine biologist, he fully embraced photography once he realized that his creative work could have greater conservation impact than his scientific research. His TED Talk, "Dive into an Ocean Photographer's World" has been viewed more than 1 million times, and his @thomaspeschak Instagram account has 1.2 million followers. As a National Geographic explorer and fellow, and the director of storytelling for the Save Our Seas Foundation, Thomas now merges science with photojournalism to tackle critical ocean conservation issues around the world.

In his forthcoming book, *Wild Seas*, Thomas shares more than 200 remarkable ocean images—and the stories behind them—from close encounters with Galápagos sharks, to surfing seals, dancing albatrosses, and, of course, sea turtles. The book charts his transformation from a marine biologist to full-time conservation advocate, who—armed with little more than a mask, fins, and a camera—offers an impassioned case for revering and preserving the world's oceans. Through vivid photographs of the ocean's splendor and vulnerability, Thomas's provocative book presents a compelling case for change.

Readers of *SWOT Report* are familiar with Thomas's unique sea turtle shots, which have been featured in our pages over several years, including the iconic cover of *SWOT Report*, vol. V. Many more of Thomas's artful images illustrated a once-in-a-generation feature article on sea turtles that appeared in *National Geographic Magazine*'s October 2019 issue. Titled "Sea Turtles are Surviving—Despite Us," the article was written by Craig Welch. For nearly two years leading up to its publication, Thomas traveled to the remote ocean corners of Earth to capture the article's photographs, garnering what we think are extraordinarily striking and unusual photographs of sea turtles, their habitats, and the humans who interact with them, plus stories to accompany them. In the pages that follow, and scattered throughout this volume of *SWOT Report*, are our favorite Thomas Peschak sea turtle images, accompanied by his words describing the inspiration, emotions, and techniques used to capture them. •

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PREVIOUS SPREAD: Farmer's Cay, Bahamas – Before this shoot, my perception of green turtles was of a regal, elegant, and serene species, but here I witnessed a totally different reality. When green turtles are this numerous and there is fresh food to compete for, the façade of serenity falls away, and surprisingly assertive predators are revealed. It was astounding to see the speed and agility with which the turtles darted around snapped up conch fishing discards. I wanted to capture this frenetic chaos, so I waited until dusk, and reduced my shutter speed to translate the kinetic energy of the scene into blurs of motion.

→

Dubai, UAE – Because hawksbills are critically endangered, each individual is vital to the population, which is why the rescue and rehabilitation center in Dubai is so important. Cold-stunned animals that strand on the beach are transported to one of the world's most luxurious hotels, where they are nursed back to health. Later they are released right in front of the Burj Al Arab hotel, one of the most iconic buildings in the world. By combining an endangered animal with a famous landmark, this rare photograph depicts an unusual and contrasting juxtaposition of an ancient animal with the ultra-modern human footprint.

Farmer's Cay, Bahamas – Jeremy Jackson's paper "Reefs Since Columbus" references a description from one of Christopher Columbus's voyages in the Caribbean in which green turtles were so numerous that his crew could walk to shore on their backs. I wanted to pay homage to this historical datum about Caribbean greens by re-creating a modern visual of that description. While researching locations, I discovered a fledgling ecotourism project where green turtles flock to docks where conch fishermen clean and discard bits of their catch. I was not disappointed—there was a swarm of green turtles around the docks, and as I lined up my shots from the water, it wasn't difficult to imagine what the Caribbean may have looked like in the 1400s.

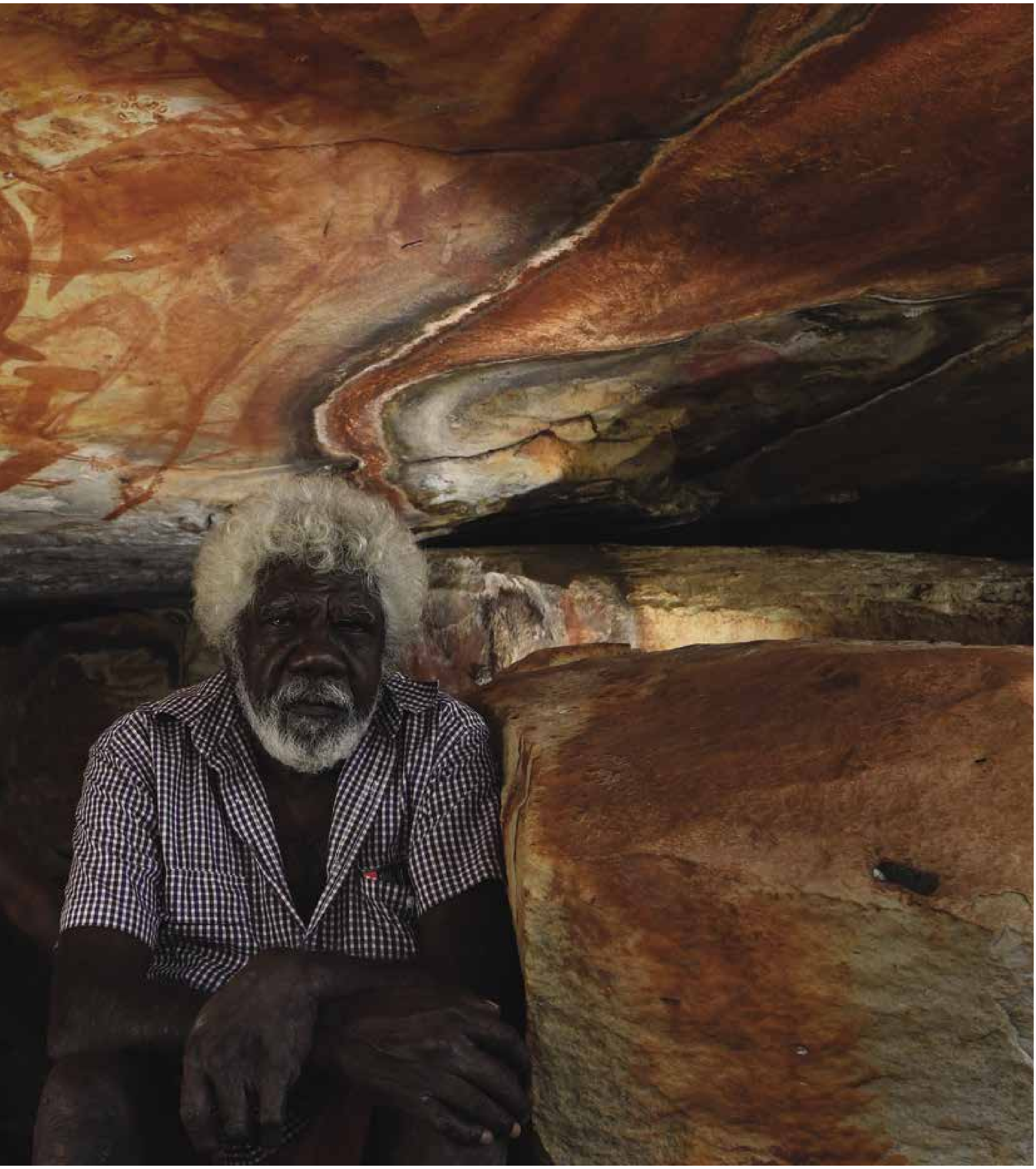
Crab Island, Australia – I became obsessed with documenting flatbacks on this rarely photographed, remote, prehistoric island. Upon arriving, I quickly learned why so few photos of the place exist. The landscape is *harsh*—the sand flies, which swarm you in brutal heat of the day, are replaced by mosquitos at sunset. And although escaping the buggy heat for a dip in the ocean is tempting, the insects are preferable to the saltwater crocodiles that swarm the island during sea turtle nesting season. Early on, I decided I wanted to include these dead, ghostly trees in my photo, but it took nearly the entire two weeks for a turtle to nest there. While shooting long exposures in pitch darkness was concerning, it was also exhilarating to know that crocs were watching me and that I was sharing the beach with two ancient reptiles. I will forever be grateful to the indigenous rangers of the Apudthama Land Trust for keeping me safe while camping on the island.

↑

Kei Islands, Indonesia – I wanted to capture what could be perceived as a gory and sad event, but in a way that didn't lead my audience toward any unfair conclusions. Thus, I chose to tell this story with artful subtlety instead, emphasizing the intricate relationship between the hunter and the turtle. A brutal scene played out above the surface, but underwater I was struck by the intimacy of the synchronized movements of the leatherback and its captor, blood delicately leaking from the harpoon wound in its carapace. This hunt, which was once sustainable, forces us to think about the thin line between preserving cultural rituals and finding sustainable alternatives.

→

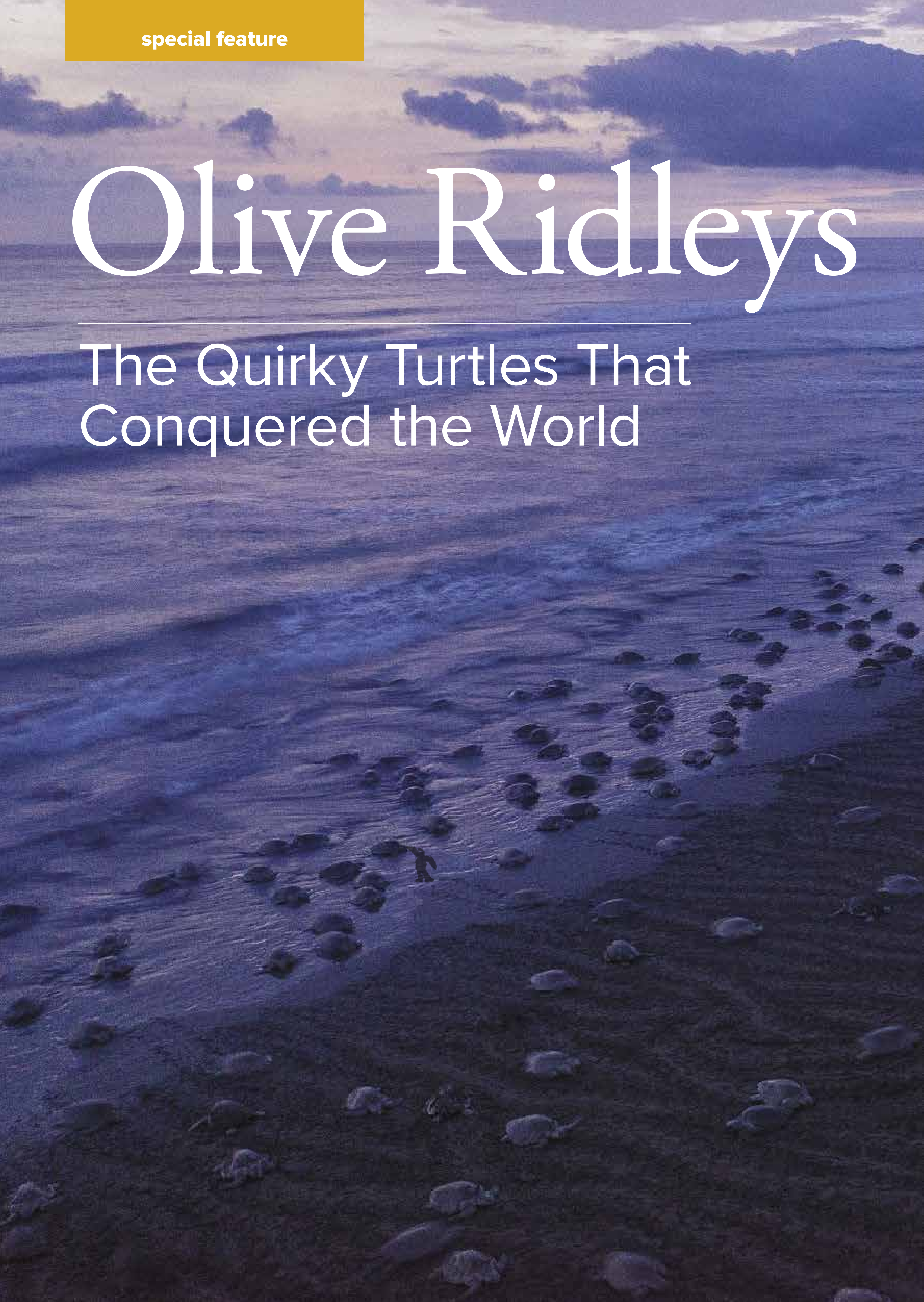
Arnhem Land, Australia – I had not set out to photograph indigenous rock art in Australia, but when I picked up a tourist book from the 1980s and the page opened to an old photo of sea turtle cave paintings, I was captivated. Finding the location was not so simple, however. After many wild goose chases through the bush, an anthropologist connected us with an aboriginal community in Northern Australia. Aboriginal elders Ida Mamarika and her husband Christopher Maminyama led us to a remote cave whose walls and ceilings were covered in marine-themed frescoes. After talking with them at length about their connection to sea turtles, I abandoned my original plan of photographing just the art and instead made this image to celebrate the story that became as much about the people as the paintings.



special feature

Olive Ridleys

The Quirky Turtles That Conquered the World



By Kartik Shanker, Alberto Abreu-Grobois, Vanessa Bezy, Raquel Briseño, Liliana Colman, Alexandre Girard, Marc Girondot, Michael Jensen, Muralidharan Manoharakrishnan, Juan M. Rguez-Baron, Roldán A. Valverde, and Lindsey West

With contributions from Ernesto Albavera, Randall Arauz, Luis Fonseca, Nupur Kale, Tere Luna, Carlos Mario Orrego Vasquez, Erika Peralta, Ashwini Petchiappan, Wilfredo Poveda, Chandana Pusapati, Chetan Rao, César Reyes, Daniela Rojas, Laura Sarti, and Adhith Swaminathan

EVOLUTIONARY HISTORY

The ridley turtles have interesting origins. Approximately 3 million to 5 million years ago, the formation of the Isthmus of Panama separated the Atlantic and Pacific Oceans and drove marine populations on either side onto separate evolutionary paths. This profound transformation shaped the phylogeography of many marine species, including sea turtles. The role of the isthmus in separating Kemp's and olive ridleys was first hypothesized by the late Peter Pritchard in the 1960s and was later confirmed by genetic studies.

Molecular studies of specific mitochondrial DNA sequences of olive ridleys show two main genetic clusters. One of these clusters, which comprises a particular sequence called "K" and others closely related to it, is found in olive ridleys in India and Sri Lanka. Because of the similarity of the DNA sequence with Kemp's ridleys, this is thought to be the ancestral type. The other cluster has a sequence called "J" and, with its relatives, and is found in olive ridleys throughout the Indian and western Pacific Ocean basins, as well as in the eastern Pacific and Atlantic Oceans. Olive ridleys sharing this sequence are therefore likely to have served as the evolutionary sources for their current populations in the Pacific and Atlantic Oceans.

The climatic stability of the Indian Ocean during the original split might explain why it is the probable source of global olive ridley populations. Ancestral olive ridleys may have dispersed there from the East Pacific and persisted because of favorable environmental conditions. Another possibility is that warm climates facilitated the survival of an ancestral ridley population in the Indian and North Atlantic Oceans, from which the two species that we know have evolved. Either way, the Pacific and Atlantic Oceans have probably been colonized many times over by olive ridleys, with the most recent event being just 100,000 years ago.

Thus far, only a tiny portion of the ridley turtles' fascinating genealogical history has been revealed, and new techniques will improve our understanding of the evolutionary history of this and other sea turtle species and populations.

GLOBAL DISTRIBUTION AND TRENDS

Olive ridleys are the most ubiquitous and abundant of the world's seven sea turtle species. Solitary nesting beaches can be found throughout the tropics on all continents and in most island groups. Beaches that each host hundreds to thousands of nests per year can be found throughout the Pacific coasts of Mexico and Central America, the Atlantic and Pacific coasts of South America, the west coast of Africa, all of South Asia, and parts of Southeast Asia.

However, a handful of mass nesting (*arribada*) beaches account for the largest numbers of nesting females. The term *arribada* has been used to refer both to a physical place (a nesting beach and nearshore waters) and to the synchronous nesting behavior of a large number of ridleys (more than 1,000 females) over just a few days (see p. 29). Olive ridley arribada sites are restricted mainly to Pacific Mexico and Central America, and to India's east coast. Today there are 5 major sites (greater than 100,000 nests per year) and 8–10 minor sites (10,000–100,000 nests per year) globally. Many beaches in those regions, but also in Suriname and French Guiana, have (or had) mini arribadas with a few hundred or up to 1,000 nests on some nights. (See the map on p. 29 for trends and relative abundance at the sites.)

The largest arribada sites on Earth have historically been in Mexico, with the largest occurring on Playa Escobilla. Beginning in the 1960s and continuing for three decades, tens of thousands of turtles were killed annually in Mexico to provide olive ridley hides to a burgeoning international trade, which used the hides as a substitute for scarce crocodile leather. Following a global outcry over the declining abundance of turtles and the collapse of arribadas at Mismaloya, Tlacoyunque, and Chacahua, the infamous turtle slaughterhouse at San Agustinillo was shut down in the 1980s. A permanent ban on sea turtle exploitation in Mexico was established in 1990. Nesting at Playa Escobilla subsequently increased fivefold, from approximately 200,000 nests per year in the 1990s to more than 1 million by the year 2000; this number is currently stable with about nine arribada events per year. The nearby beach at Morro Ayuta also hosts more than 1 million nests each year (see the map on pp. 32–33).

In Central America, arribadas are known to occur in three countries. Of the three, Panama has the lowest abundance, while Nicaragua has large aggregations at La Flor and Chacocente. Costa Rica has regular arribadas at Ostional and Nancite, and it is witnessing the origins of two new arribada rookeries at Corozalito and Camaronal. The arribada at Nancite is a curious case. This location is a small beach that lies within Santa Rosa National Park, so the arribada is essentially free from the anthropogenic threats that typically affect turtles—yet there has been a 90 percent collapse in nesting abundance there since the early 1970s. Large numbers of turtles nesting atop one another at this tiny beach likely led to high numbers of broken eggs and a significant microbial load on the entire beach. A decrease in oxygen because of microbial activity can suffocate developing embryos and result in low hatching success. The resulting low recruitment to the population over the course of many years may have caused the collapse at Nancite.

In India, the major mass nesting beaches are in Odisha on the east coast. Unlike in the Americas, one or two major arribadas occur there in most years, typically during the dry season between February and April. Mass nesting was first reported at Gahirmatha in 1974. The beaches in this region are sand bars that erode and accrete over time; they have undergone dramatic changes in the past few decades. With the advent of mechanization in the 1970s, tens of thousands of ridleys were caught in Odisha and shipped by road and rail to Kolkata, where the meat was widely consumed. Concerns expressed by international and local conservationists led to the implementation of wildlife laws with support from then Prime Minister Indira Gandhi, ending this practice.

Further south, mass nesting was reported at the Devi River mouth in the 1980s, but no arribadas have been reported there since 1997. Rushikulya, the southernmost of Odisha's mass nesting sites, has remained relatively stable topographically over the past 20 years. Nesting there increased from between 25,000 and 50,000 nests in the 2000s to more than 200,000 nests in a single arribada in the 2010s.

Trends in the locations and sizes of arribada rookeries are highly dynamic. For example, nesting at Ixtapilla, Mexico, began in the late 1990s; by 2009 this arribada had increased to more than 200,000 nests per year. In Costa Rica, at the two new arribada beaches (Corozalito and Camaronal), nesting has increased from approximately 1,000 nests per year in 2008 to more than 47,000 in 2019. In India's Andaman archipelago, a new rookery appeared in the early 2010s and now hosts 5,000 to 10,000 nests per year.

Although sea turtle biologists initially believed that the disappearance of arribadas was entirely human induced, there may be more influences at play. Given the ephemeral nature of beaches, the vast fluctuations in numbers of nests over short periods, and the

AT LEFT: A local resident watches an arribada nester at the Rushikulya rookery in Odisha, India. © Arghya Adhikary; PREVIOUS SPREAD: Ostional, Costa Rica – To an untrained eye, this may look like a shot taken from the beach of hundreds of sea turtle hatchlings. In fact, it was taken from hundreds of feet in the air. A drone, coupled with a slow shutter speed, provided a unique and different perspective of what is a well-documented and often-photographed event. © Thomas P. Peschak

→ SEE MORE PHOTOS AND STORIES FROM TOM ON PAGES 14–23.

negative impact on hatching rates from the buildup of organic matter resulting from broken eggs, perhaps arribada rookeries blink on and off depending on conditions, as has been suggested for Nancite. Most arribada nesters, as well as solitary turtles, appear to prefer beaches near river mouths. Because seasonal flooding "cleans" those beaches of organic buildup, they may be the most optimal nesting sites, thus enabling long-term resilience of turtle populations. However, the dynamic nature of the beaches may also cause fluctuations in the presence and size of arribadas. Precisely how and why arribadas are born, expand, and contract remains a mystery.

MIGRATIONS

Sea turtles are migratory, and they spend most of their time engaged in some sort of movement—either for breeding or for foraging. Olive ridleys exhibit a great deal of behavioral plasticity in this regard; they can be nomadic oceanic migrants feeding on surface fauna, or they may stick to the coast while feeding on shallow-water invertebrates.

Satellite tracking studies in recent years have shed much light on the movements of olive ridleys. A diversity of patterns can be seen even within the same population. Post-nesting olive ridleys that were tracked from their nesting grounds in Sergipe, Northeast Brazil, moved north and south along the continental shelf, but also east into oceanic waters toward West Africa. In the Pacific, although some males were tracked from Sinaloa, Mexico, and remained close to breeding zones, some females swam directly up the coast to rich foraging grounds off Baja California Sur; still others stayed close inshore or meandered in oceanic gyres.

In India, some post-nesting females migrated to the coast of Sri Lanka and the Gulf of Mannar, while others followed gyres in the Bay of Bengal. In contrast, some long-term data sets show olive ridleys widely distributed in pelagic zones, with no evidence of migration corridors at all. Australian ridleys seem to remain mainly in nearshore areas after nesting, and the same behavior has been recorded for rookeries in French Guiana and Oman.

Distinct migration patterns may reflect different reproductive or foraging strategies among individuals. Forensic analyses of stable isotopes of carbon and nitrogen have been used to draw further inferences about migratory patterns and connectivity of individual turtles. For olive ridleys, those studies have confirmed what was found by satellite tracking studies: the turtles use both nearshore and oceanic habitats, with high individual variability.

The variety of migratory behaviors in this species across the world is remarkable. The nomadic behavior of many olive ridleys does not mean they lack navigation abilities; rather it represents a successful mode of opportunistic searching for prey, which is patchily distributed. Such flexibility could be a strategy to cope with unpredictable changes in highly dynamic environments, suggesting that olive ridleys might prove to be resilient to threats such as climate change. This flexibility may also help to explain why olive ridleys are the most abundant of all sea turtles.

CULTURAL SIGNIFICANCE

Historically, olive ridleys have had great commercial value, and they have been harvested for their meat, oil, and eggs across much of their range. But they also figure prominently in a variety of traditional cultures because they have held salient roles in diet, materials, medicine, religious beliefs, and spiritual values.

In much of Central America, turtle eggs are still believed to possess sexual enhancement powers and are sold as snacks in bars, where they are prized as a side dish to accompany a shot of rum or *aguardiente*. Although this belief may have no basis in fact, it nonetheless fuels an enormous legal and illegal trade in turtle eggs—mostly those of the olive ridley, given its relative abundance. This claim is just one of the countless and widespread cultural beliefs prevalent in coastal Latin America that presume sea turtle parts have aphrodisiac or sexual enhancement properties.

In parts of Guyana, the leatherback turtle is believed to be the "Mother of All Turtles," and it is said that "if her blood is spilled, then the beach will wash away." Those communities favor olive ridleys over leatherbacks as food. In French Guiana, Kali'na Amerindian coastal communities ate mostly olive ridley eggs during the 1980s and 1990s, but this consumption shifted to leatherback eggs around 2010, the reasons for which are not known.

In much of India, turtles are believed to be an incarnation of the god Vishnu and are therefore not killed or consumed. Indeed, there is a temple for Kurma (the turtle avatar) at Srikurmam, just south of Rushikulya. However, turtle eggs were widely consumed as food and for various purported medicinal properties along much of the country's coast until the implementation of wildlife laws and conservation programs. In Gahirmatha, turtle eggs were dried and used as cattle feed until the 1970s.

Harvest of olive ridley adults and eggs also occurs in Australia's Northern Territory. As traditional owners of local land and sea estates, the indigenous groups are at the forefront of olive ridley conservation and management, particularly concerning threats from ghost fishing gear. Aboriginal (Yolngu) rangers have identified ghost fishing gear hotspots, from which they remove debris and release entangled turtles.

In southwest Madagascar, the indigenous Vezo people have a long history of traditions that are associated with sea turtles and that involve offerings to ancestors as well as ceremonies and rituals for preparing and eating turtle meat. Although olive ridleys are rarer than greens there, they are included in Vezo spiritual practices. Indigenous groups in the Andaman and Nicobar Islands have similar spiritual relationships with sea turtles, which form an important part of their food traditions and culture.

Olive ridleys are highly valued for their medicinal qualities by the Wayúu people of the Guajira Peninsula in Venezuela and Colombia. Sea turtles are considered gifts from the ancestral God Maleiwa; olive ridleys are believed to be a kind of rare green turtle and their parts are used to treat various conditions, including hypertension, diabetes, rheumatism, and menstrual disorders. Those traditions are passed on orally through stories told by healers and play a vital role in preserving the cultural identity of the Wayúu.

Although olive ridleys have been used by many cultures for food, materials, and medicine, their relationship with some ethnic groups in Ghana is entirely different and is based instead on a system of traditional social taboos. The Dangme people of Ada believe that a turtle once saved their ancestors' lives during a war with the Ashante; hence, all turtles are sacred to them and are off limits for hunting. Olive ridley turtles are now protected across most of their global range, although various uses remain an essential cultural practice in some countries.

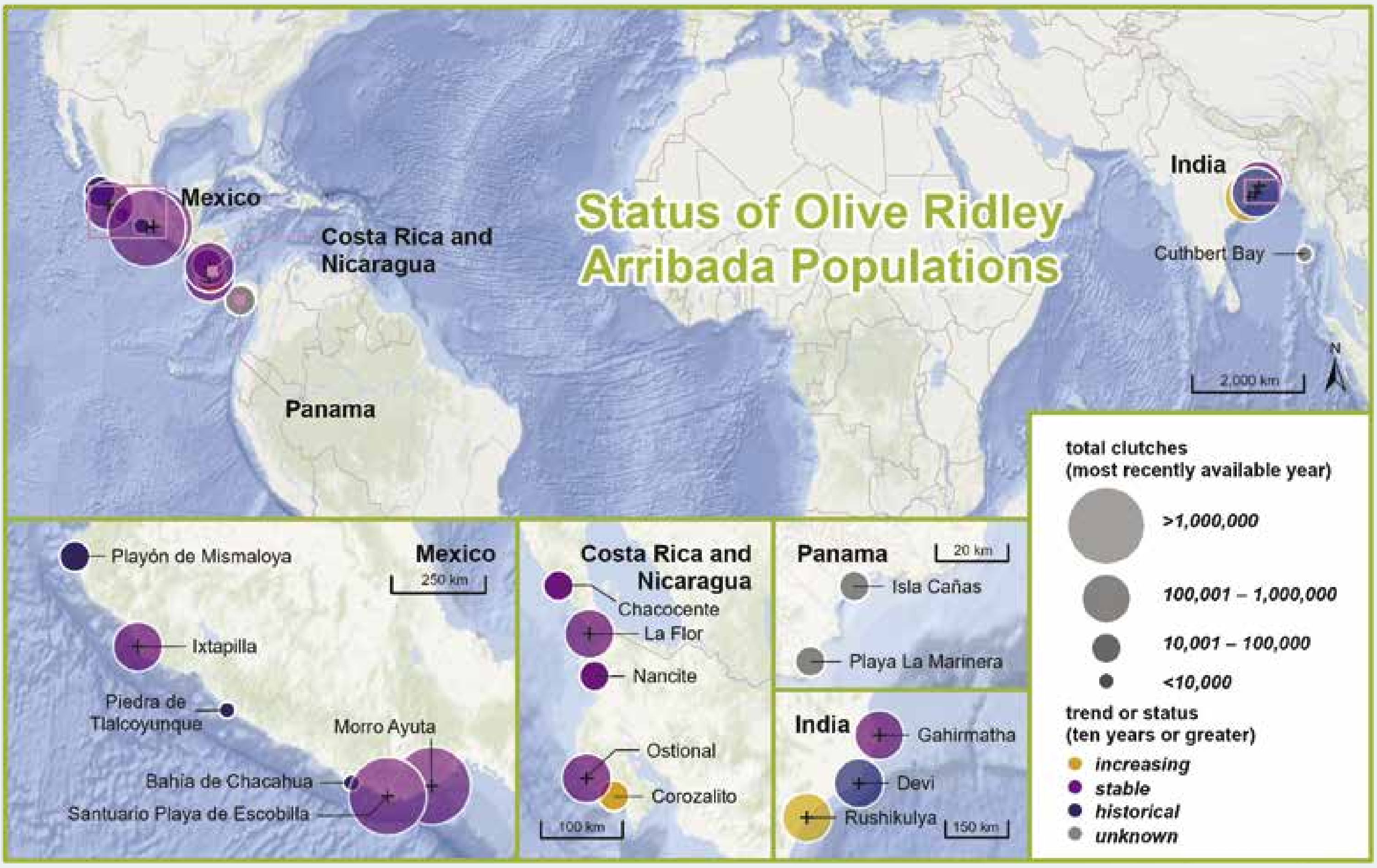
THE ARRIBADA

Derived from the Spanish word for arrival, arribada refers to the phenomenon of synchronized nesting of thousands of ridley turtles, one of nature's most impressive and mysterious wildlife spectacles.

Prior to an arribada, thousands of female turtles aggregate in front of the beach before hauling out at once to lay their eggs. Studies have examined the cues that may elicit emergence, ranging from oceanographic and atmospheric features, lunar phases, and possibly even pheromones or other agents released by the gravid females. As yet, however, there are no definitive answers. No matter how it is triggered, the consequence is a dramatic onset of synchronous nesting by thousands of ridleys depositing millions of eggs over a few nights, followed by a rapid tailing off. At any given site, this phenomenon may repeat several times each year.

Arribada behavior likely evolved as an antipredator strategy. As the smallest of all sea turtles, ridleys lay relatively shallow nests, which tend to be susceptible to depredation. Indeed, on many solitary nesting beaches, more than 80 percent of nests are taken by predators. An arribada ensures predator glut, as mammals, birds, crustaceans, fish, and others are unable to consume more than a fraction of the brief surfeit of prey in the form of adults and eggs, and—roughly seven weeks later—hatchlings. Thus, the population's chance of survival is increased.

This survival advantage has a price, because hatching rates at arribada beaches may be significantly lower than at solitary nesting beaches. Though there are trade-offs, the strategy seems to have worked well for the olive ridley, the world's most abundant sea turtle species.



This map shows the locations and trends or statuses of arribada nesting populations. Trends were calculated using data from the past 10 years. If data from the past 10 years were not available, the status of the population was categorized as "unknown" and is represented by a gray dot. Increasing trends are represented by yellow dots, stable trends by purple dots, and populations that historically nested in arribada events but no longer do are categorized as "historical" and are represented by a blue dot. Dots are scaled to their relative nesting abundance, the values for which were calculated from the average number of clutches for the years available. Data and sources are listed starting on p. 52 under their respective beach names with the exception of Playón de Mismaloya, which is a combination of four nesting beaches (Mismaloya–sección El Playón, La Gloria, Playa Majahuas, and Chalacatepec).

Olive ridley turtles mate off the coast of the Osa Peninsula in Costa Rica. © Philip Hamilton Photography

GLOBAL STATUS, THREATS, AND CONSERVATION

The abundance of olive ridleys was once believed to be so great that they were immune to overexploitation. This belief was hardly true. In fact, the large scale of industrial extraction from the 1960s to the 1980s brought such alarming crashes in many rookeries, particularly in Mexico, that the species rose to the category of Endangered on the *IUCN Red List of Threatened Species*.

Evaluating a species' risk of extinction is complex and requires knowledge of global trends over generational time frames. In the case of olive ridleys, however, it is changes in their massive arribada populations that drive global status. Although monitoring arribada sizes has proven to be highly challenging, local programs now provide reliable data for status evaluation. Decades of conservation effort from nesting beach protection, together with policies banning sea turtle commerce and direct capture on land and at sea, have led to very encouraging results from current trend data. Overall trends in most arribada rookeries are positive or stable over the past two decades (see the map on p. 29).

Nonetheless, causes for concern remain, including the following: low hatching success at some arribada sites; decreased survival of all age classes due to plastic ingestion; climate change; and, above all, fisheries impacts. The overlap of olive ridley at-sea distribution with fisheries makes this species particularly vulnerable to entanglement in fishing gear. Although bans on trawl fishing and strict enforcement of the use of Turtle Excluder Devices in some areas have decreased this pressure, fisheries remain the primary threat to ridleys worldwide. Large-scale mortality (approximately 10,000 turtles per year) in trawl fisheries still occurs in India's Odisha state and elsewhere in the world where enforcement is lax.

Olive ridley behavior also increases the likelihood of encountering abandoned, lost, or discarded fishing gear, known collectively as *ghost gear*. A study of ghost gear in the Maldives found that 97 percent of entangled turtles were olive ridleys. Addressing threats from ghost gear requires strong collaboration between multiple stakeholders, including national governments, regional fisheries management organizations, and local communities.

Though many olive ridley nesting beaches are located in protected areas, threats to nesting habitats persist, particularly from coastal development for tourism, aquaculture, urban growth, or industrial activities. The construction of Dhamra Port near the Gahirmatha mass nesting site in India may have caused significant changes to the geomorphology of the nesting beach, in addition to causing increased light and water pollution. In Gabon, the nesting habitat is affected by the accumulation of beached timber lost from commercial logging activities, thereby changing the erosion and accretion dynamics of the beach system and blocking access to nesting areas. Such large-scale threats are difficult to address and require sustained, high-level engagement with decisionmakers.

At many sites, conservation programs conduct beach patrols and relocate olive ridley nests to hatcheries to protect them from human and natural predators. At many solitary nesting beaches, upward trends in olive ridley populations are probably the result of such long-term efforts. Community-based conservation programs exist in many parts of the world, including Brazil, Colombia, Guatemala, Kenya, and Mexico. In India, every coastal state has multiple NGOs working on the conservation of olive ridleys. Besides their importance for conservation, research, and education, beach projects take advantage of sea turtles as a flagship species and provide opportunities to conserve species and habitats that are less charismatic.

The abundance of eggs laid at mass-nesting sites and solitary beaches serves as food and as an income source in some marginalized coastal communities. In the 40 years since its establishment, the legal, community egg harvest program at the Ostional National Wildlife Refuge in Costa Rica has been largely successful, with long-term monitoring studies suggesting that the rookery nesting there remains stable. Furthermore, studies on the illegal egg trade suggest that these eggs may play an important role in swamping out the black-market egg trade. The community egg harvest program continues to generate substantial funding and resources for conservation as well as to support local family incomes. Turtle tourism is also on the rise, providing sustainable income for the community. With stable or increasing populations, some conservationists have suggested that such approaches can be transferred to other arribada sites, but this strategy remains controversial.

CONCLUSION

Olive ridleys may be abundant and widespread, but they remain an enigma in many ways. Their large arribadas drive not only global trends and status, but also public imagination about the turtles. The disappearance of arribadas at many sites, the precipitous decline at Nancite, or the failure of the arribada to occur during a particular year at Gahirmatha or Rushikulya can lead to greatly exaggerated reports of their impending demise. But then new arribada rookeries appear, such as those at Camaronal, at Corozalito, and in the Andaman Islands. Even more interesting is the role that beaches with solitary nesters play. Are they future arribada sites, producers of male hatchlings in cooler areas, or perhaps a source of genetic variation?

To best determine future management strategies for the olive ridley, local studies on habitat use, incidental capture, and genetics must be expanded. As new arribada sites emerge and the species recovers, monitoring protocols and conservation strategies must be adapted accordingly. Solitary nesting rookeries need more conservation and research attention. On the whole, olive ridleys are doing rather well, but larger-scale global and development threats still loom. Sustainable fishing practices need to be implemented wherever sea turtle interactions occur if we are to ensure a safe future for the animals. As some of the most effective ambassadors for conservation worldwide, these turtles have an important role to play in the future of coastal and marine ecosystems. •

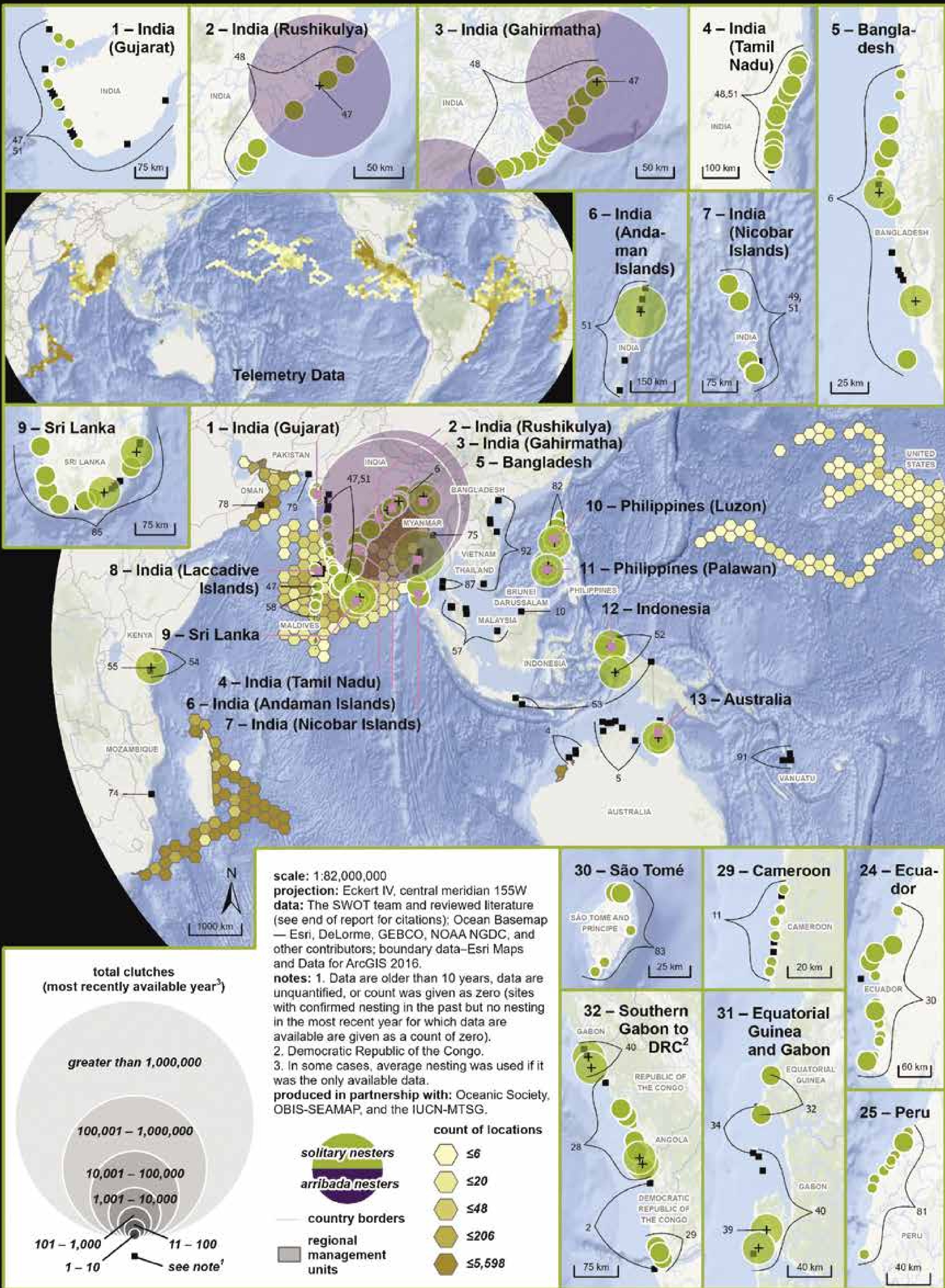
BIOGEOGRAPHY OF OLIVE RIDLEY SEA TURTLES

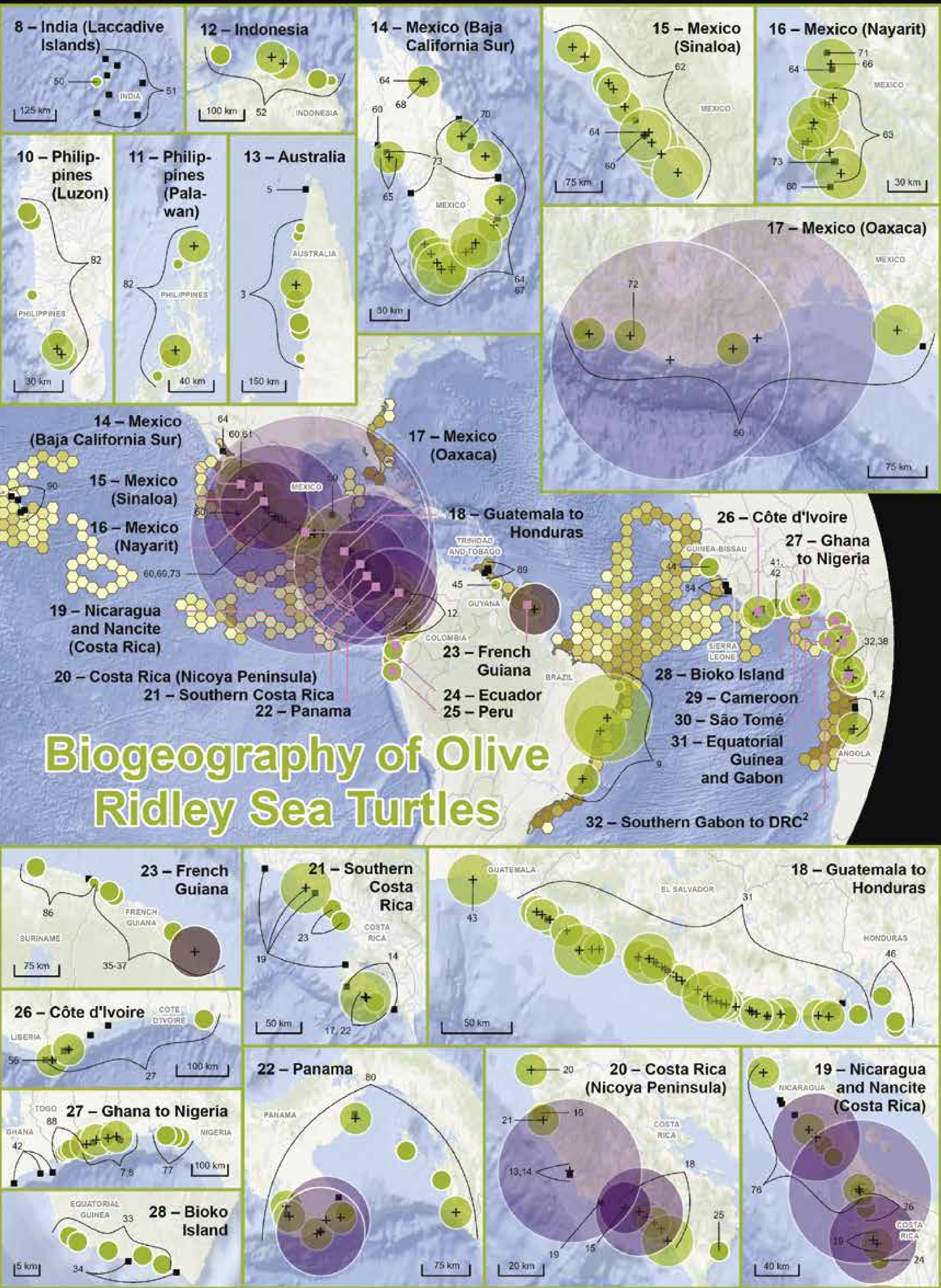
The map on pp. 32–33 displays available nesting and satellite telemetry data for olive ridley sea turtles. The data include 774 nesting sites and 283 satellite tags, compiled through a literature review and provided directly to SWOT by data contributors worldwide. For metadata and information about data sources, see the data citations beginning on p. 52.

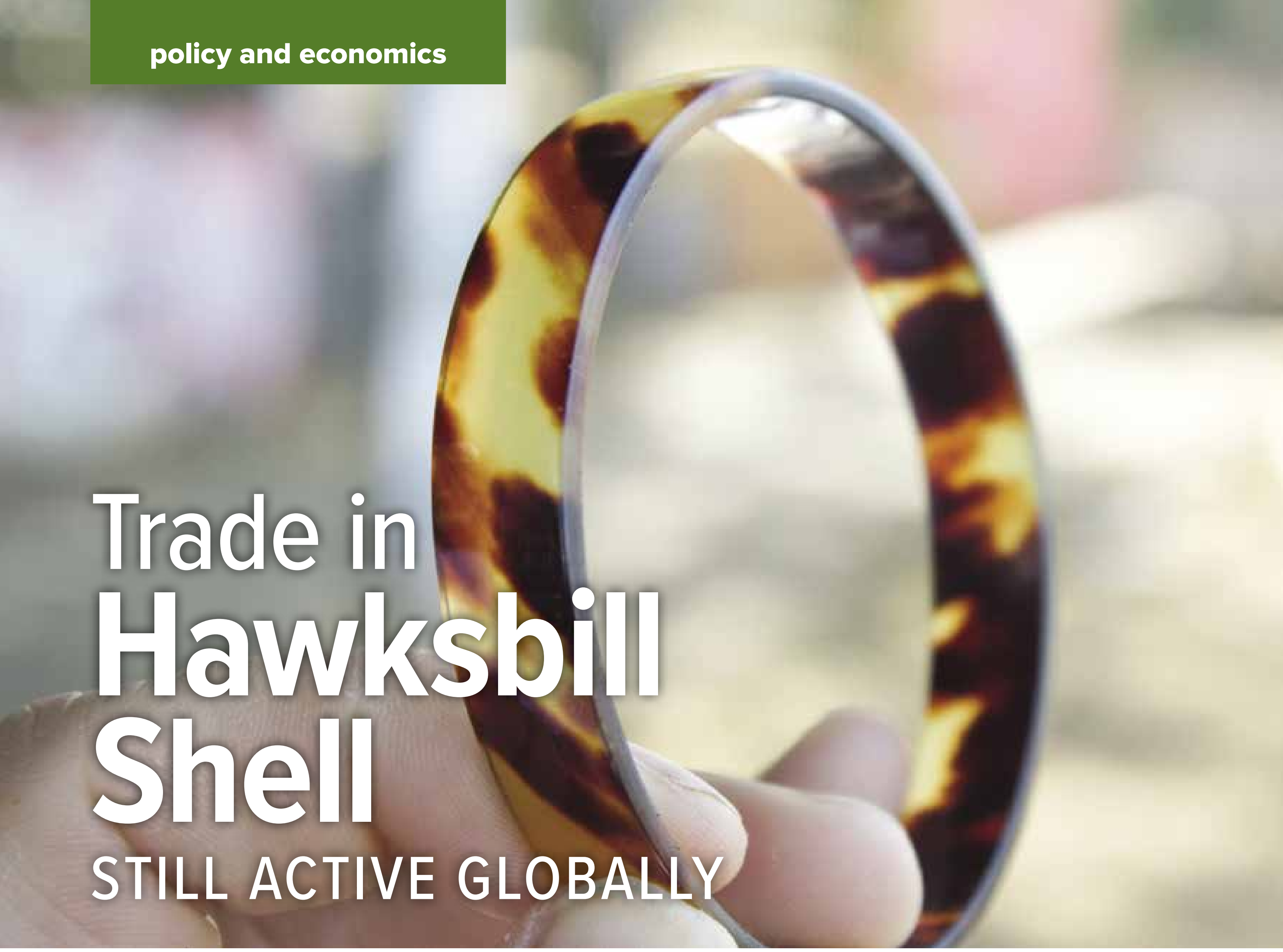
Solitary (non-arribada) nesting sites are represented by green dots and arribada sites by purple dots, both of which are scaled according to their relative nesting abundance in the most recent year for which data are available. Black squares represent nesting sites for which data are older than 10 years, data are unquantified, or the nest count for the most recent year was given as zero. For the purposes of uniformity, all types of nesting counts (e.g., number of nesting females, number of crawls) were converted to number of clutches as needed. Conversion factors were as follows: a ratio of 3.00 nests to each nesting female in the East Pacific, 1.40 nests to each nesting female in the Wider Caribbean and Southwest Atlantic, and 2.20 nests to each nesting female in all other regions, plus a ratio of 0.74 nests for every crawl in all regions.

Satellite telemetry data are represented as polygons that are colored according to the number of locations. Darker colors represent a higher number of locations, which can indicate that a high number of tracked turtles were present in that location or that turtles spent a lot of time in that location. Telemetry data are displayed as given by the providers, with minimal processing to remove locations on land and visual outliers. As such, some tracks are raw Argos or GPS locations, whereas others have been more extensively filtered or modeled.

We are grateful to all of the data contributors and projects that participated in this effort. For details, please see the complete data citations beginning on p. 52.


1 – India (Gujarat)
2 – India (Rushikulya)
3 – India (Gahirmatha)
4 – India (Tamil Nadu)
5 – Bangla-desh
6 – India (Anda-man Islands)
7 – India (Nicobar Islands)
Telemetry Data
9 – Sri Lanka
1 – India (Gujarat)
2 – India (Rushikulya)
3 – India (Gahirmatha)
5 – Bangladesh
8 – India (Laccadive Islands)
9 – Sri Lanka
10 – Philippines (Luzon)
11 – Philippines (Palawan)
12 – Indonesia
13 – Australia
4 – India (Tamil Nadu)
6 – India (Andaman Islands)
7 – India (Nicobar Islands)
INDIA
BANGLADESH
SRI LANKA
PAKISTAN
OMAN
MYANMAR
VIETNAM
THAILAND
BRUNEI DARUSSALAM
PHILIPPINES
MALAYSIA
MALDIVES
KENYA
INDONESIA
MOZAMBIQUE
AUSTRALIA
VANUATU
UNITED STATES
75 km
50 km
100 km
25 km
150 km
1000 km
N
30 – São Tomé
SÃO TOMÉ AND PRÍNCIPE
29 – Cameroon
CAMEROON
24 – Ecua-dor
ECUADOR
32 – Southern Gabon to DRC²
GABON
REPUBLIC OF THE CONGO
ANGOLA
DEMOCRATIC REPUBLIC OF THE CONGO
31 – Equatorial Guinea and Gabon
EQUATORIAL GUINEA
GABON
25 – Peru
PERU
20 km
60 km
40 km
scale: 1:82,000,000
projection: Eckert IV, central meridian 155W
data: The SWOT team and reviewed literature (see end of report for citations); Ocean Basemap — Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors; boundary data–Esri Maps and Data for ArcGIS 2016.
notes: 1. Data are older than 10 years, data are unquantified, or count was given as zero (sites with confirmed nesting in the past but no nesting in the most recent year for which data are available are given as a count of zero).
2. Democratic Republic of the Congo.
3. In some cases, average nesting was used if it was the only available data.
produced in partnership with: Oceanic Society, OBIS-SEAMAP, and the IUCN-MTSG.
total clutches (most recently available year³)
greater than 1,000,000
100,001 – 1,000,000
10,001 – 100,000
1,001 – 10,000
101 – 1,000
11 – 100
1 – 10
see note¹
solitary nesters
arribada nesters
country borders
regional management units
count of locations
≤6
≤20
≤48
≤206
≤5,598


Biogeography of Olive Ridley Sea Turtles
8 – India (Laccadive Islands)
INDIA
125 km
12 – Indonesia
INDONESIA
100 km
14 – Mexico (Baja California Sur)
MEXICO
30 km
15 – Mexico (Sinaloa)
MEXICO
75 km
16 – Mexico (Nayarit)
MEXICO
30 km
10 – Philippines (Luzon)
PHILIPPINES
30 km
11 – Philippines (Palawan)
PHILIPPINES
40 km
13 – Australia
AUSTRALIA
150 km
17 – Mexico (Oaxaca)
MEXICO
75 km
14 – Mexico (Baja California Sur)
15 – Mexico (Sinaloa)
16 – Mexico (Nayarit)
17 – Mexico (Oaxaca)
18 – Guatemala to Honduras
19 – Nicaragua and Nancite (Costa Rica)
20 – Costa Rica (Nicoya Peninsula)
21 – Southern Costa Rica
22 – Panama
23 – French Guiana
24 – Ecuador
25 – Peru
26 – Côte d'Ivoire
27 – Ghana to Nigeria
28 – Bioko Island
29 – Cameroon
30 – São Tomé
31 – Equatorial Guinea and Gabon
32 – Southern Gabon to DRC²
MEXICO
TRINIDAD AND TOBAGO
GUYANA
COLOMBIA
BRAZIL
GUINEA-BISSAU
SIERRA LEONE
ANGOLA
23 – French Guiana
SURINAME
FRENCH GUIANA
75 km
21 – Southern Costa Rica
COSTA RICA
50 km
18 – Guatemala to Honduras
GUATEMALA
EL SALVADOR
HONDURAS
50 km
26 – Côte d'Ivoire
LIBERIA
COTE D'IVOIRE
100 km
27 – Ghana to Nigeria
TOGO
GHANA
NIGERIA
100 km
28 – Bioko Island
EQUATORIAL GUINEA
5 km
22 – Panama
PANAMA
75 km
20 – Costa Rica (Nicoya Peninsula)
COSTA RICA
20 km
19 – Nicaragua and Nancite (Costa Rica)
NICARAGUA
COSTA RICA
40 km



Trade in Hawksbill Shell

STILL ACTIVE GLOBALLY

By Brad Nahill

The hawksbill shell industry thrives despite decades of communications and policy efforts to eradicate it. *Too Rare to Wear* is a coalition of more than 150 conservation organizations and tourism companies led by the nonprofit SEE Turtles, which is dedicated to ending this threat. A recent report revealed that fully 40 countries still have an active trade in tortoise shell (hawksbill turtle) products. Researchers conservatively estimate that more than 45,000 such items have been documented for sale worldwide since 2017, both online and in shops. At least 10 countries (most notably Indonesia) still have significant illegal markets, 30 others participate in minor trade, and 7 countries require additional investigation (including the Dominican Republic, Guatemala, and Papua New Guinea).

HISTORY OF TORTOISESHELL TRADE

~45 AD
Julius Caesar held warehouses of tortoiseshell in Alexandria, Egypt.

IX
Tortoiseshell was traded by Arabs throughout the Indian Ocean.

1500–1700s
Tortoiseshell trade expands globally, driven by European colonization and trade by Portugal, France, England, and the Netherlands.

1700s
Japan's bekko artisans are established in Nagasaki.

1800–1900s
Trade in Central America and Caribbean intensifies.

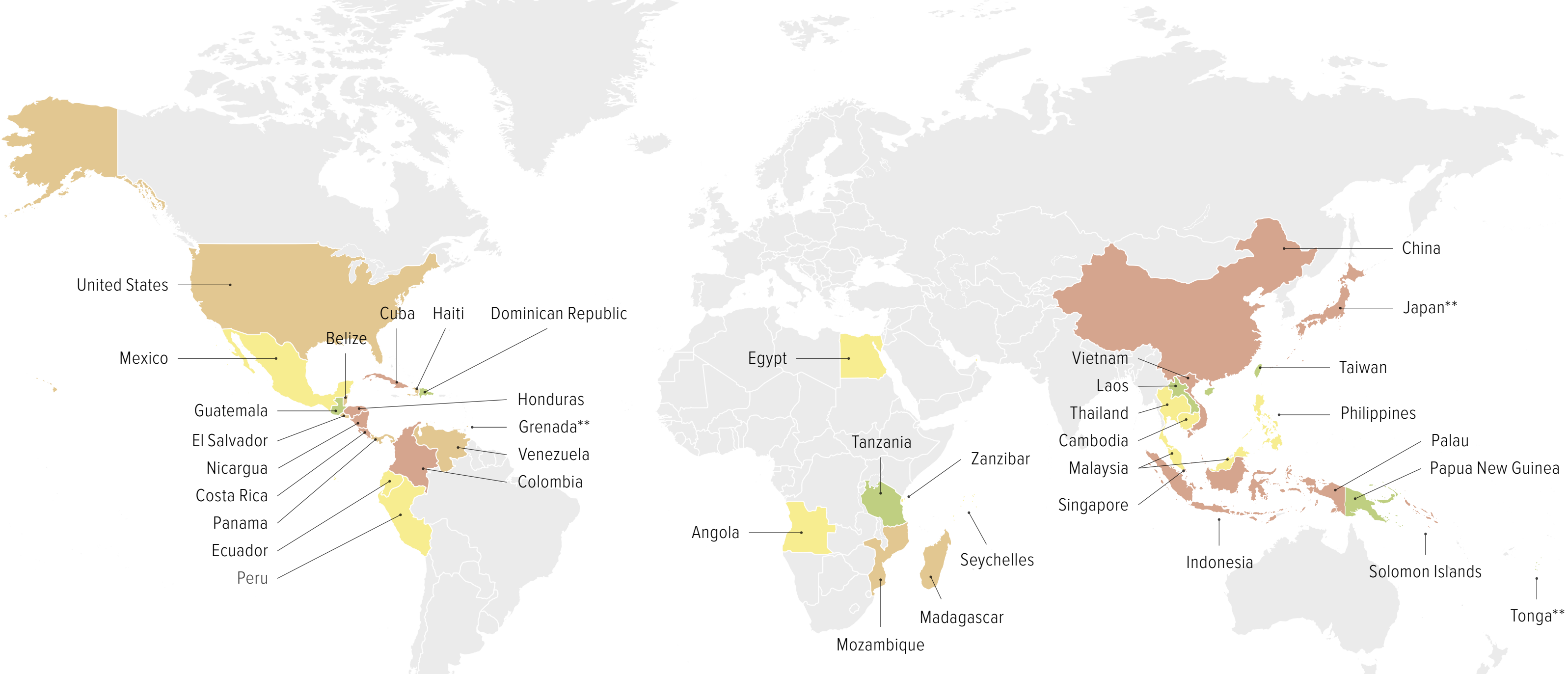
1975
Convention on International Trade of Endangered Species (CITES) Treaty goes into force.

1977
Hawksbills is added to Appendix I of CITES.

Late 1970s
45 countries trade tortoiseshell, with Japan importing an average of 37,700 turtles per year.

1980
Japan joins CITES and takes exception and reduces quota to 28,300 turtles per year.

GLOBAL TORTOISESHELL TRADE MAP



Tortoiseshell Amounts

Highest | Lower | Anecdotal or minimal | More study needed | No reports | ** Trade is legal

In its comprehensive 2020 report titled "The Global Tortoiseshell Trade," Too Rare to Wear drew from numerous sources and relied on data from past studies, news stories, and first-person accounts, as well as from a large 2019 survey conducted by the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES) and from its own 2017 report titled "Endangered Souvenirs." The 2017 report demonstrated that although hawksbill trade has declined in many countries (CITES banned legal trade among its signatories in 1977, though some parties held reservations to the ban until the 1990s), that trade continues to be a leading threat to the species, which is listed as critically endangered by the International Union for the Conservation of Nature (IUCN). The report highlights many recent examples, including the following:

- Research by the Monterey Bay Aquarium (U.S.A.) estimated that 9 million turtles were traded globally between 1844 and 1992, thereby decimating hawksbill populations.
- Evidence was published by the Japan Tiger and Elephant Fund about illegal hawksbill sales in that country, including 33 imports from 2016 to 2019—despite the fact that government subsidies for the legal domestic market were ended in 2016.
- A report from Nicaragua documented that active legal hawksbill sales are continuing unabated. A rapid assessment in January 2020 at two markets, Masaya and Roberto Huembes, found 45 stalls with an estimated 2,250 products identified.
- A survey conducted by PROFAUNA and Yayasan Penyu Indonesia identified more than 400 hawksbill products at 23 shops, as well as 22 online sites with approximately 200 accounts selling a shocking 30,000 hawksbill items that had an estimated value of more than US$30,000.

The good news, however, is that the trade is coming under control in some areas. The Colombian organization Fundación Tortugas del Mar noted that Cartagena, Colombia, which is the second largest hawksbill products market in the Western Hemisphere, recorded an 80 percent drop in hawksbill product sales following years of work to educate consumers and engage local government and law enforcement agencies. In addition, significant increases in hawksbill nesting on Mexico's Yucatan Peninsula and on Panama's northern Caribbean shores roughly coincide with the end of the legal trade in 1994.

Please join with Too Rare to Wear and the hundreds of concerned citizens and institutions now working steadfastly to reduce demand for hawksbill turtle products through education, outreach, and creation of policy and enforcement frameworks; together we can stamp out this global threat. •

AT LEFT: A bracelet made from a hawksbill turtle shell in Nicaragua, where recent market surveys found that illegal trade in hawksbill products is still rampant. © Hal Brindley/TravelForWildlife.com

1987
Report by Milliken and Tokunaga documents continued trade between CITES countries without proper documents.

1990
Japan reduces quote to 18,870 turtles per year.

1993
Japan establishes zero quota to avoid an embargo by the United States, and Cuba reduces annual fishery quota from 5,000 to 500 in response.

1994
Japan drops its reservation to the treaty.

1997
Cuba proposes to sell stockpile to Japan and continue international trade through CITES, but the proposal fails.

1998
Seychelles and Zanzibar acquire tortoiseshell stocks from artisans and burn them to demonstrate their commitment to ending the trade.

2000
Cuba proposes again to sell stockpile to Japan and continue international trade through CITES, but the proposal fails.

2007
Cuba instates voluntary moratorium on its hawksbill fishery, though the country still maintains its reservation to the treaty and stockpile.

2019
Illegal tortoiseshell trade continues in at least 40 countries and the trade remains legal in at least 3 countries or territories.

Sources: IUCN Red List and The State of the World's Turtles (SWOT)

AFRICAN CONSERVATION NETWORKS PURSUE A SHARED AGENDA

By Alexandre Girard and Roderic Mast

This group has forged a common vision: to generate expert recommendations for the long-term well-being of sea turtles, their habitats, and the human communities that interact with them.

GROWTH OF A MOVEMENT

Sea turtle conservation stakeholders in West Africa celebrated a major leap forward in Lomé, Togo, in October 2020 during a congress led by RASTOMA (the French acronym for the network of marine turtle conservation stakeholders for Central Africa, Réseau des Acteurs de la Sauvegarde des Tortues Marines en Afrique Centrale) and WASTCON (West African Sea Turtle Conservation). At this first-ever, subregional, marine turtle congress for Western and Central Africa, more than 70 participants from a dozen countries and a variety of national and international institutions gathered to validate priorities and to lay the foundation for a concerted action plan to protect marine turtles and their habitats along the full Atlantic coast of Africa. Special thanks to the French Global Environment Facility's Small-Scale Initiatives Program for their support that made the meeting possible.

RASTOMA began in 2012 with no plans or funding but with a small and very enthusiastic handful of like-minded sea turtle conservation stakeholders. After years of planning, their first General Assembly took place in 2015 at Pointe Noire (Republic of Congo), with a second in São Tomé in 2016, and a third in Kribi (Cameroon) in 2017. Among their first commitments, RASTOMA proudly participated in the creation of the first comprehensive maps of marine turtle biogeography for Africa (see *SWOT Report*, vol. XII, pp. 24–29). Since then, RASTOMA has further expanded in membership and in the diversity of areas represented. More important, the team has created an ever-growing spirit of community synergy; members support one another by sharing in-depth insights gained through cumulative centuries of sea turtle monitoring, community outreach, and local conservation work.

A COMMON VISION WITH PRACTICAL APPROACHES

From the outset, this group of African professionals has forged a common vision for a network in which civil society actors can openly collaborate on equal footing through respectful dialogue to generate expert recommendations for the long-term well-being of sea turtles, their habitats, and the human communities with which they interact. RASTOMA members compose a nonpartisan, politically unbiased movement. They function within the context of their respective institutional and community roles but outside the influences of local politics, government, and corporate agendas. To ensure that they have the tools necessary for this type of autonomy, the members have paid close attention to participatory decisionmaking; support for African leaders; and continuous dialogue with local communities to defend the role of African civil society in national, regional, and international planning for sea turtle conservation.

Early on in its establishment, RASTOMA set up a scientific council made up of about 30 international turtle specialists whose role is to inform the decisions of local actors and to participate in the creation of protocols for collecting, sharing, and making best use of sea turtle monitoring data for conservation purposes. Moreover, this council has helped RASTOMA's local partners to launch and conduct monitoring programs using protocols that are suited to the realities of the field in this remote and often culturally complex region, as well as to prioritize actions that are of benefit primarily to local stakeholders while being of value to the regional, national, and even global setting of priorities and conservation actions for sea turtles.

GOVERNANCE AND PARTICIPATION

The governance of RASTOMA is organized to guarantee the engagement of all members, and the network's strategic priorities are chosen in two stages: first, through an initial brainstorming at which all members are given the opportunity to name the priority projects needed in their locale; second, after ample debate, the full membership votes to create a short list of key projects and the timelines for their implementation. Once those projects are identified, working groups are formed to build strategic action plans. Thanks to this participatory exercise, which is renewed at each general assembly, the network ensures that it responds as closely as possible to the individual needs of its members and to the conservation priorities for marine turtles on the African Atlantic coasts that they collectively define. Dialogue with the RASTOMA scientific council ensures that the action plans remain in accordance with good conservation practices, current science, and larger-scale priorities.

AT LEFT: RASTOMA members pose with *SWOT Report*, vol. XII at the 2017 RASTOMA Congress in Kribi, Cameroon. © Alexis Guilleux/RASTOMA

NETWORK EXPANSION AND IMPACT AMPLIFICATION

Sea turtle stakeholders from outside RASTOMA's region manifested their interest in replicating the group's success in other West African countries to the north and west as early as 2016. However, RASTOMA wished to limit the scope of its work to Central Western Africa (roughly the coasts and waters of Cameroon and south to Democratic Republic of Congo) to best address local realities. At RASTOMA's 2017 General Assembly, the idea was born to support the emergence of a sister network that was built on similar values, governance, and participatory principles, but that was designed to serve the culturally and biologically distinct geography of the West African countries (specifically, the six countries from Nigeria east to Liberia). At a meeting held in Grand Bassam (Côte d'Ivoire) in 2018 with support from IUCN Africa, a steering committee was formed that resulted in the creation of WASTCON in 2019. WASTCON is now legally declared and engaged in refining its charter with help from RASTOMA and others.

A SEA TURTLE ACTION PLAN FOR WEST AFRICA

The Togo Congress in 2020 was an important inflection point for the emergence of a grassroots sea turtle conservation movement led by RASTOMA—and now WASTCON—with high hopes of expansion to one day ensure the proper conservation of sea turtles and their habitats along all of Africa's Atlantic coastline. Drawing on those experiences, RASTOMA supports the emergence of the North Africa Sea Turtle Network (NAST-Net), which will similarly represent the work that must take place to conserve sea turtles in Algeria, Egypt, Libya, Morocco, and Tunisia. NAST-Net held its first General Assembly in Tunis (Tunisia) in 2019. Those three civil society networks retain their respective identities but share common values that ensure an inclusive, Afrocentric vision of conservation governance led by on-the-ground stakeholders.

The next challenge is for conservationists to use this bottom-up approach to take on larger-scale sea turtle planning and conservation actions at regional and national levels. This effort has been envisioned since 1999 and was reaffirmed in 2002 and 2008 under the aegis of the Convention on Migratory Species (CMS Bonn) and its "Memorandum of Understanding Concerning Conservation for Marine Turtles of the Atlantic Coast of Africa." This memorandum has now been ratified by 23 African nations, but to date it has largely remained a commitment only on paper. Highly representative regional groups such as RASTOMA, WASTCON, and NAST-Net hope to serve as a driver to engage states, regional and international institutions, and donors so that this effort can move along the continuum from signatures to on-the-ground sea turtle conservation action. Much can be achieved by people working together from the ground up. •

Global Connections

FOR THE MEDICAL TREATMENT OF SEA TURTLES

By Maximilian Polyak, Claire Petros, Alessandro Ponzo, Alex McGhee, and Fabienne McLellen

The health of threatened sea turtles is an important concern for maintaining the critical ecological roles that they play in marine ecosystems. Threats to sea turtle health that result in trauma, disease, and stranding, as well as the subsequent need for medical care, are increasing. Yet existing capacities to meet such challenges have been fragmented and difficult to implement on a broad scale. Hundreds of sea turtle rescue and rehabilitation facilities around the world have focused principally on disease surveillance, stranding and rehabilitation protocols, veterinary workshops, and provision of online resources that cater to veterinary surgeons. However, there is no comprehensive, accessible platform that the many stakeholders in the sea turtle rehabilitation community can turn to when faced with treating an injured sea turtle. The Sea Turtle Rescue Alliance (STRA) uses modern telemedicine technology to fill this void.

Shared medical networks are important tools in human and veterinary medicine alike. STRA facilitates collaboration and connectivity between veterinary professionals, enhances knowledge and capacities at rescue centers, and helps to ensure that standards and best practices are adhered to by sea turtle clinicians worldwide. STRA has partnered with the veterinary software company titled Provet Cloud and with the Swiss-based ocean conservation nonprofit OceanCare to develop an easy-to-use, globally accessible, cloud-based system for sea turtle clinical records. This low-cost platform offers its users tailored access to sea turtle technicians, field biologists, veterinarians, and managers. STRA can even be used for virtual consultations about clinical cases and for clinical and diagnostic support. STRA also aspires to provide online training to rescue-center professionals, to assist with refining and reporting clinical techniques, and to serve as a centralized hub for individual identification and tissue-sample databases.

Initial case consultations and daily telemedicine service have already begun, and usage is rapidly accelerating. A juvenile hawksbill turtle admitted to a rehabilitation center in Kenya with significant head trauma from a suspected spearfishing event was successfully triaged and treated through daily consultations with STRA veterinarians. This turtle exhibited profound neurological deficits and required intensive medical care, but with help from STRA, the Kenyan team successfully released the patient to the wild. In another case, STRA was able to assist efforts to triage and manage an adult female green turtle in The Gambia that had experienced severe trauma from machete strikes. And recently a subadult green in the United Arab Emirates was diagnosed with gastrointestinal obstruction; using STRA's telemedicine platform, veterinarians were able to virtually guide the facility staff through complex case management including whole blood transfusion, formulation and administration of intravenous nutrition, and even laparoscopic surgery. This patient is recovering well and is expected to be released. Those examples provide a small glimpse of what STRA can offer to the more than 130 (and growing) sea turtle rescue and rehabilitation centers worldwide, where access to advanced care might not otherwise be available.

STRA offers an exciting opportunity for global collaboration in the effort to protect threatened and endangered sea turtles. Not only will a global platform of shared knowledge and expertise like STRA improve individual patient care and save the lives of many sea turtles, but also it can organize and connect far-flung practitioners and can combine participants' often underused expertise and clinical datasets to refine actionable therapies so that the gold standard of care is afforded to rescue facilities of all means and abilities everywhere. •

AT LEFT: Lewa, an officer at Local Ocean Conservation's Turtle Rehabilitation Centre in Kenya cares for Pole, a juvenile hawksbill turtle. © Local Ocean Conservation

sea turtles and COVID-19

Introduction

By David Godfrey

Almost as soon as COVID-19 began forcing people into their homes, locking down travel, and changing human behavior in unprecedented ways, these headlines started to appear: "Sea Turtles Booming Thanks to Pandemic," "Sea Turtles Thrive as Beaches Lock Down," and "Room to Roam: Wildlife Responds to Pandemic."

Looking for any kind of feel-good story as humanity grappled with a once-in-a-century pandemic, media outlets around the world latched onto early images and anecdotal reports of wildlife being spotted in unusual places, of air quality improving in the world's most populated cities, and of sea turtles supposedly nesting in places and in numbers not seen before. Photos of wildlife walking in deserted city streets and aerial views (some later found to be fake) of clear water in the canals of Venice fueled people's collective imagination that the swift change in human behavior was miraculously causing wildlife and the environment in general to thrive during humans' brief absence. On some level, we probably all wished it were true, thus making it easy for the press and a public looking for silver linings to buy into the hype.

Because the human species is the primary cause of threats to sea turtles globally, it stood to reason that a massive lockdown may well have resulted in some relief for chelonians. This author certainly saw the potential for the pandemic to benefit sea turtles, especially in a place such as the U.S state of Florida, where most major threats originate from human behavior on overdeveloped nesting beaches. Just as sea turtles were returning to nest in Florida (where more than 90 percent of the country's sea turtle nesting occurs) in spring 2020, beaches had been largely closed to the public. Tourism to the Sunshine State had vanished, and even Disney World had been forced to shut its magical gates. For a time, nearly all beachfront hotels were dark, creating the potential for fewer turtle disorientations from artificial lights. Beaches were deserted both day and night, so fewer turtles were likely to be disturbed as they emerged to nest. And most public marinas in Florida were closed to recreational boating, giving hope that vessel strikes, a major cause of sea turtle mortality, might also be reduced for a time.

Alas, the willingness of Americans to stay indoors and curtail their social and recreational activities to help get the pandemic under control was very short lived. Beaches were opened well before 2020's first turtle nests started to hatch, boats were back on the water conducting political flag parades, and any real hope that the pandemic might improve sea turtle survivorship had pretty much vanished. Even so, early reports indicated that nesting numbers in Florida and elsewhere in the world were in fact a bit higher than expected last year. Of course, nothing about the pandemic could produce adult, nesting turtles, but the uptick helped continue the romantic notion that sea turtles and other wildlife flourished as the pandemic raged.

The reality is far more complicated and, unfortunately, not as optimistic for sea turtles. The hope that sea turtles in Florida and elsewhere in the southeastern United States might benefit from the pandemic was at one time based on a semblance of real possibility. However, conditions for sea turtles in many other parts of the world always pointed to threats being exacerbated by negative impacts on ecotourism, international volunteerism, economies of remote coastal communities, and governments' abilities to sustain the presence of resource managers and law enforcement as public budgets took a major hit.

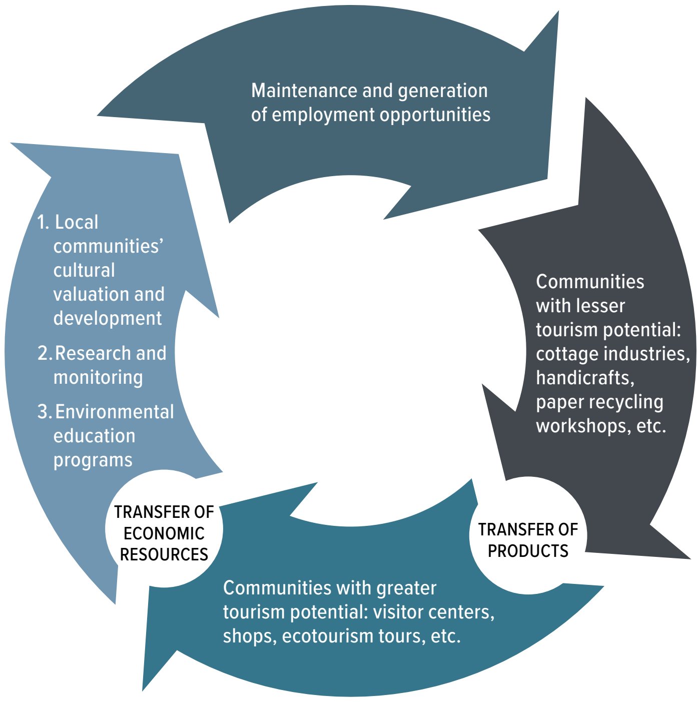
What follows are brief essays and anecdotes by different authors from around the world that examine the ways in which sea turtles were actually affected during the COVID-19 pandemic, with the perspective of hindsight.

AT LEFT: Gary Stokes, co-founder of OceansAsia, finds surgical masks that have washed up on the beach of Soko Islands, Hong Kong, China, following the outbreak of the novel coronavirus in early 2020. © Naomi Branna courtesy of Gary Stokes/OceansAsia

BRAZIL

Fundação Projeto Tamar

By Neca Marcovaldi and Joca Thome



COVID-19 (the coronavirus) hit Brazil even harder than it did the rest of the world in 2020, leading to the suspension of Fundação Projeto Tamar's research and environmental education activities; the closure of 10 retail stores and six visitor centers; and the disruption of the social production cycle that is tied to the jobs, incomes, and survival of thousands of community partners—all of whom are essential to the deep sense of social inclusion upon which the success of this four-decades-old sea turtle conservation program depends. To make matters worse for turtles during the pandemic, many Brazilians left cities and moved to seaside properties, thus increasing beach use, artificial lights, and vehicle traffic in nesting areas, as well as creating an even greater demand for the services normally provided by Tamar's already beleaguered staff.

Fundação Projeto Tamar is a private nonprofit institution that uses revenue from visitor centers and stores located near significant sea turtle nesting and foraging sites to sustain the lives of local community members and to maintain research and environmental education programs. Through a circular economy model, Projeto Tamar generates job opportunities in communities with low tourism potential by engaging community members in the production of turtle-themed clothing and accessories. Those products are then sold in communities with high tourism potential, where awareness and education programs reach tens of thousands of tourists from all over the world. Prior to the pandemic, this business model supported fully 1,800 people and provided more than 500 jobs, a number that was cut by two-thirds during the initial days of the pandemic.

Meanwhile, on a national governmental scale, Centro Tamar (Brazil's National Center for Sea Turtle Research and Conservation) was also delayed in pursuing major components of its National Action Plan for Sea Turtles. The researchers' access to federally protected lands was curtailed; the field professionals were forced to work from home; the monitoring of fishing fleets, environmental education in schools, and other activities came to a near standstill; and the administrative processes underway to prevent the adverse impacts of port projects and other forms of habitat alteration had all local inspections postponed. Nonetheless, hundreds of virtual meetings allowed the office work to continue and ensured that the legal and administrative processes that protect nature in Brazil did not stop altogether.

Projeto Tamar's reaction to COVID-19 was to do what they do best—to *reinvent themselves* in the face of seemingly impossible challenges—a slogan that has become their mantra over time. Starting in August 2020, little by little they began to resume activities and reopen some of their centers, stores, and T-shirt factories—but the road ahead is still long. They are optimistic that the knowledge they have accumulated over four decades of social engagement, sea turtle conservation, policy advances, and business development will allow them to reinvent yet again and to continue the critical work that has contributed to the recovery of Brazil's five sea turtle species.

COSTA RICA

Latin American Sea Turtles (LAST)

By Didiher Chacón

The year 2020 began like any other for LAST's sea turtle projects in Pacuare and Osa, Costa Rica, with high expectations of hosting more than 1,000 volunteer beach workers and serving an estimated 2,000 visitors, mostly primary school children coming to Moín Beach on field trips. But when COVID-19 came to Costa Rica in March, LAST's entire volunteer force—the free labor made up of international and Costa Rican volunteers who enable its projects to run sustainably—collapsed from one day to the next! To make matters worse for LAST, the government closed beaches, restricted vehicular movements, and froze LAST's research permits. By April, LAST was left with no workforce and no funding.

Among the many goals of LAST's projects are to reduce the illegal extraction of eggs and the slaughter of turtles for food, so closing the beaches might seem a good thing. However, soon after the closures, the police and other authorities changed focus to concentrate more on quarantine measures, thus ignoring beach protection.

Despite this dire situation, LAST staff members and partners did not ignore any turtles or nests that needed protection. While staff members on the coasts continued doing their jobs by forging alliances with local community members to assist with patrols, LAST's office staff members dedicated themselves to seeking support for its basic needs from national and international partners and to negotiating with local authorities for special permission to continue night patrols.

Because of a lack of employment caused by closures and restrictions, many people in developing countries have necessarily thrown themselves into their roles as providers for their families by seeking food or goods with which to barter by any means possible; not surprisingly, they hunt, fish, and collect turtle eggs just to survive. All socioeconomic sectors on Costa Rica's coasts suffered greatly, but LAST's beach projects were hit especially hard by a drastic increase in illegal activities involving sea turtles.

Thanks to several generous donors, LAST was fortunate to stay afloat. It was able to protect at least half of all turtle nests on the beaches and to ensure that more than 70 percent of females were returned safely to the sea. While most citizens were sheltering in place at home, LAST's staff members, at great personal risk, were kept very busy relocating nests doomed by erosion, saving turtles from hunters' machetes, and protecting eggs from illegal harvest for the egg trade. LAST also kept its staff and partners safe by being one of the first organizations to put biosecurity protocols in place at the work sites.

As LAST begins the 2021 nesting season having exhausted its financial and human resources, its plan remains the same: go to the beaches to give nature a helping hand, respect Costa Rica's laws and protocols, and continue to bring Costa Rica's youth safely into nature to create future generations of sea turtle and ocean conservation ambassadors.

GREECE
ARCHELON

By Aliki Panagopoulou

In February 2020, ARCHELON—The Sea Turtle Protection Society of Greece—was preparing for another season at the turtle nesting sites of Zakynthos, Peloponnesus, and Crete. Activities at the Rescue Center were in full swing, with several turtles under treatment and an almost fully booked schedule of school visits. Then COVID-19 arrived, bringing with it travel restrictions that canceled the participation of 80 percent of ARCHELON's volunteers, school shutdowns that forced the closure of ARCHELON's environmental education program, and an anemic tourist season that left the organization in unprecedented financial strife. ARCHELON's very survival came under challenge, and tough decisions needed to be made.

ARCHELON sprang into action to ensure its survival. Urgent expenses were met with the help of emergency grants from private groups such as MAVA Foundation and public agencies such as the Greek Ministry of Environment's Green Fund. Monitoring protocols at nesting beaches were revised to accommodate smaller teams, and Greek volunteers from decades ago dusted off their field clothes and kept ARCHELON's projects staffed—one day at a time—during what turned out to be one of the busiest years ever for sea turtle nesting in Greece.

Fully 7,600 loggerhead nests were recorded in the 2020 season. Although those high numbers were not related to COVID-19, the pandemic did result, initially at least, in fewer tourists and tourism-related disturbances for nesting females (e.g., less beach furniture, fewer people on the beach at night, less harassment at sea by speedboats). However, as the country reopened to tourism later in the season, anthropogenic pressures returned, and many hatchlings were lost because of light pollution.

ARCHELON adapted to the challenges and is now preparing for a new season. With the arrival of vaccines, it is hoped that the pandemic is receding just as the 2021 turtles are returning to their nesting sites. But there is also pressure from many sectors for a fast-paced economic recovery in Greece, pressure that may prioritize the economy over protection of the environment. Already a bill has been passed that will open a window for development projects within protected areas; the projects may have an impact on turtle nesting sites. The real COVID-19 challenges for loggerhead turtles in Greece may lie ahead, not behind.

INDIA
Dakshin Foundation

By Muralidharan Manoharakrishnan and Kartik Shanker

The year 2020 will forever be etched in people's collective memory as the time when life practically came to a standstill; yet the year somehow went by before anyone noticed. Working in a developing nation on environmental issues and with charismatic species such as sea turtles had its own particular set of challenges during the pandemic. The Indian government made tough decisions to curb the virus through a lockdown that halted all modes of transport (air, rail, road, and waterways) except for essential commodities, and even those required elaborate documents and permissions.

Over the years, Dakshin Foundation has been monitoring sea turtle populations as part of its Flagships program at index sites in the country, including an olive ridley mass nesting (or *arribada*) beach in the state of Odisha on India's east coast, as well as nesting beaches of leatherbacks in the Andaman Islands and of green turtles in the Lakshadweep Islands. Dakshin also coordinates a national grassroots network of sea turtle nongovernmental organizations (NGOs) as part of the Turtle Action Group.

Just as the first lockdown was imposed, the arribada in Odisha commenced; Dakshin's leatherback monitoring camp had just closed for the season, and its researchers were still waiting to head to Lakshadweep for the start of that season. Although they initiated the arribada census at Rushikulya, they had to abandon work after a few days because of lockdown constraints. At the same time, they started to receive news about stranded laborers and disenfranchised communities stuck without access to income, food, resources, or any opportunity to travel back home.

In addition to the organization's work on flagship species conservation over the years, Dakshin has worked on governance and community well-being in coastal communities. Thus, it was decided that pandemic efforts would be best directed toward assisting government and NGOs in coordinating relief efforts. Dakshin staff set up several task forces to provide relief and transport for stranded fishers, food and sanitation supplies for coastal communities, improved awareness about community health and COVID-19, and fundraising. Thanks to the diverse backgrounds of Dakshin's staff members and active projects in different parts of the coast, Dakshin was able to assist many communities in Odisha, Andaman, and Nicobar Islands, and elsewhere.

Although the world was buoyed by exaggerated stories of environmental recovery, of turtles nesting during the day, and of whales returning to coastal waters, the harsher impacts of the pandemic on the already marginalized worker classes around India (and in other parts of the world) were a far more serious consequence. Even for Dashkin Foundation, an organization rooted in social justice, this experience had an impact on its team (especially those working in the areas of ecology and conservation) and on how members of the team view the people who live alongside the turtles, sharks, and other species in the marine ecosystems they work to conserve.

INDIAN OCEAN

Olive Ridley Project

By Claire Petros and Jillian Hudgins

The Olive Ridley Project (ORP) is a U.K.-based charity that operates sea turtle–related projects in several Indian Ocean countries. ORP's ability to remove ghost nets from the ocean, to rescue and treat injured turtles, to work with local communities, and to promote conservation awareness about the importance of sea turtles was drastically hindered by the COVID-19 pandemic.

In Maldives, Kenya, and Oman, ORP partners with tourist resorts and relies heavily on donations to fund its work and on volunteers to help staff its rescue center. As such, when those countries closed their borders to tourism in March 2020, ORP was forced to suspend most operations. Moreover, the rescue center was left without a veterinarian for six months because of visa complications, a difficult period that lasted until late 2020 during which ORP did not take in any new patients in Maldives. Fortunately, this period coincided with what is normally the low season of patient admittance. Presumably because of a reduction in tourist boat traffic, the ORP staff also noted a dramatic drop in sea turtle entanglements.

In Pakistan, ORP works closely with the fishing community of Abdul Rehman Goth to provide alternative incomes through the production and sale of dog leashes fabricated from recycled ghost net plastic. Effects of the lockdown were felt acutely in Abdul Rehman Goth because of restrictions that limited fishers' access to both food and income, since the production of dog leashes also came to a standstill. In response to this problem, ORP was able to raise funds to help cover food rations for more than 150 families. The ORP staff also pivoted to producing an educational platform for homeschooling called e-Turtle School, which provides lessons about sea turtle biology and conservation free of charge to anyone around the world.

The pandemic brought human relationships with the natural world into sharp focus and showed the true extent to which human

A Projeto Tamar employee displays a sea turtle accessory produced by local community members. Projeto Tamar's workforce was cut by two-thirds during the initial days of the COVID-19 pandemic. © Fundação Projeto Tamar

activity can be detrimental to the health of the planet, as well as how vulnerable societies and systems are in the face of rapid global change. Conservationists now face a new set of challenges for which protecting natural spaces will require a new strategy that is able to evolve with a changing world. For the types of conservation work conducted by charities such as ORP to be effective, the work will require a broad base of financial support from individuals and businesses irrespective of the vagaries of tourism trends.

The key to adaptation must be greater capacity building of in-country conservationists. By empowering local communities, we can protect the world's vulnerable species and remain resilient to the volatile nature of a changing world.

PHILIPPINES
Ten Knots Group

By Jamie Dichaves

Leah Sabanal, like most of the locals in El Nido, lost her steady income when the spa she works for had to stop operating because of the pandemic. No one in the tourism industry was spared from COVID-19 impacts, and the Philippines suffered estimated losses of USD $4 billion from March to July 2020. This happened just as the Ten Knots Group received recognition as "the world's first certified Sea Turtle Friendly™ tourism operator." But the company and staff did not let the pandemic dampen their spirits; instead, it hardened their resolve to confront the challenge.

A sizable donation enabled them to launch the "Be G.R.E.E.N. (Guard, Respect, Educate El Nido) and GREAT" program, which was able to hire displaced personnel from four tourism industry projects: Coastal Cleanup, Wildling Rescue and Replanting, Mooring Buoy Rehabilitation, and the Pawikan Patrol. Participants such as Leah Sabanal cycled through 10–15 days in each of the four programs and were paid with money and goods sourced from local suppliers. The Pawikan Patrol—one of several sea turtle conservation efforts deployed on sea turtle beaches with historically high levels of poaching as well as a risk of high tide inundation—put locals to work tagging and monitoring nesting turtles and relocating threatened nests to protected hatcheries. Those workers remain a valuable component of a broader local turtle conservation network founded in 2017, which has the full endorsement of Philippine government agencies.

With partners such as Leah, no pandemic can stop the local community from carrying out its mission to protect sea turtles while creating livelihoods that positively contribute to the environment.

GLOBAL
Oceanic Society

By Wayne Sentman, Christina Ullrich, and Roderic Mast

Plastic has many beneficial applications, but more than 40 percent of the world's virgin plastic produced each year ultimately takes the form of short-lived or single-use products that are readily discarded by consumers, often after mere minutes of use. This production has created an ever-rising tide of plastic pollution, much of which winds up in the world's oceans.

The tragic effects of plastic pollution in the oceans are now ubiquitous, affecting marine flora and fauna from zooplankton all the way up the food chain, including sea turtles of all species and age classes that ingest plastic or become lethally entangled in it. Recent studies suggest that sea turtles have a propensity to ingest marine plastic pollution and may even be attracted to plastic over their natural prey. And as plastics break down, they become microplastics that are a severe threat for filter-feeding animals ranging from barnacles and tubeworms all the way up to whale sharks, manta rays, and baleen whales.

The COVID-19 pandemic is worsening the plastic pollution problem because of the increased use of personal protective equipment—the World Health Organization estimates that 129 billion face masks and 65 billion plastic gloves are now used each month globally, and the conservation group OceansAsia estimates that as many as 1.56 billion face masks found their way into marine systems in 2020 alone.

Other lifestyle changes resulting from COVID-19 further exacerbate the problem, including the spike in takeout dining. With restaurants pivoting from in-house dining to takeout, and with the mounting use of online ordering and home delivery services, plastic use (usually nonrecyclable packaging, cutlery, straws, and more) has ballooned. One estimate suggests that plastic waste generated per U.S. household has increased by at least 25 percent since the onset of COVID-19.

In addition to propelling plastic consumption, COVID-19 is contributing to the plastic pollution problem by altering attitudes and behaviors related to plastic use. Public health concerns around COVID-19 have reversed many of the gains communities had made in eliciting businesses to proactively reduce their reliance on single-use plastic products. Hard-fought advances in behavior change and adoption of sustainable alternatives to plastics were quickly lost in the name of hygiene. This usage is despite the fact that single-use plastic is not inherently safer than reusables and once discarded may cause additional public health concerns. Human reliance on single-use plastics, reinforced by the pandemic, will require even greater resolve, effort, and resources to reverse in the future.

Plastic pollution in the seas as a result of the COVID-19 pandemic is a poignant reminder that there is no "away" and that every plastic item prevented from entering the ocean is consequential. The interconnectivity between human health and ocean health cannot be overstated. Now more than ever, we must remember that we are all in this (ocean) together. •

FAQs ABOUT SEA TURTLES

Sea turtles can elicit tricky questions from those curious about their mysterious lives and natural histories. And even sea turtle specialists can struggle to answer some of the most seemingly basic questions about sea turtle biology and conservation. If you are among the many specialists who have stumbled to concisely answer things such as "How many sea turtles are there?," "How old do turtles get?," or "Where do baby turtles go?," then this feature is for you. Our hope is to set the record straight about often-asked questions with answers written by top experts who will prepare you to respond like an expert yourself. Moreover, we hope that for those questions about sea turtles that may still have no firm answers, this series can pique SWOT readers' curiosity and drive them to conduct the research needed to solve the mysteries.

WHAT DOES CLIMATE CHANGE MEAN FOR SEA TURTLES?

By Jeanette Wyneken

The planet's climate changes; it has done so throughout Earth's history. Those environmental changes can affect all life stages of marine turtles, including egg survival and the reproductive success of adults, in addition to affecting food quality and availability.

Some climate models predict that many marine turtle nesting sites could become warmer, drier, and subject to more severe storms as climate change progresses. Dry sand can increase unsuccessful nesting attempts (false crawls), cause nest chambers to collapse while being excavated, and dehydrate and destroy nests. Conversely, wetter sand caused by storms and wave runup can suffocate sea turtle embryos or lower hatching success. Sea turtle eggs incubate more rapidly at warmer temperatures up to a point, but as the upper thermal limit is approached (~34°C [~93°F] for most species) development slows, and higher heat can cause embryos to perish. Temperature also affects sex ratios, with warmer incubation resulting in a preponderance of female hatchlings, a demographic problem that could become catastrophic over time if insufficient numbers of males are produced.

Warming seas and estuaries are likely to undergo ecological shifts as well, such as losses of basic or intermediate links in food chains; these losses could in turn affect the habitats used by juvenile turtles and alter how they move from one developmental habitat to another as they mature. Those same factors may also have an impact on the abundance, quality, and distribution of adult turtle feeding grounds. However, changes in sea level and storm severity are the climate components most likely to have direct, near-term effects on sea turtle reproduction, causing nest inundations and the loss of turtle nesting sites to rising seas. Researchers are already beginning to see such effects at many armored beaches in Florida, U.S.A., and elsewhere (see *SWOT Report*, vol. XII, pp. 12–13, "Coastal Armoring and Rising Seas Put a Squeeze on Turtles").

The effects of climatic shifts seem dire for sea turtles. Yet history across geological time can provide perspective and even some hope. Turtles appeared on Earth about 220 million years ago, with several marine lineages persisting for millions of years and through many major climate change events, including the Mesozoic and Cenozoic interglacial and glacial periods. Today's seven species of marine turtles arose ~20–70 million years ago; the oldest ones arose around the time of the K–T or Cretaceous–Tertiary mass extinction event caused by an asteroid some 66 million years ago. Their ancestors evolved from stock that lived in much warmer times, compared with more recent millions of years characterized by cooler seas and beaches. What extant turtles now face is a different (generally warmer) thermal trajectory accompanied by a more rapid onset. The question is whether ancestral resiliencies that allowed sea turtles to thrive to the present will be sufficient to carry them past the current threat posed by climate change.

AT TOP: Galápagos Islands, Ecuador – Although the Galápagos is at the equator, the oceanography, especially in the western islands, brings cold waters and extreme climate conditions for both mammals and reptiles. On a remote beach on Fernandina Island, green turtles emerge from the cold waters to bask in the warming sun while at the same time sea lions seek respite in the cool surf from the terrestrial heat. This photo highlights the extremes a marine reptile and marine mammal have to go to so that they can survive the Galápagos Islands unique and challenging climatic conditions. © Thomas P. Peschak

→ SEE MORE PHOTOS AND STORIES FROM TOM ON PAGES 14–23.

WHY DO SEA TURTLES BASK?

By George Balazs and Roderic Mast

Of the seven species of ocean turtles, only the green is known to emerge from the sea to bask, or, as defined by Merriam-Webster, "to lie or relax in a pleasant warmth or atmosphere." Greens of both sexes and all sizes and life stages exhibit this fascinating behavior, but it only occurs at a few well-documented locations in the Pacific, including the Galápagos, Mexico's Socorro Island, Australia's Wellesley Islands, and—most notably—the Hawaiian archipelago.

In Hawaii, basking occurs by day or night on shorelines where nesting occurs or adjacent to algal foraging pastures; turtles have also been observed basking on floating objects. Turtles may crawl ashore on their own or passively surface to bask as a result of falling tides in shallow bays. Basking has even been documented in captive animals at Hawaii's Sea Life Park, where turtles emerge onto artificial nesting beaches. Basking turtles often cluster together, suggesting that the behavior may have a social function; there may also be a genetic component involved. Substrates on which turtles bask include black to light-colored sand of varying particle sizes, rocks and old lava flows, limestone benches and the tops of offshore coral heads, shipwrecks, and even beach lounge chairs!

In the Galápagos and northwestern Hawaiian Islands, green turtle basking has been known for centuries from the logbooks of early European voyagers. But in the main Hawaiian Islands, basking didn't exist before the 1990s; then the behavior began to spread rapidly in both scope and magnitude, concomitant with sharp increases in turtle populations tied to the 1970s ban on commercial harvest. Now a normal and iconic feature of Hawaiian beach landscapes, basking greens (locally called *honu*) have grown accustomed to people being close to them, and honu has facilitated an array of life history research projects about the phenomenon. Not surprisingly, human conflicts have erupted over the need to manage touristic "turtle viewing" on beaches often shared with bathers, surfers, fishers, and others. (See *SWOT Report*, vol. XII, pp. 38–39, "Trapped in the Crossroads of Honu Conservation.")

Not unlike other ectotherms, from freshwater turtles to snakes, lizards, and more, greens bask to optimize body temperature; a major thermal ecology study has gone deeper to suggest why. For instance, elevated body temperatures can mobilize stored fat and theoretically accelerate egg maturation in nesting females; warmer body temperatures can also speed and promote digestion in all sizes of turtles. Beyond warmth, basking may also be a means for females to avoid unwanted copulation attempts and for both sexes to stay out of harm's way from predators like tiger sharks. And, intuitively, basking serves to conserve energy, since a turtle out of the water doesn't need to periodically rise to the surface to breathe as it would when resting in underwater refugia. Another hypothesis, now supported by research, is that carrying capacities of certain foraging pastures in Hawaii are being exceeded as a result of the increased turtle population in recent decades, so basking may result from suboptimal nutrition. Further research will help shed light on this unique behavior of Pacific green turtles.

The first published photo of "a green turtle asleep on a sandy beach" in the northwestern Hawaiian Islands appeared in a 1925 issue of *National Geographic Magazine*. The caption provided what is possibly the most concise answer as to why green turtles bask: "These grotesque creatures browse in submarine fields of algae until hunger is satisfied, and then crawl heavily out to sprawl in the sand, safe from enemies in the sea."

HOW DO SEA TURTLES NAVIGATE IN THE OCEAN?

By Catherine M. F. Lohmann and Kenneth J. Lohmann

Sea turtles live life on the move. Most migrate to open-sea nursery habitats as hatchlings and then migrate back to coastal waters as juveniles. Some migrate seasonally. Adults migrate repeatedly between feeding and breeding areas. So the question naturally arises: How do turtles guide their journeys across vast expanses of water without landmarks or a GPS? Thirty years of work with turtles along the eastern U.S. coast has provided a framework for understanding those remarkable travels.

A sea turtle's first migration seems a straightforward task: swim toward the open ocean and away from shore. Hatchlings start this trip in the dark; they cannot see the direction of the open ocean, but they can use wave direction to find it. When hatchlings enter the sea, they dive beneath the surface and use water motion to determine the direction that waves are moving. They then swim directly into the approaching waves and thus inevitably swim away from land and toward open water.

Sea turtles can also maintain a course in one direction using biological compasses based on the sun or Earth's magnetic field. For young turtles, however, a compass alone is not enough to keep them safe within the boundaries of their nursery habitat. Fortunately, Earth's magnetic field provides turtles with a map. Several magnetic features vary geographically so that most locations have unique combinations of magnetic characteristics. Essentially, every place has its own magnetic address.

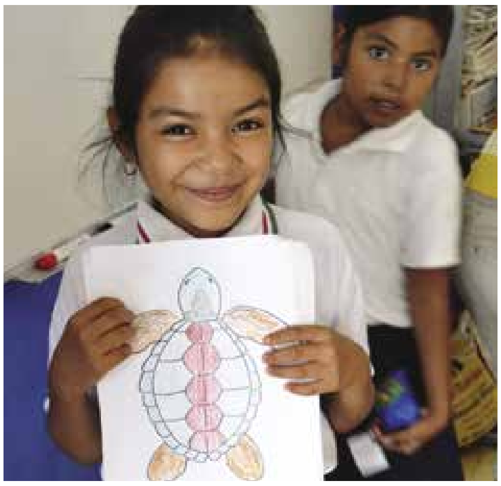
Hatchling loggerheads emerge from their nests programmed to recognize specific magnetic addresses in the ocean and to swim innately in directions that keep them safe; thus, for example, Florida turtles do not stray too far north into fatally cold waters. As the turtles age, they move beyond those innate responses and learn to use the spatial patterns of Earth's magnetic field as a map, thereby allowing them to sense their current magnetic addresses and set course for the magnetic addresses of their destinations. It seems likely that once juvenile turtles return to coastal waters, they can use their magnetic map to guide travel between different feeding sites, such as during the seasonal migrations of turtles along the U.S. coast. Sea turtles also use magnetic cues to migrate to their natal beaches; as hatchlings, they are thought to learn or imprint on the magnetic address of the beach where they hatched and, as adults, swim back to it years later to breed.

The remarkable magnetic navigation of turtles has important conservation implications. Conservationists need to ensure that turtles can imprint on their natal beach in a natural magnetic environment, and they need to understand that turtle populations are probably not interchangeable. Animals programmed to migrate in the Atlantic Ocean are unlikely to navigate appropriately in the Pacific and vice versa. If researchers keep such needs in mind, it seems likely that the same skills that guided turtles for the last 120 million years will keep them on track for the next 120 million. •

Acting Globally

SWOT SMALL GRANTS 2020

Since 2006, SWOT's small grants have helped field-based partners around the world to achieve their research and conservation goals. To date, 104 grants have been awarded to 88 applicants in more than 52 countries and territories for work addressing three key themes: (1) networking and capacity building, (2) science, and (3) education and outreach. The following are brief overviews of our 2020 grantees. Visit www.SeaTurtleStatus.org/grants for application instructions and a list of all past SWOT grantees.



African Chelonian Institute – SENEGAL

African Chelonian Institute will use its 2020 SWOT grant to host the inaugural "Senegal National Sea Turtle Days," a three-day event that will be held in the coastal towns of Joal-Fadiouth and Palmarin to raise awareness about sea turtles and ocean pollution with special attention to plastic waste. This event will become an annual activity that will inspire community members to integrate ocean-friendly behaviors into their everyday lives.

Bio Conservation Society (BCSL) – SRI LANKA

The Kalpitiya peninsula in Sri Lanka provides essential habitat for a wide variety of marine species, including olive ridley sea turtles. The presence of sea turtles is known primarily through the high rates of incidental capture in the area. Despite this, no formal surveys have been done to estimate the number of turtles that nest on the 5 km (3.1 mi) of beach. BCSL will use its 2020 SWOT grant to conduct surveys to estimate the scale of olive ridley turtle nesting on the Kalpitiya peninsula, and will share the results via the SWOT database.

Czech University of Life Sciences Prague and Syiah Kuala University – INDONESIA

In Indonesia, the hunting of hawksbill turtles for tortoiseshell still occurs on a considerable scale (see pp. 34–35). A 2020 SWOT grant will help the project's researchers investigate the status of tortoiseshell trade at 12 carefully selected locations on Sumatra and its islands. Through fieldwork, market surveys, and interviews, the researchers hope to better understand the domestic trade, to promote the conservation of hawksbill turtles, and to propose conservation steps to reduce the tortoiseshell trade.

ecOceánica – PERU

In Cancas and Punta Mero, Peru, the accidental capture and mortality of sea turtles, especially hawksbills, is a pervasive problem in artisanal fisheries. ecOceánica will use its 2020 SWOT grant to reduce turtle bycatch and mortality by implementing bycatch reduction technology, creating partnerships with local communities, developing a sea turtle conservation strategy, and increasing public awareness and knowledge of environmental issues through place-based education and citizen science.

Ocean Connectors – MEXICO

Ocean Connectors students in San Diego, California, and Nayarit, Mexico, simultaneously learn about protecting sea turtles that connect them: the eastern Pacific green turtles that migrate between the San Diego Bay and the Revillagigedo Islands in Mexico. With their 2020 SWOT grant, Ocean Connectors will reach 800 students in Nayarit through the "Sea Turtle Discovery Program" to cultivate a future generation of passionate, globally aware, and empowered coastal residents who take active steps to enjoy and protect sea turtles and support ocean health.

The Solon Foundation – SIERRA LEONE

The Turtle Islands of Sierra Leone are home to diverse marine, bird, and reptile life and provide nesting habitat for five of the seven species of sea turtles. Local residents in the Turtle Islands continue to hunt turtles for their meat and to harvest their eggs for consumption. To combat this, The Solon Foundation will use its SWOT grant to lead sea turtle awareness training programs in the Turtle Islands that aim to reduce turtle consumption, monitor and protect nesting sites, and create policies in support of a National Marine Protected Area.

AT LEFT, TOP ROW: © ecOceánica; © Ocean Connectors; **MIDDLE ROW:** © Czech University of Life Sciences Prague and the Faculty of Veterinary Studies and Centre for Wildlife Studies at Syiah Kuala University; **BOTTOM ROW:** © African Chelonian Institute; © The Solon Foundation (TSF)

AZA-SAFE GRANT RECIPIENTS

Since 2019, SWOT has partnered with the Association of Zoos and Aquariums (AZA) and its Sea Turtle SAFE (Saving Animals from Extinction) program to make additional grants available for projects related to the conservation of two of the top global priorities for sea turtle conservation—eastern Pacific leatherbacks and Kemp's ridleys—throughout their respective ranges. The projects on these pages were awarded 2020 SWOT grants thanks to the AZA-SAFE program.

Marine Conservation without Borders – MEXICO

Marine Conservation without Borders (MCwB) collaborates with Indigenous communities worldwide to develop environmental science curricula that integrate Indigenous ecological knowledge with western science to help these two worlds collaborate to protect biodiversity. With its 2020 AZA-SAFE SWOT grant, MCwB will develop a middle school science curriculum on sea turtles for students in Quintana Roo, focusing on eastern Pacific leatherbacks and Kemp's ridleys, written in Spanish and English and ethno-translated into Maya.

The Mazunte Project – MEXICO

Along the coast of Oaxaca, Mexico, both domestic and stray dogs pose a threat to the sea turtle nests and hatchlings, including critically endangered eastern Pacific leatherbacks. With their 2020 AZA-SAFE SWOT grant, the Mazunte Project will conduct mobile dog spay/neuter and education events along the Pacific coast of Oaxaca in order to decrease the canine predation of sea turtle eggs and hatchlings at these important nesting habitats.

Palmarito Sea Turtle Rescue, Inc. – MEXICO

The Campamento Tortuguero Palmarito was established in 2005 as a full-time effort to protect and conserve the sea turtle populations nesting on Palmarito Beach, including eastern Pacific leatherbacks. Palmarito Sea Turtle Rescue will use their 2020 AZA-SAFE SWOT grant to establish hatcheries and train local volunteers to patrol nesting beaches in Oaxaca, Mexico and to properly relocate and monitor eastern Pacific leatherback nests to protected hatcheries.

Patricia Huerta Rodriguez – MEXICO

The coast of Tamaulipas provides important nesting habitat for Kemp's ridley turtles, yet it is also highly developed and therefore experiences high levels of traffic on its beaches and in its waters. This project will use a 2020 AZA-SAFE SWOT grant to address threats to Kemp's ridleys in Tamaulipas by targeting various stakeholders with educational talks and printed materials that address key issues including pollution, the consumption of turtle eggs, bycatch reduction technology, and nesting beach protection.

Sea Turtle Recovery – USA

The number of stranded, cold-stunned sea turtles, especially critically endangered Kemp's ridleys, found along New Jersey's coastline has increased in recent years. Cold stunned turtles require immediate and specific care if they are to survive. In order to increase response efforts for affected turtles, a 2020 AZA-SAFE SWOT grant will help Sea Turtle Recovery build and train a team of locally based volunteers to properly handle and transport cold stunned turtles.

Universidad Veracruzan – MEXICO

The Veracruzano Coral Reef System National Marine Park (Parque Nacional Sistema Arrecifal Veracruzano) in Mexico, consists of six islands totaling 52,238 hectares (129,083 acres) that provide habitat for around 1,300 species of fauna, including Kemp's ridley sea turtles. Veracruz is also the second most important trading port in the country, and the overlap of boats and marine life means that boats sometimes strike and kill turtles. Universidad Veracruzana will use its 2020 AZA-SAFE SWOT grant to lead an educational workshop in conjunction with park administration, local fishermen, and private tourist boats to help decrease sea turtle and boat interactions.

AT LEFT, TOP ROW: © Marine Conservation without Borders; **MIDDLE ROW:** © The Mazunte Project; © Patricia Huerta Rodriguez; **BOTTOM ROW:** © Sea Turtle Recovery; © Palmarito Sea Turtle Rescue, Inc.

SWOT Data Citations

We are grateful to all who generously contributed their sea turtle data for inclusion in the maps on pp. 29 and 32–33. For information about how the maps were created, please the sidebar on p. 31.

GUIDELINES OF DATA USE AND CITATION

The data that follow correspond directly to the maps on p. 29 and pp. 32–33. In the case of nesting data, every data record is numbered to correspond with its respective point on the map. To use data for research or publication, you must obtain permission from the data provider(s).

Nesting Data Citations

DEFINITIONS OF TERMS

Clutches: A count of the number of nests of eggs laid by females during the monitoring period. **Nesting females:** A count of nesting female turtles observed during the monitoring period. **Year:** The year in which a given nesting season ended (e.g., data collected between late 2015 and early 2016 would be listed as year 2016).

Nesting data are reported from the most recent available nesting season or as averages for the years reported. Beaches for which count data are not available or were not reported are listed as “unquantified.” Additional metadata are available for many of the data records and may be found online at http://seamap.env.duke.edu/swot or by viewing the original data source (if published).

ANGOLA

DATA RECORD: 1

Data Source: Le Corre, L. D .B. M., and M. J. Pereira. 2021. Cambeú Project: Angola Sea Turtle Nesting. Personal communication. In *SWOT Report—State of the World’s Sea Turtles*, vol. XVI (2021).
Nesting Beach: Lobito
Year: 2019
Count: 106 clutches
SWOT Contacts: Mário Pereira and Luz Le Corre

DATA RECORD: 2

Data Sources: **(A)** Weir, C. R., T. Ron, M. Morais, and A. D. C. Duarte. 2007. Nesting and at-sea distribution of marine turtles in Angola, West Africa, 2000–2006: Occurrence, threats, and conservation implications. *Oryx* 41 (2): 224–231; **(B)** Wildlife Conservation Society and Angola Liquid Natural Gas. 2009. *Marine Turtle Research and Conservation in the Sereia Peninsula Angola: End of Season Report*. Unpublished report, June; **(C)** Limpus, C., and Queensland Government Department of Environment and Science. 2021. Queensland Marine Turtle Conservation Database. Personal communication. In *SWOT Report—State of the World’s Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Benguela Province;[A] **(2)** Cabinda Province;[B] **(3)** Luanda North to Rio Longa South;[B] **(4)** Palmeirinhas;[A] **(5)** Sereia Peninsula, from Ponta do Padrão to Sereia Beach[C]
Years: **(1)** 2006; **(2)** 1983; **(3)** 1985; **(4)** 2005; **(5)** 2008
Counts: **(1)** unquantified; **(2)** 5; **(3)** 100; **(4)** 120; **(5)** 181 clutches
SWOT Contact: Tamar Ron

AUSTRALIA

DATA RECORD: 3

Data Sources: Limpus, C., and the Queensland Government Department of Environment and Science. 2021. Queensland Marine Turtle Conservation Database. Personal communication. In *SWOT Report—State of the World’s Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Bulurga; **(2)** Christmas; **(3)** Flinders Beach; **(4)** Janie Beach; **(5)** South Wik; **(6)** South Wik Beach (Aurakun); **(7)** Topsy Beach
Years: **(1–2)** 2018; **(3–4)** 2017; **(5)** 2014; **(6)** 2015; **(7)** 2016
Counts: **(1)** 11–100; **(2)** 11–100; **(3)** 1–10; **(4)** 1–10; **(5)** 11–100; **(6)** 101–500; **(7)** 1–10 clutches
SWOT Contact: Col Limpus

DATA RECORD: 4

Data Sources: (A) Whiting, S., T. Tucker, K. Pendoley, N. Mitchell, et al. 2018. Marine turtles in the Kimberley: Key biological indices required to understand and manage nesting turtles along the Kimberley coast. Western Australia Marine Science Institution Project 1.2.2 report; (B) Tucker, T. 2021. Olive ridley nesting in Western Australia. Personal communication. In *SWOT Report—State of the World’s Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Cape Leveque;[A,B] **(2)** Darcy Islands;[A,B] **(3)** Langgi;[A,B] **(4)** Smokey Bay[A,B]
Year: 2018
Counts: **(1–4)** unquantified clutches
SWOT Contact: Tony Tucker

DATA RECORD: 5

Data Sources: **(A)** Whiting, S. 1997. Observations of a nesting olive ridley turtle in the Northern Territory. *Herpetofauna* 27 (2): 39–42; **(B)** Whiting, A. U., A. Thomson, M. Y. Chaloupka, and C. J. Limpus. 2009. Seasonality abundance and breeding biology of one of the largest populations of nesting flatback turtles, *Natator depressus*: Cape Domett, Western Australia. *Australian Journal of Zoology* 56 (5): 297–303; **(C)** Cogger, H. G., and D. A. Lindner. 1969. Marine turtles in northern Australia. *Australian Zoologist* 15: 150–159; **(D)** Limpus, C. J., C. J. Parmenter, V. Baker, and A. F. Leay. 1983. The Crab Island sea turtle rookery in the northeastern Gulf of Carpentaria. *Australian Wildlife Research* 10 (1): 173–184; **(E)** Limpus, C. J., J. D. Miller, C. J. Parmenter, and D. J. Limpus. 2003. The green turtle, *Chelonia mydas*, population of Raine Island and the Northern Great Barrier Reef: 1843–2001. *Memoirs Queensland Museum* 49 (1): 349–440; **(F)** Gow, G. F. 1981. Herpetofauna of Groote Eylandt Northern Territory. *Australian Journal of Herpetology* 1 (2): 62–70; **(G)** Limpus, C. J., J. D. Miller, C. J. Paramenter, D. Reimer, et al. 1992. Migration of green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles to and from eastern Australian rookeries. *Wildlife Research* 19 (3): 347–358; **(H)** Guinea, G. F. 1990. Notes on sea turtle rookeries on the Arafura Sea Islands of Arnhem Land, Northern Territory. *Northern Territory Naturalist* 12: 4–12; **(I)** Prince, R. I. T., M. P. Jensen, D. Oades, and the Bardi Jawi Rangers. 2010. Olive ridley presence and nesting records for western Australia. *Marine Turtle Newsletter* 129: 9–11.
Nesting Beaches: **(1)** Bare Sand Island;[A] **(2)** Cape Van Diemen;[B] **(3)** Cobourg Peninsula;[C] **(4)** Crab Island;[D,E] **(5)** Groote Eylandt;[F] **(6)** McCluer Island;[G] **(7)** Southern Arafura Sea;[H] **(8)** Tiwi Islands[I]
Years: **(1)** 1997; **(2)** 2004; **(3)** 1969; **(4)** 1978; **(5)** 1981; **(6)** 1992; **(7)** 1990; **(8)** 2010
Counts: **(1, 3–8)** unquantified; **(2)** 3,300 clutches

BANGLADESH

DATA RECORD: 6

Data Sources: **(A)** Islam, M. Z. 2020. Bangladesh. In A. D. Phillott and A. F. Rees (eds.), *Sea Turtles in the Middle East and South Asia Region: MTSG Annual Regional Report 2020*, pp. 35–56. International Union for Conservation of Nature (IUCN)–Species Survival Commission (SCC) Marine Turtle Specialist Group; **(B)** Rashid, S. M. A. and M. Z. Islam. 2006. Status and conservation of marine turtles in Bangladesh. In K. Shanker and B. C. Choudhury (eds.), *Marine Turtles of the Indian Subcontinent*, pp. 200–216. Hyderabad, India: Universities Press.
Nesting Beaches: **(1)** Bashkhali;[A] **(2)** Bordal;[B] **(3)** Cox’s Bazar–Teknaf Peninsula;[A] **(4)** Dubla Island;[B] **(5)** Egg Island;[B] **(6)** Gohira;[A] **(7)** Haserchar, Dholghata;[A] **(8)** Inoni;[B] **(9)** Kaladia, Laldia;[A] **(10)** Kochopia;[B] **(11)** Kuakata;[A] **(12)** Kutubdia Island;[A] **(13)** Mandarbaria;[B] **(14)** Matarbari;[A] **(15)** Moheskhali Island;[B] **(16)** Monkhali;[B] **(17)** Sonadia Island;[A] **(18)** Sonar Char;[A] **(19)** St. Martins Island;[A] **(20)** Teknaf[A]
Years: **(1, 6–7, 9, 11–12, 14, 18, 20)** 2013–2020; **(2, 8)** 1989; **(3)** 2004–2013; **(4)** 1994; **(5, 13)** 2003; **(10)** 1985; **(15)** 1987; **(16)** 1984; **(17)** 2004–2020; **(19)** 1996–2020
Counts: **(1)** 2 average clutches per year; **(2)** 4 clutches; **(3)** 88.9 average clutches per year; **(4)** 3 clutches; **(5)** 4 clutches; **(6)** 2.7 average clutches per year; **(7)** 55.3 average clutches per year; **(8)** 6 clutches; **(9)** 5 average clutches per year; **(10)** 6 clutches; **(11)** 8.7 average clutches per year; **(12)** 14.3 average clutches per year; **(13)** unquantified clutches; **(14)** 12.7 average clutches per year; **(15)** 5 clutches; **(16)** 4 clutches; **(17)** 215.1 average clutches per year; **(18)** 9.3 average clutches per year; **(19)** 82.8 average clutches per year; **(20)** 283.7 average clutches per year

BENIN

DATA RECORD: 7

Data Source: Tchibozo, S. 2021. *Lepidochelys olivacea* nesting in South Benin. Personal communication. In *SWOT Report—State of the World’s Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Hilla-Condji; **(2)** Kraké Beach
Year: 2020
Counts: **(1–2)** unquantified clutches
SWOT Contact: Séverin Tchibozo

DATA RECORD: 8

Data Source: Madogotcha, T. J., S. J. Dossou-Bodjrenou, D. M. Dossou-Bodjrenou, M. D. Sossou, et al. 2021. Olive ridley nesting in Benin. Personal communication. In *SWOT Report—State of the World’s Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Abomey-Calavi; **(2)** Cotonou; **(3)** Grand-Popo; **(4)** Ouidah; **(5)** Sèmè-Podji
Years: 2017–2019
Counts: **(1)** 90; **(2)** 225; **(3)** 353; **(4)** 120; **(5)** 150 clutches
SWOT Contacts: T. Josias Madogotcha, S. Joséa Dossou-Bodjrenou, D. Marie Dossou-Bodjrenou, M. Danielle Sossou, P. Patrice Sagbo, Nadège Hounsou, Isidore Cobede, and Mikhaïl Padonou

BRAZIL

DATA RECORD: 9

Data Source: Projeto TAMAR Database (SITAMAR). 2014.
Nesting Beaches: **(1)** Abais–Pirambu–Ponta dos Mangues; **(2)** Anchieta–Comboios–Povoação–Pontal do Ipiranga–Guriri–Itaunas; **(3)** Arembepe–Praia do Forte–Costa do Sauipe–Sitio do Conde; **(4)** Pipa; **(5)** Quissamã–Farol–Atafona–São Francisco do Itabapoana
Year: 2014
Counts: **(1)** 10,981; **(2)** 106; **(3)** 1,481; **(4)** 2; **(5)** 5 clutches
SWOT Contacts: Alexsandro Santos, Armando Barsante, Cesar Coelho, Claudio Bellini Frederico Tognin, Gustave López, Jaqueline Castilhos, João Carlos Thomé, and Maria Angela Marcovaldi

BRUNEI DARUSSALAM

DATA RECORD: 10

Data Source: Shanker, K., and N. J. Pilcher. 2003. Marine turtle conservation in South and Southeast Asia: Hopeless cause or cause for hope? *Marine Turtle Newsletter* 100: 43–51.
Nesting Beach: Brunei
Year: 2001
Count: 301 clutches

CAMEROON

DATA RECORD: 11

Data Sources: **(A)** Fretey, J. 2001. Biogeography and conservation of marine turtles of the Atlantic Coast of Africa. *CMS Technical Series*, No. 6, United Nations Environment Program, Convention on Migratory Species Secretariat, Bonn, Germany; **(B)** Ayissi, I., H. Angoni, and J. Fretey. 2016. Kudu Project–Cameroon component (Kudu à Tubé). Personal communication. In SWOT Database Online 2017.
Nesting Beaches: **(1)** Beaches between Kribi and Campo;[A] **(2)** Bekolobé;[B] **(3)** Boussibelika;[B] **(4)** Ebodjé;[B] **(5)** Eboundja;[B] **(6)** Elombo;[B] **(7)** Ipeyendjé;[B] **(8)** Lolabé;[B] **(9)** Mbenddji;[B] **(10)** Nlendé[B]
Years: **(1)** 1999; **(2–10)** 2014
Counts: **(1)** unquantified; **(2)** 5; **(3)** 4; **(4)** 1; **(5)** 5; **(6)** 0; **(7)** 3; **(8)** 3; **(9)** 6; **(10)** 0 clutches
SWOT Contacts: Isidore Ayissi and Kudu à Tubé

COLOMBIA

DATA RECORD: 12

Data Sources: **(A)** Rguez-Baron, J. M., D. F. Amorocho, J. T. Artuluaga Reales, J. S. Ayala, et al. (2020). Colombia. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Region: MTSG Annual Regional Report 2020*, pp. 169–184. IUCN-SSC Marine Turtle Specialist Group; **(B)** Amorocho, D. F., A. Tobón, M. Abrego, H. Medina, et al. 2015. *Quantifying Hawksbill Nesting via Rapid Assessments along the Pacific Coast of the Darien Gap–Chocó Regions of Panama and Colombia.* Centro de Investigación para el Manejo Ambiental y el Desarrollo (CIMAD), World Wide Fund for Nature (WWF), International Council on Animal Protection in OECD Programmes (ICAPO). Project supported by a U.S. Fish and Wildlife Service grant; **(C)** Amorocho, D. F. 2008. *Informe del Taller Estandarización de Metodologías en Investigación y Monitoreo para la Conservación de Tortugas Marinas en Colombia.* Ministerio de Ambiente, Vivienda y Desarrollo Territorial–WWF Convention.
Nesting Beaches: **(1)** Blanca–Parque Nacional Natural Gorgona;[A] **(2)** Chaguera;[B] **(3)** Chocó–El Valle;[A] **(4)** La Cuevita;[C] **(5)** Los Mulatos;[A] **(6)** Palmeras–Parque Nacional Natural Gorgona;[A] **(7)** Parque Nacional Natural Sanquianga;[C] **(8)** Termales;[A] **(9)** Tortuguera[B]
Years: **(1, 6)** 2016; **(2, 8–9)** 2015; **(3)** 2018; **(4, 7)** 2007; **(5)** 2017
Counts: **(1)** 45.3 average clutches per year; **(2)** 8 clutches; **(3)** 142.7 average clutches per year; **(4)** 41 clutches; **(5)** 83.6 average clutches per year; **(6)** 45 average clutches per year; **(7)** unquantified; **(8)** 20 clutches; **(9)** 39 clutches
SWOT Contacts: Juan Manuel Rguez-Baron, Diego Amorocho, and Alexander Tobón López

COSTA RICA

DATA RECORD: 13

Data Sources: **(A)** Piedra-Chacón, R., E. Vélez-Carballo, D. Chacón-Chaverri, P. Santidrián-Tomillo, et al. 2020. Costa Rica. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Region: MTSG Annual Regional Report 2020*, pp. 97–141. IUCN-SSC Marine Turtle Specialist Group; **(B)** Fonseca, L. 2021. Personal communication. In *SWOT Report—State of the World’s Sea Turtles*, vol. XVI (2021).
Nesting Beach: Ostional
Years: 2014–2018
Count: 873,979 average clutches per year
SWOT Contact: Luis Fonseca and Alberto Abreau

DATA RECORD: 14

Data Source: Sarti, L. 2009. Personal communication. In *SWOT Report—State of the World’s Sea Turtles*, vol. V (2010).
Nesting Beaches: **(1)** Nosara; **(2)** Punta Banco–Punta Burica; **(3)** Sirena and Corcovado
Years: **(1)** 2009; **(2–3)** 2008
Counts: **(1)** unquantified; **(2)** 213; **(3)** 137 clutches
SWOT Contacts: Alex Gaos, Didiher Chacón Chaverri, and Mariana Malavar Montenegro

DATA RECORD: 15

Data Source: Piedra-Chacón, R., E. Vélez-Carballo, D. Chacón-Chaverri, P. Santidrián-Tomillo, et al. 2020. Costa Rica. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Region: MTSG Annual Regional Report 2020*, pp. 97–141. IUCN-SSC Marine Turtle Specialist Group.
Nesting Beach: Camaronal
Year: 2019
Count: 1,274 clutches
SWOT Contacts: Carlos Mario Orrego Vásquez, Fabricio Alavarez, and Nelson Espinoza

DATA RECORD: 16

Data Source: Ward, M., and C. Elkins. 2015. Sea Turtles Forever. Personal communication. SWOT Database Online 2015.

Nesting Beach: Punta Pargo
Year: 2013
Count: 16 clutches
SWOT Contacts: Chris Elkins and Marc Ward

DATA RECORD: 17
Data Source: COPROT (Comunidad Protectora de Tortugas de Osa). 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Carate; **(2)** Pejeperro; **(3)** Río Oro
Year: 2020
Counts: **(1)** 1,191; **(2)** 2,940; **(3)** 2,439 clutches
SWOT Contact: COPROT

DATA RECORD: 18
Data Sources: **(A)** Rojas, D. Rescue Center for Endangered Marine Species. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(B)** Beange, M., and R. Arauz. 2015. Personal communication. SWOT Database Online 2015; **(C)** Piedra-Chacón, R., E. Vélez-Carballo, D. Chacón-Chaverri, P. Santidrián-Tomillo, et al. 2020. Costa Rica. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Region: MTSG Annual Regional Report 2020*, pp. 97–141. IUCN-SSC Marine Turtle Specialist Group.
Nesting Beaches: **(1)** Bejuco;[A] **(2)** Caletas;[B] **(3)** Corozalito;[A,C] **(4)** Costa de Oro;[A] **(5)** San Miguel[A]
Years: **(1, 4–5)** 2019; **(2)** 2014; **(3)** 2008–2018
Counts: **(1)** 973; **(2)** 1,644; **(3)** 18,000 average clutches per year; **(4)** 384; **(5)** 314 clutches
SWOT Contacts: Daniela Rojas, Maddie Beange, and Randall Arauz

DATA RECORD: 19
Data Sources: **(A)** Solano, R., and Asociación de Voluntarios para el Servicio en las Areas Protegidas. 2015. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. X (2015); **(B)** Sánchez, F. A., D. Melero, P. A. Smith, M. Bigler, et al. 2007. *Proyecto de Protección Conservación y Recuperación de Poblaciones de Tortuga Marina en Playa Drake, Peninsula de Osa–Costa Rica.* Reporte Técnico Temporada 2006, Corcovado Foundation, San José, Costa Rica; **(C)** Piedra-Chacón, R., E. Vélez-Carballo, D. Chacón-Chaverri, P. Santidrián-Tomillo, et al. 2020. Costa Rica. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Region: MTSG Annual Regional Report 2020*, pp. 97–141. IUCN-SSC Marine Turtle Specialist Group; **(D)** Conejo Salas, K., and K. Wesenberg. 2008. *Monitoreo de la Dinámica de Anidación y Manejo de Nidadas Tortugas Marinas en Playa Matapalo Pacífico de Costa Rica: Temporada 2007–2008*; **(E)** Fonseca, L. G. 2015. Personal communication. SWOT Database Online 2015.
Nesting Beaches: **(1)** Buenavista;[A] **(2)** Drake;[B] **(3)** Hermosa;[C] **(4)** Matapalo–Puntarenas;[D] **(5)** Nancite;[C] **(6)** Naranjo;[E] **(7)** Punta Mala[A]
Years: **(1–2)** 2006; **(3)** 2002–2011; **(4, 7)** 2007; **(5)** 2014–2018; **(6)** 2014
Counts: **(1)** 332 clutches; **(2)** 103 clutches; **(3)** 1,424 average clutches per year; **(4)** 5 clutches; **(5)** 81,445 average clutches per year; **(6)** 250 clutches; **(7)** 759 clutches
SWOT Contacts: Luis Gabriel Fonseca López, Francisco Delgado, and Roberto Solano

DATA RECORD: 20
Data Source: Paladino, F. 2014. Sea turtle nesting at Playa Grande, Costa Rica. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. X (2015).
Nesting Beach: Playa Grande–Playa Ventanas
Years: 2013
Counts: 138 clutches
SWOT Contact: Frank Paladino

DATA RECORD: 21
Data Source: Francia, G. 2014. *Proyecto de Conservación de Tortugas Marinas de Junquilla.* Asociación Vida Verdiazul.
Nesting Beach: Junquillal
Years: 2013
Counts: 253 clutches
SWOT Contact: Gabriel Francia

DATA RECORD: 22
Data Source: Saborio, G., and M. Sánchez. 2013. Unpublished data. Sea Turtle Conservation Project, Osa Conservation Costa Rica.
Nesting Beaches: **(1)** Pejeperro; **(2)** Piro
Years: **(1)** 2011; **(2)** 2012
Counts: **(1)** 697; **(2)** 13 clutches
SWOT Contacts: Guido Saborio, Hansel Herrera, and Jim Palmer

DATA RECORD: 23
Data Source: Brenes Arias, O. 2021. Reserva playa tortuga. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Playa Hermosa de Uvita; **(2)** Playa Tortuga
Year: 2020
Counts: **(1)** 73; **(2)** 62 clutches
SWOT Contacts: Oscar Brenes Arias and Graciela Pulido Petit

DATA RECORD: 24
Data Source: Santidrián-Tomillo, P. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beach: Cabuyal
Year: 2019
Count: 86 clutches
SWOT Contact: Pilar Santidrián-Tomillo

DATA RECORD: 25
Data Source: Mills, R. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beach: Playa Tambor
Year: 2020
Count: 64 clutches
SWOT Contact: Ron Mills

DATA RECORD: 26
Data Source: Piedra-Chacón, R., E. Vélez-Carballo, D. Chacón-Chaverri, P. Santidrián-Tomillo, et al. 2020. Costa Rica. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Region: MTSG Annual Regional Report 2020*, pp. 97–141. IUCN-SSC Marine Turtle Specialist Group.
Nesting Beaches: **(1)** Coquito; **(2)** Coyotera; **(3)** El Jobo; **(4)** Rajada; **(5)** Rajadita
Years: **(1–2)** 2017; **(3–5)** 2016–2018
Counts: **(1)** 46 clutches; **(2)** 78 clutches; **(3)** 18 average clutches per year; **(4)** 30 average clutches per year; **(5)** 16 average clutches per year

CÔTE D'IVOIRE

DATA RECORD: 27
Data Sources: **(A)** Fretey, J. 1999. Repartition des tortues du genre *Lepidochelys Fitzinger*, 1843. I. L'Atlantique ouest. *Biogeographica* 75 (3): 97–117; **(B)** Penate, J. G. 2017. Sea turtle nesting in Cote d'Ivoire. Personal communication. In *SWOT Report State of the World's Sea Turtles*, vol. XII (2017); **(C)** Gómez, J. 2012. Personal communication. In SWOT Online Database 2012; **(D)** Gomez, J., B. Sory, and K. Mamadou. 2003. A preliminary survey of sea turtles in the Ivory Coast. In J. A. Seminoff (ed.) *Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation.* Miami, FL: National Marine Fisheries Service; **(E)** Gómez, J., and A. Dah. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Dagbego;[A] **(2)** Mani;[B] **(3)** Many–Dodo;[A] **(4)** Mondoukou;[C] **(5)** Monogaga;[A] **(6)** Pitike;[D] **(7)** Pointe Poor;[E] **(8)** Soublake[D]
Years: **(1, 3, 5)** 1999; **(2)** 2015; **(4)** 2010; **(6, 8)** 2001 **(7)** 2019
Counts: **(1, 3, 5)** unquantified; **(2)** 504; **(4)** 32; **(6)** 72; **(7)** 587; **(8)** 50 clutches
SWOT Contact: Jose Gómez Peñate

CONGO, REPUBLIC OF THE

DATA RECORD: 28
Data Sources: **(A)** Bréheret, N. G., and A. Girard. 2008. *Renatura: Rapport d'Activité du Programme d'Étude et de Sauvegarde des Tortues Marines au Congo, Saison 2007–2008*; **(B)** Bréheret, N. G., and J.-G. Mavoungou. 2017. Renatura Congo. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XII (2017); **(C)** Bal, G., N. G. Bréheret, and H. Vanleeuwe. 2007. An update on sea turtle conservation activities in the Republic of Congo. *Marine Turtle Newsletter* 116: 9–10; **(D)** Bitsindou, A. 2006. *Rapport d'Activité: WCS Volet Recherches Écologiques—Recensement des Tortues Marines au Parc National de Conkouati-Douli, Saison 2005–2006.*
Nesting Beaches: **(1)** Congolese Coast;[A] **(2)** Bas–Kouilou Sud;[B] **(3)** Bas–Kouilou Nord;[B] **(4)** Bellelo;[B] **(5)** Bellelo–Longo–Bondy;[B] **(6)** Cabinda Frontie;[B] **(7)** Conkouati Lagoon;[C,D] **(8)** Djeno;[B] **(9)** Mvassa;[B] **(10)** Nkounda;[B] **(11)** Pointe-Noire;[B] **(12)** Tchissaou[A]
Years: **(1, 7)** 2005; **(2–6, 8–11)** 2016; **(12)** 2007
Counts: **(1)** 2,088; **(2)** 4; **(3)** 45; **(4)** 40; **(5)** 21; **(6)** 14; **(7)** 302; **(8)** 107; **(9)** 179; **(10)** 54; **(11)** 66; **(12)** 41 clutches
SWOT Contacts: Alexandre Girard, Nathalie Bréheret, and Jean-Gabriel Mavoungou

DEMOCRATIC REPUBLIC OF THE CONGO

DATA RECORD: 29
Data Source: Mbungu, S., C. Collet, A. Girard, and M. Girondot. 2013. *Nesting Report ACODES* (2012). Actions Collectives pour le Développement Social.
Nesting Beaches: **(1)** Banana; **(2)** Nsiamfumu; **(3)** Tonde
Year: 2013
Counts: **(1)** 48; **(2)** 19; **(3)** 39 clutches
SWOT Contact: Samuel Mbungu Ndamba

ECUADOR

DATA RECORD: 30
Data Sources: **(A)** Baquero, A., J. P. Muñoz, and M. Peña. 2009. Personal communication via Equilibrio Azul. In *SWOT Report—State of the World's Sea Turtles*, vol. V (2010); **(B)** Miranda, C. 2020. Ecuador. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Region: MTSG Annual Regional Report 2020*, pp. 185–231. IUCN-SSC Marine Turtle Specialist Group, 2020; **(C)** Herrera, M., D. Coello, and C. Flores. 2009. *Notas Preliminares: Cabo San Lorenzo y Su Importancia como Área de Reproducción de Tortugas Marinas en el Ecuador.* Instituto Nacional de Pesca, Ministerio de Agricultura, Ganadería, Acuacultura y Pesca; **(D)** Ponce, L. 2014. Resultados del segundo periodo anual de monitoreo de tortugas marinas en el Refugio de Vida Silvestre y Marino Costera Pacoche y su zona de influencia Manta-Manabi, Ecuador, Junio de 2013–Marzo 2014. In *Ecuador Annual Report 2014*, Inter-American Convention for the Protection and Conservation of Sea Turtles; **(E)** Miranda, C. 2015. Equilibrio Azul Sea Turtle Monitoring Project–Ecuador. Unpublished data.
Nesting Beaches: **(1)** Bahia Drake–Isla de la Plata;[A] **(2)** Caimito;[B] **(3)** Canoa;[B] **(4)** Crucita;[B] **(5)** El Abra;[C] **(6)** Estero de Platano;[B] **(7)** Galera;[B] **(8)** Galerita;[B] **(9)** La Botada;[D] **(10)** La Diablica;[B] **(11)** La Playita;[E] **(12)** Las Palmas;[B] **(13)** Las Piñas;[C] **(14)** Las Tunas;[B] **(15)** Ligüiqui;[B] **(16)** Mar Bravo;[B] **(17)** Mompiche;[A] **(18)** Montañita;[B] **(19)** Murciélago;[B] **(20)** Olón;[B] **(21)** Playa Bruja;[B] **(22)** Playa de Palmar;[B] **(23)** Playa de Valdivia;[B] **(24)** Playa Dorada;[B] **(25)** Playa Escondida;[B] **(26)** Playa Rosada–Playa Chipi-Chipi;[B] **(27)** Portete;[E] **(28)** Puerto López;[E] **(29)** Punta Brava;[B] **(30)** Punta Carnero;[B] **(31)** Quingüe;[B] **(32)** Río Caña;[B] **(33)** Same;[A] **(34)** San José;[B] **(35)** San Lorenzo;[D] **(36)** Santa Marianita;[B] **(37)** Tres Cruces[B]
Years: **(1, 17)** 2008; **(2, 3, 6, 25)** 2015; **(4, 7, 12, 15, 36)** 2016–2017; **(5, 13)** 2007; **(8, 19, 21, 23)** 2015–2017; **(9–10, 30, 35)** 2013; **(11, 27–28)** 2014; **(14, 24)** 2014–2016; **(16, 29, 37)** 2013–2014, 2017; **(18, 20, 22, 26, 34)** 2017; **(31)** 2015, 2017; **(32)** 2016; **(33)** 2009
Counts: **(1)** 1 clutch; **(2)** 2 clutches; **(3)** 1 clutch; **(4)** 15 average clutches per year; **(5)** 1 clutch; **(6)** 1 clutch; **(7)** 2.5 average clutches per year; **(8)** 28.7 average clutches per year; **(9)** 64 clutches; **(10)** 1 clutch; **(11)** 1 clutch; **(12)** 88.5 average clutches per year; **(13)** 1 clutch; **(14)** 15.25 average clutches per year; **(15)** 5 average clutches per year; **(16)** 26.3 average clutches per year; **(17)** 2 clutches; **(18)** 2 clutches; **(19)** 2 average clutches per year; **(20)** 1 clutch; **(21)** 4.7 average clutches per year; **(22)** 1 clutch; **(23)** 3.3 average clutches per year; **(24)** 4 average clutches per year; **(25)** 1 clutch; **(26)** 1 clutch; **(27)** 69 clutches; **(28)** 2 clutches; **(29)** 7.6 average clutches per year; **(30)** 2 clutches; **(31)** 13.5 average clutches per year; **(32)** 1 clutch; **(33)** 1 clutch; **(34)** 7 clutches; **(35)** 87 clutches; **(36)** 15 average clutches per year; **(37)** 8.3 average clutches per year
SWOT Contacts: Andres Baquero, Dialhy Coello, Marco Herrera, Cristina Miranda, and Felipe Vallejo

EL SALVADOR

DATA RECORD: 31
Data Sources: (A) Liles, M., M. Vásquez, W. López, G. Mariona, et al. 2009. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. V (2010); (B) Liles, M., A. Enríquez, and F. Medina. 2020. El Salvador. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Region: MTSG Annual Regional Report*, pp. 61–80. IUCN-SSC Marine Turtle Specialist Group.
Nesting Beaches: **(1)** Ahuachapan;[A] **(2)** Amatecampo;[B] **(3)** Área Natural Protegida (ANP) Barra de Santiago;[B] **(4)** ANP Los Cóbanos;[B] **(5)** Barra Ciega;[B] **(6)** Bola de Monte;[B] **(7)** Ceiba Doblada;[B] **(8)** Corral de Mulas;[B] **(9)** Costa del Sol;[B] **(10)** El Amatal;[B] **(11)** El Espino;[B] **(12)** El Icacal;[B] **(13)** El Icaco;[B] **(14)** El Majahual (Isla Meanguera);[B] **(15)** El Pimental;[B] **(16)** El Tamarindo;[B] **(17)** Garita Palmera;[B] **(18)** Isla de Méndez;[B] **(19)** Isla Montecristo;[B] **(20)** Isla San Sebastián;[B] **(21)** Isla Tasajera;[B] **(22)** La Libertad;[A] **(23)** La Paz;[A] **(24)** La Unión;[A] **(25)** La Zunganera;[B] **(26)** Las Bocanitas;[B] **(27)** Los Pinos–Cangrejera;[B] **(28)** Metalío;[B] **(29)** Playa Dorada;[B] **(30)** Punta Amapala;[B] **(31)** Punta San Juan;[B] **(32)** Salamar;[B] **(33)** San Blas;[B] **(34)** San Diego;[B] **(35)** San Juan del Gozo;[B] **(36)** San Marcelino–Las Hojas;[B] **(37)** San Vincente;[A] **(38)** Sonsonate;[A] **(39)** Toluca;[B] **(40)** Usulután[A]
Years: **(1, 22–24, 37–38, 40)** 2007; **(2–8, 15, 17–18, 25–27, 32, 35, 39)** 2009, 2012; **(9, 19)** 2009, 2011–2016; **(10–12, 20–21, 29, 33–34)** 2009, 2012, 2016; **(13)** 2009, 2011; **(14)** 2009, 2016; **(16)** 2009–2010, 2012–2016; **(28)** 2012; **(30)** 2012, 2016; **(31)** 2011; **(36)** 2016
Counts: **(1)** 988; **(2)** 405; **(3)** 418.5; **(4)** 1,255; **(5)** 197.5; **(6)** 370.5; **(7)** 282.5; **(8)** 471; **(9)** 673.7; **(10)** 339; **(11)** 241.7; **(12)** 137; **(13)** 484.5; **(14)** 49; **(15)** 520.5; **(16)** 61.4; **(17)** 230.5; **(18)** 723.5; **(19)** 777.7; **(20)** 684; **(21)** 1,036; **(22)** 1,072; **(23)** 653; **(24)** 166; **(25)** 382; **(26)** 416.5; **(27)** 771.5; **(28)** 405; **(29)** 750.7; **(30)** 170.5; **(31)** 227; **(32)** 92.5; **(33)** 144; **(34)** 1,381.3; **(35)** 743; **(36)** 360; **(37)** 280; **(38)** 1,873; **(39)** 823.5; **(40)** 1,376 average clutches per year
SWOT Contacts: Georgina Mariona, Johanna Segovia, Mauricio Vásquez, Michael Liles, and Wilfredo López

EQUATORIAL GUINEA

DATA RECORD: 32
Data Source: Fallabrino, A., and TOMAGE. 2016. Sea turtle nesting in Equatorial Guinea. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XII (2017).
Nesting Beaches: **(1)** Ilende; **(2)** Nendyi; **(3)** Tika
Years: **(1, 3)** 2015; **(2)** 2010
Counts: **(1)** 63; **(2)** 13; **(3)** 13 clutches
SWOT Contact: Alejandro Fallabrino

DATA RECORD: 33
Data Source: Honarvar, S., D. B. Fitzgerald, C. L. Weitzman, E. M. Sinclair, et al. 2016. Assessment of important marine turtle nesting populations on the southern coast of Bioko Island, Equatorial Guinea. *Chelonian Conservation and Biology* 15 (1): 79–89.
Nesting Beaches: Gran Caldera–Southern Highlands Scientific Reserve: **(1)** Beach A; **(2)** Beach B; **(3)** Beach C; **(4)** Beach D; **(5)** Beach E
Year: 2013
Counts: **(1)** 20; **(2)** 19; **(3)** 70; **(4)** 41; **(5)** 26 clutches
SWOT Contact: Shaya Honarvar

DATA RECORD: 34
Data Sources: **(A)** Tomás, J., J. Castroviejo, and J. A. Raga. 1999. Sea turtles in the South of Bioko Island (Equatorial Guinea). *Marine Turtle Newsletter* 84: 4–6; **(B)** Formia, A. 1999. Les tortues marines de la baie de Corisco. *Canopée* 14: i–ii; **(C)** Fretey, J. 2001. Biogeography and conservation of marine turtles of the Atlantic Coast of Africa. *CMS Technical Series*, No. 6, United Nations Environment Program, Convention on Migratory Species Secretariat, Bonn, Germany; **(D)** Tomás, J., B. J. Godley, J. Castroviejo, and J. A. Raga. 2010. Bioko: Critically important nesting habitat for sea turtles of West Africa. *Biodiversity and Conservation* 19: 2699–2714.
Nesting Beaches: **(1)** beaches between Punta Oscura and Punta Santiago;[A] **(2)** northern beaches of Cabo San Juan;[B] **(3)** Corisco Island;[C] **(4)** Gran Caldera–Southern Highlands Scientific Reserve[D]
Years: **(1)** 2006; **(2)** 1999; **(3)** 2001; **(4)** 1997
Counts: **(1)** 150; **(2–3)** unquantified; **(4)** 22 clutches

FRENCH GUIANA

DATA RECORD: 35
Data Sources: **(A)** Dow, W. E., and K. L. Eckert. 2007. *Sea Turtle Nesting Habitat: A Spatial Database for the Wider Caribbean Region.* WIDECAST Technical Report No. 6, Wider Caribbean Sea Turtle Conservation Network (WIDECAST) and the Nature Conservancy, Beaufort, NC; **(B)** Chevalier, J. 2014. Reserve Naturelle Nationale de l'Amana. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XI (2016).
Nesting Beaches: **(1)** Pointe Isère: Farez, Irakumpapi, Organabo;[A] **(2)** Rizières[B]
Years: **(1)** 2006; (2) 2014
Counts: **(1)** 555; **(2)** 24 clutches
SWOT Contacts: Amana Nature Reserve, Laurent Kelle, Alexandre Habert, Johan Chevalier, and Rachel Berzins

DATA RECORD: 36
Data Source: de Thoisy, B., and V. Dos Reis. 2021. Kwata NGO. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beach: Rémire-Montjoly
Year: 2019
Count: 2,009 clutches
SWOT Contacts: Benoît de Thoisy and Virginie Dos Reis

DATA RECORD: 37
Data Sources: **(A)** Hervé, P., M. Lasfargue, N. Paranthoën, A. Sacchettini, B. de Thoisy, R. Crasson, D. Chevallier, and R. Wongsopawiro. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(B)** Entraygues, M. 2014. Plan National d'Actions en Faveur des Tortues Marines en Guyane; Partie II: Plan d'Actions. Office National de la Chasse et de la Faune Sauvage.
Nesting Beaches: **(1)** Awala Yalimapo;[A,B] **(2)** Azteque;[A,B] **(3)** Île de Cayenne;[A,B] **(4)** Kourou[A,B]
Years: **(1–2, 4)** 2016; **(3)** 2019
Counts: **(1)** 8; **(2)** 86; **(3)** 1,177; **(4)** 22 clutches
SWOT Contact: Mathilde Lasfargue

GABON

DATA RECORD: 38
Data Source: **(A)** Mounguéngui, G.-A., and B. Verhage. 2007. *Update after Five Years of Marine Turtle Monitoring in Gamba, Gabon (2002–2007).* Ibonga ACPE Technical Report; **(B)** Mounguéngui, G.-A., and B. Verhage. 2008. Activites de recherche et de suivi des tortues marines sur les plages de Gamba au Gabon. Rapport technique final, Ibonga ACPE.
Nesting Beach: Pont Dick
Year: 2007
Count: 46 clutches
SWOT Contacts: Aimee Leslie and Bas Verhage

DATA RECORD: 39
Data Source: Frost, L., T. Harper, O. James, and M. C. Paiz. 2021. Nesting Data, Season 2020–2021. Projet Tortues Tahiti, Libreville, Gabon.
Nesting Beach: Tahiti Beach
Year: 2020
Count: 190 clutches
SWOT Contacts: Marie-Claire Paiz, Laura Frost, Tim Harper, and Projet Tortues Tahiti

DATA RECORD: 40
Data Sources: **(A)** Metcalfe, K., P. D. Agamboue,

E. Augowet, F. Boussamba, et al. 2015. Going the extra mile: Ground-based monitoring of olive ridley turtles reveals Gabon hosts the largest rookery in the Atlantic. *Biological Conservation* 190: 14–22; **(B)** Moundemba, J.-B. 1999. As cited in Fretey, J. 2001. Biogeography and conservation of marine turtles of the Atlantic Coast of Africa. *CMS Technical Series*, No. 6, United Nations Environment Program, Convention on Migratory Species Secretariat, Bonn, Germany; **(C)** Girard, A., M. C. Godgenger, A. Gibudi, J. Fretey, et al. 2016. Marine turtles nesting activity assessment and trend along the Central African Atlantic coast for the period of 1999–2008. *International Journal of Marine Science and Ocean Technology* 3 (3): 21–32; **(D)** Formia, A. 1999. Les tortues marines de la baie de Corisco. Canopée 14: i–ii.
Nesting Beaches: (1) Bame–Mayumba National Park;[A] **(2)** Banio Lagoon;[B] **(3)** Gamba;[C] **(4)** Hoco Island;[D] **(5)** Mayumba;[C] **(6)** Mbanye Island;[D] **(7)** Nyafessa–Mayumba National Park;[A] **(8)** Pointe Denis[A]; **(9)** Pongara[C]; **(10)** Sette Cama Reserve[A]
Years: (1, 7–8, 10) 2012; **(2, 4 ,6)** 1999; **(3, 5, 9)** 2006
Counts: (1) 126; **(2, 4, 6)** unquantified; **(3)** 155; **(5)** 2,500; **(7)** 526; **(8)** 101; **(9)** 72; **(10)** 60 clutches
SWOT Contact: Samuel Mbungu Ndamba

DATA RECORD: 41
Data Source: Agyekumhene, A., and P. Allman. 2016. Sea turtle nesting in Ghana. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XII (2017).
Nesting Beaches: (1) Warabeba; **(2)** Winneba
Years: (1) 2011; **(2)** 2015
Counts: (1) 10; **(2)** 84 clutches
SWOT Contact: Andrews Agyekumhene

DATA RECORD: 42
Data Source: Fretey, J. 2001. Biogeography and conservation of marine turtles of the Atlantic Coast of Africa. *CMS Technical Series*, No. 6, United National Environment Program, Convention on Migratory Species Secretariat, Bonn, Germany.
Nesting Beaches: (1) Ada-Foah; **(2)** Keta-Anloga; **(3)** Ningo-Prampram
Year: 2001
Counts: (1–3) unquantified clutches

GUATEMALA
DATA RECORD: 43
Data Source: Muccio, C. 2013. Personal communication. In SWOT Database Online 2013.
Nesting Beach: Chiquimulilla–Santa Rosa
Year: 2012
Count: 1,890 clutches
SWOT Contact: Colum Muccio

GUINEA-BISSAU
DATA RECORD: 44
Data Source: Institute of Biodiversity and Protected Areas of Guinea-Bissau. 2015. Personal communication. SWOT Database Online 2015.
Nesting Beach: Orango National Park
Year: 2013
Count: 55 clutches
SWOT Contact: Aissa Regalla and M. Betania Ferreira Airaud

GUYANA
DATA RECORD: 45
Data Source: Guyana Marine Turtle Conservation Society and World Wide Fund for Nature–Guianas. 2015. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XI (2011).
Nesting Beaches: Shell Beach–Almond Beach
Year: 2015
Count: 3 clutches
SWOT Contacts: Claudine Sakimin, Romeo de Freitas, Suresh Kandaswamy, Sopheia Edghill, Catharina Bilo, and Michael Hiwat

HONDURAS
DATA RECORD: 46
Data Sources: (A) Dunbar, S. G., and L. Salinas. 2008. Activities of the Protective Turtle Ecology Center for Training, Outreach, and Research (ProTECTOR) on olive ridley (*Lepidochelys olivacea*) in Punta Raton, Honduras. *Annual Report of the 2007–2008 Nesting Seasons*; **(B)** Dunbar, S. G., L. Salinas, and S. Castellanos. 2010. Activities of the Protective Turtle Ecology Center for Training, Outreach, and Research (ProTECTOR) on olive ridley (*Lepidochelys olivacea*) in Punta Raton, Honduras. *Annual Report of the 2008–2009 Nesting Seasons*; **(C)** Dunbar, S. G., L. Salinas, and S. Castellanos. 2011. Activities of the Protective Turtle Ecology Center for Training, Outreach, and Research (ProTECTOR) on olive ridley (*Lepidochelys olivacea*) in the Gulf of Fonseca, Honduras. *Annual Report of the 2009–2010 Nesting Season*; **(D)** Dunbar, S. G. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: (1) Buquete;[A,B] **(2)** Camprirana;[C] **(3)** Condega;[D] **(4)** Del Muerto;[A,B] **(5)** Don Walther;[B] **(6)** El Banquito;[C] **(7)** El Muerto;[B] **(8)** El Muro;[C] **(9)** El Patio;[A,B] **(10)** El Tiburón;[B] **(11)** La Cooperativa;[B] **(12)** La Dorada;[D] **(13)** La Playa;[A,B] **(14)** La Playa North;[A,B] **(15)** La Playa South;[A,B] **(16)** La Punta;[A,B] **(17)** La Punta–La Puntilla;[C] **(18)** La Vuelta;[C] **(19)** Palo Pique;[B] **(20)** Primer Punta[C]
Years: (1, 4, 9) 2007; **(2, 6, 8, 17–18, 20)** 2010; **(3)** 2012; **(5, 7, 10–11, 16, 19)** 2009; **(12)** 2013; **(13–15)** 2008
Counts: (1) 3; **(2)** 2; **(3)** 14; **(4)** 3; **(5)** 3; **(6)** 4; **(7)** 3; **(8)** 5; **(9)** 6; **(10)** 3; **(11)** 3; **(12)** 21; **(13)** 6; **(14)** 9; **(15)** 3; **(16)** 66; **(17)** 84; **(18)** 2; **(19)** 3; **(20)** 1 clutches
SWOT Contact: Stephen Dunbar

INDIA
DATA RECORD: 47
Data Source: Petchiappan, A., M. Manoharakrishnan, and K. Shanker. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: (1–59) beaches along the East Coast of India; **(60)** Gahirmatha; (61) Rushikulya; **(62)** Devi
Years: (1–59) 2020 **(60–62)** 2000–2020
Counts: (1–59) 10–100 clutches; **(60–62)** 100,000–400,000 average clutches per year
SWOT Contact: Kartik Shanker, Muralidharan Manoharakrishnan

DATA RECORD: 48
Data Source: Petchiappan, A., M. Manoharakrishnan, and K. Shanker. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: (1–48) beaches along the West Coast of India
Year: 2020
Counts: (1–48) 1–10 clutches
SWOT Contact: Muralidharan Manoharakrishnan

DATA RECORD: 49
Data Source: Petchiappan, A., M. Manoharakrishnan, and K. Shanker. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: (1–5) beaches on Nicobar Islands
Year: 2020
Counts: (1–5) 10–100 clutches
SWOT Contact: Muralidharan Manoharakrishnan

DATA RECORD: 50
Data Source: Petchiappan, A., M. Manoharakrishnan, and K. Shanker. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beach: Laccadive Islands
Year: 2020
Count: 1–10 clutches
SWOT Contact: Muralidharan Manoharakrishnan

DATA RECORD: 51
Data Sources: (A) Andrews, H., S. Krishnan, and P. Biswas. 2006. The status and distribution of marine turtles around the Andaman and Nicobar Archipelago. In K. Shanker and B. C. Choudhury (eds.), *Marine Turtles of the Indian Subcontinent*, pp. 33–57. Hyderabad, India: Universities Press; **(B)** Bhaskar, S. 1993. *The Status and Ecology of Sea Turtles in the Andaman and Nicobar Islands*. Publication ST 1/93, Centre for Herpetology and Madras Crocodile Bank Trust, Tamil Nadu, India; **(C)** Bhupathy, S., and S. Saravanan. 2006. Marine turtles of Tamil Nadu. In K. Shanker and B. C. Choudhury (eds.), *Marine Turtles of the Indian Subcontinent*, pp. 58–67. Hyderabad, India: Universities Press; **(D)** Choudhury, B. C., S. K. Das, and P. S. Ghose. 2006. Marine turtles of West Bengal. In K. Shanker and B. C. Choudhury (eds.), *Marine Turtles of the Indian Subcontinent*, 107–116. Hyderabad, India: Universities Press; **(E)** Giri, V. 2006. Sea turtles of Maharashtra and Goa. In K. Shanker and B. C. Choudhury (eds.), *Marine Turtles of the Indian Subcontinent*, pp. 147–155. Hyderabad, India: Universities Press; **(F)** Namboothri, N., A. Swaminathan, and K. Shanker. 2015. Olive ridley mass-nesting at Cuthbert Bay Wildlife Sanctuary, Middle Andaman Island. *Indian Ocean Turtle Newsletter* 21: 7–9; **(G)** Salm, R. V. 1976. Critical marine habitats of the northern Indian Ocean. Contract report to the IUCN, Morges, Switzerland; **(H)** Shanker, K. and B. C. Choudhury (eds.). 2006. *Marine turtles of the Indian subcontinent*. Hyderabad, India: Universities Press; **(I)** Shanker, K., J. Ramadevi, B. C. Choudhury, L. Singh, et al. 2004. Phylogeography of olive ridley turtles (*Lepidochelys olivacea*) on the East Coast of India: Implications for conservation theory. *Molecular Ecology* 13: 1899–1909; **(J)** Sharath, B. K. 2006. Sea turtles along the Karnataka coast. In K. Shanker and B. C. Choudhury (eds.), *Marine Turtles of the Indian Subcontinent*, pp. 141–146. Hyderabad, India: Universities Press; **(K)** Sunderraj, S. F. W., J. Joshua, and V. V. Kumar. 2006. Sea turtles and their nesting habitats in Gujarat. In K. Shanker and B. C. Choudhury (eds.), *Marine Turtles of the Indian Subcontinent*, pp. 156–169. Hyderabad, India: *Universities Press*; **(L)** Tripathy, B., K. Shanker, and B. C. Choudhury. 2003. Important nesting habitats of olive ridley turtles *Lepidochelys olivacea* along the Andhra Pradesh coast of eastern India. *Oryx* 37 (4): 454–463.
Nesting Beaches: (1) Achara–Sindhudurg;[E] **(2)** Adri–Navapara–Junagadh;[K] **(3)** Agatti Island;[L] **(4)** Agonda;[E] **(5)** Ambolgad–Ratnagrigiri;[E] **(6)** Amindivi Group;[L] **(7)** Amreli;[K] **(8)** Andrott Island;[L] **(9)** Anjunem;[E] **(10)** Bada–Layja Nana–Kachchh;[K] **(11)** Baidher Island–Jamnagar;[K] **(12)** Bambhdai–Bada–Kachchh;[K] **(13)** Betul;[E] **(14)** Bhavnagar;[K] **(15)** Bijeara–Sunderban Biosphere Reserve;[D] **(16)** Bogmalo;[E] **(17)** Calanguite;[E] **(18)** Chaimari;[D] **(19)** Chennai–Madras;[I] **(20)** Cuthbert Bay;[F] **(21)** Dahanu–Thane;[E] **(22–36)** beaches of Dakshina Kannada District;[J] **(37)** Digha and Dadanpatrabar– Medinipore;[D] **(38)** East Coast–Great Nicobar Island;[A,B] **(39)** Galathea Beach–Great Nicobar Island;[H] **(40)** Galgibaga;[H] **(41)** Gundilai–Tragadi–Kachchh;[K] **(42)** Jambudwip;[D] **(43)** Kadmat Island;[L] **(44)** Kalash;[D] **(45)** Kalingapatnam;[L] **(46)** Kalpeni Island;[L] **(47)** Kalpitti Islet;[L] **(48)** Kamond–Suthri–Kachchh;[K] **(49)** Kanniyakumari–Tiruchendur;[C] **(50)** Kasarakod;[H] **(51)** Kashid–Raigad;[E] **(52)** Kavaratti Island;[L] **(53)** Kerim;[E] **(54)** Kharakhetar–Kuranga–Jamnagar;[K] **(55)** Kovalum;[G] **(56)** Kozhikode;[H] **(57)** Laccadive Group;[L] **(58)** Lamba–Jamnagar;[K] **(59)** Lamba–Miyani–Jamnagar;[K] **(60)** Layja Nana–Mandvi–Kachchh;[K] **(61)** Malvan–Sindhudurg;[E] **(62)** Mamallapuram–Pondi;[I] **(63)** Mangrol–Bada Junagadh;[K] **(64)** Mechua;[D] **(65)** Mojap–Sivrajpur–Jamnagar;[K] **(66)** Morjim;[E] **(67)** Mumbai;[E] **(68)** Nagapattinam;[I] **(69)** Navodra–Lamba–Jamnagar;[K] **(70)** Neevati–Sindhudurg;[E] **(71)** North Hut Bay–Little Andaman Island;[A,B] **(72)** Northeastern Coast–Teressa Island;[A,B] **(73)** Paikat Bay–Middle Andaman Island;[A,B] **(74)** Palghar;[E] **(75)** Porbandhar;[H] **(76)** Rahij–Maktupur–Junagadh;[K] **(77)** Ram Nagar Beach–North Andaman Island;[H] **(78)** Rameswaram;[C] **(79)** Ratnagiri–Ratnagiri;[E] **(80)** Redi–Sindhudurg;[E] **(81)** Rutland Island;[H] **(82)** Shill–Lohej–Junagadh;[K] **(83)** Shiroda–Araval–Sindhudurg;[E] **(84)** Smith Island;[A,B] **(85)** Southern Bay–Katchal Island;[L] **(86)** Srikakulam;[L] **(87)** Srikurmam;[L] **(88)** Srivardhan–Raigad;[E] **(89)** Suheli Cheriyakara–Laccadive Island Group;[L] **(90)** Tiruchendur to Mandapam;[C] **(91)** Tranquebar–Pazhaiyar;[C] **(92–97)** beaches of Utarra Kannada District;[J] **(98)** Utorda;[E] **(99)** Velas;[H] **(100)** Velneshwar–Ratnagiri;[E] **(101)** Velye–Ratnagiri;[E] **(102)** Western Coast–Great Nicobar Island;[A,B] **(103)** Dagma River–Great Nicobar Island[A,B]
Years: (1–2, 4–5, 7, 9–14, 16–17, 19, 21–37, 39, 41, 48–49, 51, 53–54, 58–63, 65–70, 74, 76, 78–80, 82–83, 88, 90–98, 100–101) 2000; **(3, 6, 8, 15, 18, 42–47, 52, 57, 64, 86–87, 89)** 2001; **(20)** 2014; **(38, 102)** 1995; **(40, 99)** 2004; **(50, 56, 75)** 2006; **(55)** 1976; **(71–72, 84–85)** 1993; **(73)** 1984; **(77, 81)** 2003; **(103)** 1994
Counts: (1, 5, 9, 13, 16–17, 21–36, 38, 51, 53, 55, 61, 66–67, 70–74, 79–80, 83–85, 88, 92–98, 100–101) unquantified; **(2, 58)** 5; **(3)** 16; **(4)** 94; **(6)** 13; **(7, 52)** 3; **(8, 43, 46, 63, 81)** 6; **(10)** 21; **(11)** 33; **(12, 14)** 7; **(15)** 15; **(18)** 123; **(19)** 54; **(20)** 5,500; **(37)** 106; **(39)** 255; **(40, 99)** 14; **(41) 4; (42)** 24; **(44, 54)** 10; **(45)** 570; **(47, 89)** 48; **(48, 59, 65, 69)** 2; **(49)** 210; **(50)** 30; **(56)** 18; **(57)** 150; **(60)** 22; **(62)** 600; **(64)** 13; **(68)** 1,080; **(75)** 143; **(76)** 8; **(77)** 203; **(78)** 11; **(82, 90)** 1; **(86)** 283; **(87)** 264; **(91)** 18; **(102)** 163; **(103)** 57 clutches

INDONESIA
DATA RECORD: 52
Data Sources: (A) Profil Taman Pesisir Jeen Womom Kabupaten Tambrauw. 2019. Loka Pengelolaan Sumberdaya Pesisir dan Laut Sorong, Direktorat Jendral Pengelolaan Ruang Laut Kementerian Kelautan dan Perikanan Indonesia; **(B)** Erdmann, M., and R. F. Tapilatu. 2019. Mapia Atoll: The next jewel in the BHS MPA network? Bird's Head Seascape; **(C)** Tapilatu, R. F., H. Wona, P. P. Batubara. 2017. Status of sea turtle populations and its conservation at Bird's Head Seascape, Western Papua, Indonesia. *Biodiversitas* 18: 129–136; **(D)** Tapilatu, R. F. 2017. The evaluation of nest relocation method as a conservation strategy for saving sea turtle populations in the North Coast of Manokwari–Papua Barat Province–Indonesia. *Ecology, Environment and Conservation* 23 (4s): 24–33; **(E)** Setiawan, E. B., P. Boli, and R. F. Tapilatu. 2021. Studi potensi ekowisata sebagai upaya pelestarian penyu. *Musamus Fisheries and Marine Journal* (status under review); **(F)** Sembor, E. N, R. F. Tapilatu, V. Sabariah. 2020. Profil suhu pantai peneluran Sidey: Implikasi estimasi jenis kelamin tukik penyu. *Musamus Fisheries and Marine Journal* (status under review); **(G)** Conservation International. 2016. Lembar info penyu pulau venu, Kaimana. Conservation International, Kaimana, Indonesia; **(H)** Tapilatu, R. F., H. Wona, R. H. Siburian, and S. T. Saleda. 2020. Heavy metals contaminants in the eggs and temperatures of nesting beaches of sea turtles in Kaimana, West Papua, Indonesia. *Biodiversitas* 21: 4582–4590; **(I)** Tarigan, A. P., R. F. Tapilatu, and M. Matulessy. 2017. Suhuinkubasi, pasir pantai peneluran dan suksespenetasan telur penyu pada sarang semi alami di Pantai Warebar–Yenbekaki Distrik Waigeo Timur, Kabupaten Raja Ampat. *Cassowary* 1: 21–31.
Nesting Beaches: (1) Jeen Syuap;[A] **(2)** Jeen Womom;[A] **(3)** Mapia Atoll;[B] **(4)** Mubraidiba;[C,D,E] **(5)** Sidey;[F] **(6)** Venu Island;[C,G,H] **(7)** Warebar[I]
Years: (1–2) 2017; **(3, 5)** 2018; **(4, 6)** 2016; **(7)** 2019
Counts: (1) 271; **(2)** 536; **(3)** unquantified; **(4)** 7; **(5)** 14; **(6)** 368; **(7)** 15 clutches
SWOT Contacts: Ricardo F. Tapilatu and Loka Pengelolaan Sumberdaya Pesisir dan Laut Sorong

DATA RECORD: 53
Data Sources: (A) Dermawan, A. 2002. Marine turtle management and conservation in Indonesia. In I. Kinan (ed.), *Proceedings of the Western Pacific Sea Turtle Cooperative Research and Management Workshop*. Honolulu, HI: Western Pacific Regional Fishery Management Council; **(B)** Putrawidjaja, M. 2000. Marine turtles in Irian Jaya, Indonesia. *Marine Turtle Newsletter* 90: 8–10.
Nesting Beaches: (1) Meru-Betiri;[A] **(2)** Alas Purwo National Park;[A] **(3)** Hamadi Beach–Jayapura Bay–Irian Jaya[B]
Years: (1) 1996; **(2)** 2002; **(3)** 1999
Counts: (1) 11; **(2)** 230; **(3)** unquantified clutches

KENYA
DATA RECORD: 54
Data Sources: (A) Izava, M., and World Wide Fund for Nature Kenya. 2016. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XII (2017); **(B)** Okemwa, G. M., S. Nzuki, and E. M. Muenis. 2004. The status and conservation of sea turtles in Kenya. *Marine Turtle Newsletter* 105: 1–6.
Nesting Beaches: (1) Kongoale;[A] **(2)** Kiunga;[B] **(3)** Mombasa[B]
Years: (1) 2015; **(2–3)** 2000
Counts: (1) 1; **(2)** 5; **(3)** 8 clutches
SWOT Contact: Mike Olendo

DATA RECORD: 55
Data Source: Pembe Shungu, N., S. Mangi Kazungu, C. Gona Fondo, and C. Jefa Yaa. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beach: Watamu
Year: 2020
Count: 104 clutches
SWOT Contacts: Mtalii Ochieng and Justin Beswick

LIBERIA
DATA RECORD: 56
Data Source: Plotkin, P. T. 2007. *Olive Ridley Sea Turtle* (Lepidochelys olivacea) *Five-Year Review: Summary and Evaluation*. Jacksonville, FL: National Marine Fisheries Service and U.S. Fish and Wildlife Service.
Nesting Beaches: beaches in southern Liberia
Year: 2007
Count: unquantified

MALAYSIA
DATA RECORD: 57
Data Sources: (A) Sarahaizad, M. S. 2012. *Distribution, Behaviour, and Breeding Ecology of the Green Turtle*, Chelonia mydas (Famili: Cheloniidae) *on Nesting Beaches of Penang Island, Peninsular Malaysia, with Emphasis on Pantai Kerachut and Telok Kampi*. Penang, Malaysia: Universiti Sains Malaysia; **(B)** Sarahaizad, M. S., M. S. Shahrul Anuar, and Y. Mansor. 2012. Nest site selection and digging attempts of green turtles (*Chelonia mydas, Fam. Cheloniidae*) at Pantai Kerachut and Telok Kampi, Penang Island, Peninsular Malaysia. *Malaysian Applied Biology Journal* 41 (2): 39–47; **(C)** Sarahaizad, M. S., Y. Mansor, and M. S. Shahrul Anuar. 2012. The distribution and conservation status of green turtles (*Chelonia mydas*) and olive ridley turtles (*Lepidochelys olivacea*) on Pulau Pinang beaches (Malaysia), 1995–2009. Tropical Life Sciences Research 23 (1): 63–76; **(D)** Bowen, B. W., A. M. Clark, F. A. Abreu-Grobois, A. Chaves, et al. 1998. Global phylogeography of the ridley sea turtles (*Lepidochelys spp.*) as inferred from mitochondrial DNA sequences. Genetica 101: 179–189; **(E)** Dethmers, K. E., D. Broderick, C. Moritzi, N. N. Fitzsimmons, et al. 2006. The genetic structure of Australasian green turtles (*Chelonia mydas*): Exploring the geographical scale of genetic exchange. *Molecular Ecology* 15: 3931–3946; **(F)** Tisen, O. B., and J. Bali. 2002. Current status of marine turtle conservation programmes in Sarawak, Malaysia. In A. Mosier, A. Foley, and B. Brost (eds.), *Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation*, pp. 12–14. Miami, FL: National Marine Fisheries Service; **(G)** Limpus, C. 2001. *Report to Third IOSEA Meeting*. Manila, Philippines.
Nesting Beaches: (1) Tanjung Bungah;[A,B,C] **(2)** Medan;[A,B,C] **(3)** Telok Duyung;[A,B,C] **(4)** Gertak Sanggul;[A,B,C] **(5)** Telok Bahang;[A,B,C] **(6)** Telok Kumbar;[A,B,C] **(7)** Kijal;[D] **(8)** Paka;[D] **(9)** Turtle Islands;[E,F] **(10)** Terengganu[G]
Years: (1) 2004; **(2)** 2005; **(3)** 2007; **(4–5)** 2008; **(6)** 2009; **(7–8)** 1994; **(9)** 2002; **(10)** 1999
Counts: (1–5) 1; **(6)** 2; **(7–9)** unquantified; **(10)** 10 clutches
SWOT Contact: Sarahaizad Mohd Salleh

DATA RECORD: 58
Data Source: Ahmed, U., J. Hudgins, E. Riyaz, and M. Stelfox. 2020. Maldives. In A. D. Phillott and A. F. Rees (eds.), *Sea Turtles in the Middle East and South Asia Region: MTSG Annual Regional Report 2020*, pp. 132–148. IUCN-SSC Marine Turtle Specialist Group.
Nesting Beaches: (1) Hanimaadhoo (Haa Dhaalu); **(2)** Muravandhoo (Raa); **(3)** Dhuni Kolhu (Baa)
Years: (1) 2018, 2020; **(2)** 2018; **(3)** 2019

Counts: **(1)** 1 average clutch per year; **(2)** 1 clutch; **(3)** 1 crawl
SWOT Contact: Jillian Hudgins

MEXICO (ATLANTIC)

DATA RECORD: 59

Data Source: Guzman, V., and Área de Protección de Flora y Fauna Laguna de Términos, Comisión Nacional de Áreas Naturales Protegidas (CONANP). 2010. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. VI (2011).
Nesting Beach: Isla del Carmen
Year: 2009
Count: 2 clutches
SWOT Contact: Vicente Guzman

MEXICO (PACIFIC)

DATA RECORD: 60

Data Source: **(A)** CONANP. 2021. Base de datos del Programa Nacional para la Conservación de las Tortugas Marinas (PNCTM). Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(B)** Pérez, A. and PNCTM, CONANP. 2009. Personal communication from L. Sarti. In *SWOT Report—State of the World's Sea Turtles*, vol. V (2010); **(C)** Sarti, L. 2009. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. V (2010); **(D)** Abreu, A. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(E)** Delgado-Trejo, C., C. Bedolla Ochoa, B. N. Rangel Aguilar, V. Nuñez Cárdenas, et al. 2020. Mexico. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Ocean Region: MTSG Annual Regional Report 2020*, pp. 37–60. IUCN-SSC Marine Turtle Specialist Group. **(F)** Robles, J. A. 2021. Personal communication. Centro Universitario de la Costa Sur, Universidad de Guadalajara. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Bahía de Chacahua;[A] **(2)** Barra de la Cruz;[A] **(3)** Cahuitan;[A] **(4)** Chalacatepec;[A] **(5)** El Chupadero;[A] **(6)** Mexiquillo;[A] **(7)** Nuevo Vallarta;[A] **(8)** Platanitos;[A] **(9)** Puerto Arista;[A] **(10)** San Juan Chacahua;[A] **(11)** Tierra Colorada;[A] **(12)** Mismaloya (Sección el Playón);[B] **(13)** Bahía de los Angeles;[C] **(14)** Boca de Tomates;[C] **(15)** Boca del Cielo;[C] **(16)** Cachán de Echeverría;[C] **(17)** Chuquiapan;[C] **(18)** Cuixmala;[C] **(19)** Hotelito Desconocido;[C] **(20)** Isla de Pajaritos;[C] **(21)** Islas Revillagigedo;[C] **(22)** José María Morelos;[C] **(23)** La Cruz de Huanacaste;[C] **(24)** La Encrucijada;[C] **(25)** La Gloria;[D,F] **(26)** La Placita de Morelos;[C] **(27)** La Ticla;[C] **(28)** La Zacatosa;[C] **(29)** Las Guasimas;[C] **(30)** Magdalena;[C] **(31)** Motín de Oro;[C] **(32)** Peñas Lázaro Cárdenas;[C] **(33)** Playa Larga, San Andrés;[C] **(34)** Punta Diamante;[C] **(35)** Solera de Agua;[C] **(36)** Tecuán;[C] **(37)** Teopa;[C] **(38)** Todos Santos;[C] **(39)** Loreto;[A,C] **(40)** Ixtapilla;[D,E] **(41)** Santuario Playa de Escobilla;[A] **(42)** Morro Ayuta[A]
Years: **(1–12, 39)** 2019; **(13–39)** 2009; **(40)** 2010; **(41–42)** 2020
Counts: **(1)** 162; **(2)** 500; **(3)** 986; **(4)** 7,721; **(5)** 3,326; **(6)** 1,541; **(7)** 8,525; **(8)** 6,343; **(9)** 3,670; **(10)** 44; **(11)** 1,956; **(12)** 8,143; **(13–38)** unquantified; **(39)** 63; **(40)** 200,000; **(41)** 1,144,147; **(42)** 1,000,387 clutches
SWOT Contacts: Adriana Laura Sarti Martínez, Alberto Abreu, Eloy Cesar Reyes Ramírez, María Teresa Luna Medina, Erika Peralta, and José Antonio Trejo Robles

DATA RECORD: 61

Data Source: Ponce, A. M. and Chelonia Maris AC. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beach: Isla San José
Year: 2020
Count: 30 clutches
SWOT Contact: Alba Magdalena Ponce

DATA RECORD: 62

Data Sources: **(A)** CONANP. 2021. Área de Protección de Flora y Fauna Islas del Golfo de California, Zona Sur, Sinaloa. Campamento Tortuguero Isla Quevedo. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(B)** Ríos Olmeda, D. 2008. Informe Anual Playa El Verde, CONANP. Región Noroeste y Alto Golfo de California, Mexico: CONANP; **(C)** González Diego, E., and R. Briseño Dueñas. 2021. Reporte Anual, SGPA/DGVS/2020, Informe Final Convenio con SSP estado de Sinaloa. Unpublished report, Dirección General EDM; **(D)** Contreras Aguilar, H. R., and R. Briseño Dueñas. 2021. Programa de Protección y Conservación de la Tortuga Marina, Universidad Autónoma de Sinaloa en Playa Caimanero, Rosario, Sinaloa. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(E)** Barrón Hernández, J. A., R. Briseño Dueñas, and Acuario Mazatlán. Unpublished data. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(F)** Briseño Dueñas, R. 2021. Reporte Anual, Informe Final Convenio UNAM-FONATUR. Unpublished report, Universidad Nacional Autónoma de México and Fondo Nacional de Fomento al Turismo; **(G)** Martín-del-Campo, R., M. F. Calderón-Campuzano, I. Rojas-Lleonart, R. Briseño-Dueñas, et al. 2021. Congenital malformations in sea turtles: Puzzling interplay between genes and environment. Animals 11 (2): 444.
Nesting Beaches: **(1)** Isla Quevedo;[A] **(2)** Isla Altamura;[A] **(3)** Isla Santa María;[A] **(4)** Playa Lucenilla;[A] **(5)** Ceuta Norte;[A] **(6)** Santuario Playa Ceuta–Celestino Gasca;[A] **(7)** El Verde;[B] **(8)** Isla de la Piedra–Estrella del Mar;[C] **(9)** Caimanero–Rosario;[D] **(10)** Mazatlán;[E] **(11)** El Verde Camacho;[A] **(12)** Playa Espíritu;[F,G] **(13)** Meseta de Cacaxtla[A]
Years: **(1–5 ,8, 10, 13)** 2020; **(6, 11–12)** 2019; **(7)** 2007; **(9)** 2018
Counts: **(1)** 128; **(2)** 62; **(3)** 76; **(4)** 179; **(5)** 521; **(6)** 265; **(7)** 1,804; **(8)** 2,428; **(9)** 2,688; **(10)** 3,000; **(11)** 1,596; **(12)** 1,014; **(13)** 949 clutches
SWOT Contacts: Raquel Briseño Dueñas, Alberto Mendoza Flores, Artemisa Gaxiola Uzàrraga, Hugo Manuel Espinoza Flores, Indra Gabriela Domínguez Meza, Cecilia García Chavelas, Daniel Ríos Olmeda, Dialhy Coello, Marco Herrera, Eréndira González Diego, Héctor Rafael Contreras Aguilar, José Alberto Barrón Hernández, and Sergio Alejandro González Palacios

DATA RECORD: 63

Data Sources: **(A)** International Conference on Science and Applied Science (ICSAS)–Red Tortuguera A.C. 2021. *Annual Report*. Unpublished data. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(B)** ICSAS–Red Tortuguera A.C. 2021. *Municipio de Puerto Vallarta: CEMBAB Annual Report*. Unpublished data. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: **(1)** Sayulita;[A] **(2)** Guayabitos–Los Ayala;[A] **(3)** Litibu;[A] **(4)** Punta de Mita;[A] **(5)** Punta Raza–Canalan;[A] **(6)** Puerto Vallarta[B]
Year: 2020
Counts: **(1)** 375; **(2)** 183; **(3)** 253; **(4)** 155; **(5)** 215; **(6)** 3,121 clutches
SWOT Contacts: Catherine E. Hart, Alejandra Aguirre, Ildefonso Ramos Guerrero, and Antonio Ramírez

DATA RECORD: 64

Data Sources: **(A)** Asupmatoma A.C. 2021. Annual Report. Unpublished report. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(B)** Ramírez Cruz, C. 2010. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. V (2010); **(C)** Oceguera Camacho, K. 2009. *Reporte Temporada 2009 Anidación de Tortugas*. Unpublished report; **(D)** Llamas González, I. 2009. *Informe Final: UDG Preparatoria Regional de Puerto Vallarta, México*. Unpublished report; **(E)** Murrieta Rosas, J. L. 2009. *Informe Final: Patronato Cabo del Este, A.C., México*. Unpublished report; **(F)** Rangel González, Z. 2009. *Informe Final: Parque Nacional Cabo Pulmo*. Unpublished report, CONANP; **(G)** Ríos Olmeda, D. 2008. *Informe Anual Playa El Verde, Región Noroeste y Alto Golfo de California*. Unpublished report, CONANP; **(H)** Tena Espinoza, M., and M. Nuñez Bautista. 2009. *Informe Annual: Campamento Tortuguero Playa Chila A.C., México*. Unpublished report; **(I)** Tiburcio Pintos, G. 2009. *Informe Final: Red para la Protección de la Tortuga Marina en el Municipio de los Cabos*. Unpublished report, Ayto Los Cabos, Mexico; **(J)** Pinal, R., C. C. Sánchez Salazar, A. Leal Leal, C. Escobar Vázquez, et al. 2012. *Informe Anual*. Unpublished report, Asupmatoma A.C.
Nesting Beaches: **(1)** El Suspiro;[A] **(2)** Los Esteros–Pescadero;[B] **(3)** San Juan de los Planes;[C] **(4)** Mayto;[D] **(5)** Los Barriles;[E] **(6)** Parque Nacional Cabo Pulmo (Miramar, Barracas, Cabo Pulmo, Frailes);[F] **(7)** El Verde Camacho;[G] **(8)** Boca de Chila;[H] **(9)** Faro Viejo–Estero San José;[I] **(10)** San José–Frailes;[I] **(11)** San Cristóbal[J]
Years: **(1)** 2020; **(2–10)** 2009; **(11)** 2012
Counts: **(1)** 1,108; **(2)** 185; **(3)** 236; **(4)** 1,100; **(5)** 70; **(6)** 178; **(7)** 1,804; **(8)** 1,299; **(9)** 669; **(10)** 1,357; **(11)** 471 clutches
SWOT Contacts: Abilene Colin, René Pinal, Carla Sánchez, Carlos Ramírez Cruz, Daniel Ríos Olmeda, Elizabeth Arista de la Rosa, Elizabeth González Payan, Eréndira González Diego, Everardo Mariano Meléndez, Fernando Enciso Saracho, Graciela Tiburcio Pintos, Héctor Rafael Contreras Aguilar, Israel Llamas González, José Alberto Barrón Hernández, José Luis Pepe Murrieta, Karen Oceguera Camacho, Marco Tena Espinoza, María Zuemy Rangel González, René Alberto Priego Loredo, and Vicente Peña Aldrete

DATA RECORD: 65

Data Source: Agández, G., F. Dvorak, R. Rodríguez, and Tortugueros Las Playitas A.C. 2013. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. VIII (2013).
Nesting Beaches: **(1)** Todos Santos; **(2)** Las Playitas
Years: **(1)** 2012; **(2)** 2011
Counts: **(1)** 89; **(2)** 223 clutches
SWOT Contact: Francesca Dvorak

DATA RECORD: 66

Data Source: Grupo Ecológico de la Costa Verde A.C. 2021. Annual Report. Unpublished report. In *SWOT Report—The State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beach: San Francisco
Year: 2020
Count: 1,084 clutches
SWOT Contact: Frank Smith

DATA RECORD: 67

Data Source: **(A)** Tiburcio-Pintos, G. 2016. *Interacciones históricas entre los seres humanos y las tortugas marinas en la región del golfo de california.* Tesis Doctoral en Ciencias Sociales, Desarrollo Sustentable y Globalización de la UABCS, La Paz, México; **(B)** Tiburcio, P.G. and D.R. Briseño. 2012. Tortugas Marinas: Patrimonio ancestral de la región de Los Cabos. En Ganster, P., C.O. Arizpe, and A. Ivanova. *Los Cabos, Prospectiva de un Paraíso Natural y Turístico.* San Diego State University Press and Institute for Regional Studies of the Californias. San Diego, CA. USA; **(C)** Tiburcio-Pintos, G. 2012. *Uso de las Tortugas Marinas en el Municipio de los Cabos, Baja California Sur: Bajo una Perspectiva de la Historia Ambiental.* Master's thesis, Universidad Autónoma de Baja California Sur, Mexico; **(D)** Tiburcio Pintos, G. 2021. *Programa para Protección de la Tortuga Marina del H. XIII Ayuntamiento de Los Cabos, B.C.S.: Informe Final de Temporada 2020.* Technical report.
Nesting Beaches: **(1)** Pacífico Faro; **(2)** San José del Cabo; **(3)** Sheraton; **(4)** Rancho la Margarita; **(5)** Piedras Bolas; **(6)** Villas del Mar; **(7)** Corredor Turístico; **(8)** La Fortuna; **(9)** Sandos Finisterra; **(10)** Bahía de Cabo San Lucas; **(11)** La Ribera
Years: **(1, 2, 5, 1 0)** 2011–2020; [3, 9] 2011–2013; **(4)** 2011, 2013, 2018–2020; **(6)** 2017–2020; **(7, 11)** 2011–2013, 2015–2020 **(8)** 2011–2013
Counts: **(1)** 948.5; **(2)** 1157.7; **(3)** 49; **(4)** 251.8; **(5)** 468.7; **(6)** 205.5; **(7)** 341.3; **(8)** 260.2; **(9)** 126.5; **(10)** 641.3; **(11)** 304.7 average clutches per year
SWOT Contacts: Graciela Tiburcio Pintos, Carlos Villalobos, Omar Legaria, Ernesto Acevedo Ruíz, Alejandro García Ruíz, Estrella Cabrera, Ignacio Ayuso, Ivan Marrón Fiol, Miguel Ángel Cruz Ramos, Miguel Ángel Jiménez, Osvaldo Paez, Pedro Márquez, Thania Nava, Gustavo Hernández, Manuel Solano Cabrera, Rafael Marrón Fiol, and José Isaul

DATA RECORD: 68

Data Source: Oceguera Camacho, K., and Chelonia Maris A.C. 2021. Annual Report. Unpublished report. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: El Sargento–Ensenada de Muertos
Year: 2020
Count: 311 clutches
SWOT Contact: Karen Oceguera Camacho

DATA RECORD: 69

Data Source: Tello Sahagún, L. A. 2021. Annual Report. Unpublished report, Estación Biológica Majahuas, Sociedad Cooperativa de Producción Pesquera "Roca Negra." In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: Playa Majahuas
Years: 2020
Counts: 2,463 clutches
SWOT Contacts: Luis Angel Tello Sahagún

DATA RECORD: 70

Data Source: Araiza, O., and N. Araiza. 2021. *Annual Report*. Unpublished report, Grupo Tortuguero Los Barriles.
Nesting Beach: Los Barriles
Year: 2020
Count: 482 clutches
SWOT Contacts: Omar Araiza and Noé Araiza

DATA RECORD: 71

Data Source: Ricardo Villaseñor, R., and F. Sánchez. 2021. *Annual Report*. Unpublished report, Grupos Ecologistas de Nayarit A.C.
Nesting Beach: El Naranjo
Year: 2020
Count: 494 clutches
SWOT Contacts: Ricardo Villaseñor and Francisco Sánchez

DATA RECORD: 72

Data Source: Rodger, R., and A. Raymundo Perez. 2021. Personal Communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beach: Palmarito Beach
Year: 2020
Count: 613 clutches
SWOT Contacts: Rich Rodger and Alison Raymundo Pérez

DATA RECORD: 73

Data Sources: **(A)** López-Castro, M. C., and A. Rocha-Olivares. 2005. The panmixia paradigm of eastern Pacific olive ridley turtles revised: Consequences for their conservation and evolutionary biology. *Molecular Ecology* 14: 3325–3334; **(B)** Marquéz, R., A. Villanueva, and C. Peñaflores. 1976. *Sinopsis de Datos Biológicos sobre la Tortuga Golfina*, Lepidochelys olivacea (*Eschscholtz*, 1829). Sinopsis sobre la Pesca INP/S2, Instituto Nationale Pesca, Mexico; **(C)** Sullivan, P. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(D)** Rodríquez Zarate, C. J. 2008. *Estructura Genética de las Colonias Reproductoras de Tortuga Golfina*, Lepidochelys olivacea, en Baja California y Playas del Pacífico Continental Mexicano. Master's thesis, Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California, Mexico.
Nesting Beaches: **(1)** Las Tinajas;[A] **(2)** Punta Arena;[A] **(3)** Punta Colorada;[A] **(4)** Bahia Maruata;[B] **(5)** Cuyutlán;[B] **(6)** Piedra de Tlacoyunque;[B] **(7)** Playa Blanca;[C] **(8)** Bahía de Banderas;[D] **(9)** Boca de Apiza;[D] **(10)** Cabo Pulmo[D]
Years: **(1–5)** 2003; **(6)** 1997; **(7)** 2018; **(8–10)** 2007
Counts: **(1–3, 8–10)** unquantified; **(4)** 4,198; **(5)** 1,257; **(6)** 3,798; **(7)** 1,014 clutches

MOZAMBIQUE

DATA RECORD: 74

Data Source: Costa, A., and A. Mate. 2009. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. V (2010).
Nesting Beach: Bazaruto Archipelago National Park
Year: 2008
Count: 1 clutch
SWOT Contacts: Alfredo Mate and Alice Costa

MYANMAR

DATA RECORD: 75

Data Source: Thorbjarnarson, J. B., S. G. Platt, and S. T. Khaing. 2000. Sea turtles in Myanmar: Past and present. *Marine Turtle Newsletter* 88: 10–11.
Nesting Beach: Bogale River mouth
Year: 1999
Count: 140 clutches

NICARAGUA

DATA RECORD: 76

Data Sources: **(A)** Cornelius, S. 1982. Status of sea turtles along the Pacific coast of middle America. In K. A. Bjorndal (ed.), *Biology and Conservation of Sea Turtles*, pp. 211–219. Washington, DC: Smithsonian Institution Press; **(B)** Urteaga, J., V. Gadea, L. Gonzáles, C. Mejía, et al. 2020. Nicaragua. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al. (eds.), *Sea Turtles in the East Pacific Ocean Region: MTSG Annual Regional Report 2020*, pp. 81–96. IUCN-SSC Marine Turtle Specialist Group, 2020.
Nesting Beaches: **(1)** Boquita;[A] **(2)** Masachapa;[A] **(3)** Pochomil;[A] **(4)** Chacocente;[B] **(5)** Ostional;[B] **(6)** Guacalito;[B] **(7)** Holman;[B] **(8)** La Flor;[B] **(9)** Brasilón;[B] **(10)** El Coco;[B] **(11)** Escondida;[B] **(12)** Redonda;[B] **(13)** Estero Padre Ramos;[B] **(14)** Reserva Natural Isla Juan Venado;[B] **(15)** Veracruz de Acayo;[B] **(16)** Salamina[B]
Years: **(1–3)** 1982; **(4, 8)** 2011–2016; (5–6, 10) 2014–2015; **(7)** 2012–2013; **(9, 11)** 2013–2015; **(12)** 2015; **(13)** 2012–2017; **(14)** 2008; **(15–16)** 2010–2016
Counts: **(1–3)** unquantified; **(4)** 58,952; **(5)** 74; **(6)** 1; **(7)** 2; **(8)** 136,014; **(9)** 21; **(10)** 174; **(11)** 29; **(12)** 16; **(13)** 20; **(14)** 530; **(15)** 267; **(16)** 376 average clutches per year

NIGERIA

DATA RECORD: 77

Data Source: Girondot, M., and A. Girard. 2017. Unpublished data. In *SWOT Report—State of the World's Sea Turtles*, vol. XII. (2017).
Nesting Beaches: **(1)** Eastern Beach; **(2)** Western Beach; **(3)** Port Lekki Beach
Years: **(1–2)** 2013; **(3)** 2014
Counts: **(1–2)** 47; **(3)** 34 average clutches per year
SWOT Contact: Marc Girondot

OMAN

DATA RECORD: 78

Data Sources: Pilcher, N. 2010. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. V. (2010)
Nesting Beach: Masirah
Year: 2006
Count: 1,017 clutches
SWOT Contact: Nicolas Pilcher

PAKISTAN

DATA RECORD: 79

Data Source: Asrar, F. F. 1999. Decline of marine turtle nesting populations in Pakistan. *Marine Turtle Newsletter* 83: 13–14.
Nesting Beach: Sandspit and Hawkes Bay
Year: 1997
Count: 2 clutches

PANAMA

DATA RECORD: 80

Data Sources: **(A)** Amorocho, D. F., A. Tobón, M. Abrego, H. Medina, et al. 2015. *Quantifying Hawksbill Nesting via Rapid Assessments along the Pacific Coast of the Darien Gap–Chocó Regions of Panama and Colombia.* CIMAD, WWF, ICAPO. Project supported by a U.S. Fish and Wildlife Service grant; **(B)** Rodríguez, J., A. Ruíz, M. Abrego, C. Peralta, et al. 2009. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. V. (2010); **(C)** Donadi, R. 2020. Panama. In J. M. Rguez-Baron, S. Kelez, M. J. Liles, A. Zavala-Norzagaray, et al (eds.), *Sea Turtles in the East Pacific Ocean Region: MTSG Annual Regional Report 2020*, pp. 142–168. IUCN-SSC Marine Turtle Specialist Group, 2020; **(D)** Abrego, M. Dirección de Costas y Mares 2020. *Información Recabada de las Acciones de los Grupos Comunitarios, OBC, ONG, e Investigadores que Desarrollan Actividades de Protección, Conservación e Investigación de Tortugas Marinas en el Pacífico y Caribe de Panamá—Periodo*

2019–2020; **(E)** Amorocho, D. 2018. *Informe Técnico Final: Reporte de la Temporada de Anidación de Tortugas Marinas en el Parque Nacional Cerro Hoya (Panamá) y Bahía Solano (Colombia).* Programa de Especies para Latinoamérica y el Caribe, World Wide Fund for Nature; **(F)** Szejner, M. 2021. *Datos Recolectados (2013–2019) por la Organización Protectora de la Tortuga Marina y la Biodiversidad de Jaque.* Unpublished data; **(G)** Blas, J. 2020. *Informe General de Proyecto de Conservación de Tortugas Marinas Playa La Barqueta (2019–2020).* Alianza Acotomar, Universidad Autónoma de Chiriquí, Familia Rojas; **(H)** Araúz, E. A., L. Pacheco, S. Binder, and R. de Ycaza. 2017. *Diagnóstico de la Situación de las Tortugas Marinas y Plan de Acción Nacional para su Conservación.* Panama City: Ministerio de Ambiente de Panamá; **(I)** Alvárez, G. 2015. *Informe Final de Proyecto Conservación de Tortugas Marinas en las Playas de Anidación de las Comunidades Costeras de Cambutal y La Esmeralda.* Tortuguías, Panamá.
Nesting Beaches: (1) Playa Muerto;[A] **(2)** Isla Taborcillo;[B] **(3)** Morrillo;[B] **(4)** La Concepción–La Yeguada;[B] **(5)** Guánico Abajo;[B] **(6)** Malena;[C] **(7)** Reserva Ecológica Panamaes;[C,D] **(8)** Punta Chame;[C,D] **(9)** Playa La Marinera;[C,D] **(10)** Cambutal;[C,D] **(11)** Isla Cañas;[C,D] **(12)** Mata Oscura;[C,D,E,F] **(13)** Playa La Barqueta;[C,D,G] **(14)** Jaque;[C,D,F] **(15)** Lagarto;[C,H] **(16)** Playa Grande Norte;[C] **(17)** Playa Brazo[C,I]
Years: (1, 17) 2015; **(2)** 2004; **(3–5)** 2009; **(6, 11, 14)** 2020; **(7–8, 10, 12–13)** 2019; **(9)** sporadic documentation from 1997–2020; **(15)** 2017; **(16)** 2014
Counts: (1) 26–100 clutches; **(2–5)** unquantified clutches; **(6)** 300 clutches; **(7)** 138 clutches; **(8)** 166 clutches; **(9)** 30,000–50,000 average clutches per year; **(10)** 553 clutches; **(11)** 14,070 clutches; **(12)** 184 clutches; **(13)** 74 clutches; **(14)** 220 clutches; **(15)** 11 clutches; **(16)** 26 clutches; **(17)** 61 clutches
SWOT Contacts: Alexander Tobón López, Diego Amorocho, Argelis Ruíz, Carlos Peralta, Harold Chacon, Jacinto Rodríguez, Alexis Pérez, and Marino Abrego

PERU
DATA RECORD: 81
Data Sources: (A) Kelez, S. 2015. Unpublished data, ecOceánica. In *SWOT Report—State of the World's Sea Turtles*, vol. X (2015); **(B)** Hays, C., and W. M. Brown. 1982. Status of sea turtles in the southeastern Pacific: Emphasis on Peru. In K. A. Bjorndal (ed.), *Biology and conservation of sea turtles.* Washington, DC: Smithsonian Institution Press; **(C)** Kelez, S., X. Velez-Zuazo, F. Angulo, and C. Manrique. 2009. Olive ridley *Lepidochelys olivacea* nesting in Peru: The southernmost records in the Eastern Pacific. *Marine Turtle Newsletter* 126: 5–9; **(D)** Rivas Mogollón, E. L., Z. A. Vega Guarderas, and C. J. J. Saavedra Lozada. 2013. Sea turtle monitoring in El Alto, Piura, Peru. *Marine Turtle Newsletter* 137: 15–16; **(E)** Vera, M., J. Llanos, E. Torres, C. A. Rosales, et al. 2008. Primer registro de anidamiento de *Lepidochelys olivacea* (Eschscholtz 1829) en la playa Nueva Esperanza, Tumbes, Peru. In S. Kelez, F. van Oordt, N. de Paz, and K. Forsberg (eds.), *Libro de Resumenes: II Simposio de Tortugas Marinas en el Pacífico Sur Oriental.* Lima, Peru; **(F)** Wester, J. H., S. Kelez, and X. Velez-Zuazo. 2010. *Nuevo Limite sur de Anidación de las Tortuga Verde* Chelonia mydas *y Golfina Lepidochelys olivacea en el Pacífico Este.* II Congreso Nacional de Ciencias del Mar del Perú.
Nesting Beaches: (1) Los Organos;[A] **(2)** Vichayito;[A] **(3)** El Nuro;[A] **(4)** Cabo Blanquillo;[A] **(5)** Las Pocitas;[A] **(6)** Playa Bravo;[A] **(7)** Punta Sal;[A] **(8)** Punta Malpelo;[B] **(9)** Caleta Grau;[C] **(10)** Punta Restin;[D] **(11)** Nueva Esperanza;[E] **(12)** Bomba[F]
Years: (1–2) 2013; **(3–7)** 2014; **(8)** 1979; **(9)** 2000; **(10)** 2011; **(11)** 2008; **(12)** 2010
Counts: (1, 3, 10) 2; **(6)** 15; **(2, 4–5, 7–9, 11–12)** 1 clutches
SWOT Contacts: Shaleyla Kelez

PHILIPPINES
DATA RECORD: 82
Data Sources: (A) Gardner, A., and Atelier Aquatic Community Interest Company. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(B)** Curma. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(C)** Mariñas, D., and San Vicente Turtle Conservation. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(D)** Philippines Department of Environment and Natural Resources (DENR), Community Environment and Natural Resources, Olongapo City. 2020. *Report on Monitoring of Pawikan Hatching Site in Aplaya Caarusipan Beach Resort Located at Brgy. Pundakit, San Antonio, Zambales.* Unpublished report; **(E)** Cambal, H., and Anvaya Cove Beach and Nature Club. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(F)** Cambal, H., and Pawikan Conservation Center. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(G)** Dichaves, J., and El Nido Marine Turtle Conservation Network. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(H)** Mendoza, M., and Sagip Pawikan. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(I)** Pambid, R., and DENR, Community Environment and Natural Resources, Bangui. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(J)** Liggayu, R., and Project Pawikan. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021); **(K)** Del Rosario, R., and Alimanguan Sagip Pawikan. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: (1) Wild Dharma–Inaladelan–Babay Daraga–Secret Paradise;[A] **(2)** Surf Beach;[B] **(3)** Long Beach;[C] **(4)** Pawikan;[D] **(5)** Anvaya Cove Beach (Ilingin);[E] **(6)** Nagbalayong Beach;[F] **(7)** Lio Beach (Las Cabañas, El Nido Town, Duli, Nacpan, Sibaltan, Simpian, Pagauanen);[G] **(8)** Bacuit Bay Islands (Miniloc, Lagen, Pangulasian, Cadlao, Dilumacad, Matinloc, Tapiutan);[G] **(9)** Poblacion Beach;[H] **(10)** Saud Beach;[I] **(11)** Windmills area;[I] **(12)** Danacbunga Beach–Panan Beach;[J] **(13)** Lipay Dingin Beach–Panubuatan Beach–San Agustin Beach–Cabangan Beach–Liwa Liwa Beach;[J] **(14)** Alimanguan Beach[K]
Year: 2020
Counts: (1) 7; **(2)** 63; **(3)** 32; **(4)** 1; **(5)** 20; **(6)** 203; **(7)** 159; **(8)** 4; **(9)** 243; **(10)** 6; **(11)** 4; **(12)** 27; **(13)** 21; **(14)** 150 clutches
SWOT Contacts: Anita Gardner, Dixie Mariñas, Edward Julian, Hera Cambal, Jamie Dichaves, Mharlo Mendoza, Raffy Pambid, Reef Liggayu, and Ronnie Del Rosario

SÃO TOMÉ AND PRÍNCIPE
DATA RECORD: 83
Data Sources: (A) ATM and Marapa. 2015/16. *Tatô Program—Sea Turtle Conservation Project of the Island of São Tomé.* Technical report; **(B)** Marapa. 2017. Sea turtle nesting in São Tomé. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XII (2017).
Nesting Beaches: (1) Forma;[A,B] **(2)** Comprida;[A,B] **(3)** Fernão Dias;[A,B] **(4)** Governador;[A,B] **(5)** Jale;[A,B] **(6)** Micoló;[A,B] **(7)** Planta[A,B] **(8)** Tamarindos;[A,B] **(9)** Tartaruga;[A,B]
Years: (1) 2014; **(2–9)** 2015
Counts: (1–2, 7) 1; **(3)** 52; **(4)** 63; **(5)** 3; **(6)** 81; **(8)** 80; **(9)** 83 clutches
SWOT Contact: Sara Vieira

SIERRA LEONE
DATA RECORD: 84
Data Sources: (A) Aruna, E. 2007. Sea Turtle Nesting in Sierra Leone. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. II (2007); **(B)** Siaffa, D. D., E. Aruna, and J. Fretey. 2003. Presence of sea turtles in Sierra Leone (West Africa). In J. A. Seminoff (ed.), *Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation.* Miami, FL.
Nesting Beaches: (1) Lumley;[A] **(2)** Hamilton;[A] **(3)** Baki–Turtle Islands;[B] **(4)** Sherbro[B]
Years: (1–2) 2007; **(3–4)** 2002
Counts: (1–4) unquantified clutches
SWOT Contact: Edward Aruna

SRI LANKA
DATA RECORD: 85
Data Sources: (A) Rajakaruna, R. S., E. M. Lalith Ekanayake, and P. A. C. N. B. Suraweera. 2020. Sri Lanka. In A. D. Phillott and A. F. Rees (eds.), *Sea Turtles in the Middle East and South Asia Region: MTSG Annual Regional Report 2020*, pp. 245–265. IUCN-SSC Marine Turtle Specialist Group, 2020; **(B)** Amarasooriya, K. D., and M. R. A. Jayathilaka. 2002. A classification of the sea turtles nesting beaches of southern Sri Lanka. Paper presented at Second Association of Southeast Asian Nations Symposium on Sea Turtle Biology and Conservation; **(C)** Kapurusinghe, T. 2006. Status and conservation of marine turtles in Sri Lanka. In K. Shanker and B. C. Choudhury (eds.), *Marine Turtles of the Indian Subcontinent.* Hyderabad, India: Universities Press; **(D)** Rajakaruna, R. S., D. M. N. J. Dissanayake, E. M. L. Ekanayake, and K. B. Ranawana. 2009. Sea turtle conservation in Sri Lanka: Assessment of knowledge, attitude and prevalence of consumptive use of turtle products among coastal communities. *Indian Ocean Turtle Newsletter* 10: 1–13.
Nesting Beaches: (1) Benthota;[A] **(2)** Bundala;[A] **(3)** Kalamatiya;[A] **(4)** Mahapalana;[A] **(5)** Koggala;[A] **(6)** Ahungalla;[A] **(7)** Duwemodara;[A] **(8)** Induruwa;[A] **(9)** Kosgoda;[A] **(10)** Warahena;[A] **(11)** Ambalangoda;[A] **(12)** Habaraduwa;[A] **(13)** Kahawa;[A] **(14)** Kumana;[A] **(15)** Mount Lavinia;[A] **(16)** Panama;[A] **(17)** Rekawa;[A] **(18)** Balapitiya;[B] **(19)** Bandarawatta;[B] **(20)** Walawemodera;[B] **(21)** Welipatanwila;[B] **(22)** Godavaya;[C] **(23)** Amaduwa;[C] **(24)** Arugambay;[C] **(25)** Bussa;[C] **(26)** Buttawa;[C] **(27)** Maggona;[C] **(28)** Mahaseeiawe;[C] **(29)** Palatupana;[C] **(30)** Patanangala;[C] **(31)** Potuwil;[C] **(32)** Seenimodara;[C] **(33)** Tangalle;[C] **(34)** Unawaluna;[C] **(35)** Uraniya;[C] **(36)** Kahandamodara;[C] **(37)** Wedikanda[D]
Years: (1, 4–13, 15–16) 2014; **(2, 14, 17)** 2017; **(3)** 2015; **(18–21)** 1999; **(22–35)** 1999; **(36–37)** 2009
Counts: (1) 40 clutches; **(2)** 162 average clutches per year; **(3)** 22 average clutches per year; **(4)** 10 clutches; **(5)** 30 clutches; **(6)** 65 clutches; **(7)** 14 clutches; **(8)** 10 clutches; **(9)** 10 clutches; **(10)** 20 clutches; **(11)** 30 clutches; **(12)** 30 clutches; **(13)** 45 clutches; **(14)** 68 average clutches per year; **(15)** 20 clutches; **(16)** 128 clutches; **(17)** 31 average clutches per year; **(18–37)** unquantified clutches
SWOT Contact: Lalith Ekanayake

SURINAME
DATA RECORD: 86
Data Sources: (A) Nature Conservation Division and World Wide Fund for Nature Guianas. 2015. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. X (2015); (B) Schulz, J. P. 1975. Sea turtles nesting in Surinam. *Zoologische Verhandelingen* 143: 1–143.
Nesting Beaches: (1) East of Suriname River Estuary;[A] **(2)** Galibi;[A] **(3)** Galibi Nature Reserve[B]
Years: (1–2) 2015; **(3)** 2008
Counts: (1) 15; **(2)** 5; **(3)** 245 clutches
SWOT Contacts: Catharina Bilo, Claudine Sakimin, Michael Hiwat, Romeo De Freitas, Sopheia Edghill, and Suresh Kandaswamy

THAILAND
DATA RECORD: 87
Data Source: Chantrapornsyl, S. 1992. Biology and conservation olive ridley turtle (*Lepidochelys olivacea*, Eschscholtz) in the Andaman Sea, southern Thailand. *Phuket Marine Biological Center Research Bulletin* 57: 51–66.
Nesting Beaches: (1) Mai Khao; (2) Phra Thong Island
Year: 1992
Counts: (1) 9; **(2)** 9 clutches

TOGO
DATA RECORD: 88
Data Source: Hoinsoude, G. S. and D. Jacques. 2021. Akiti Sea Turtle Conservation Program, Lomé Container Terminal. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
Nesting Beaches: (1) Kodjoviakopé; **(2)** Abogame; **(3)** Avepozo; **(4)** Devikinme; **(5)** Agbodrafo; **(6)** Aného (Wlinsi)
Year: 2020
Counts: (1) 10; **(2)** 16; **(3)** 33; **(4)** 27; **(5)** 36; **(6)** 27 clutches
SWOT Contacts: Alexandre Girard and Akomedi Mensah

TRINIDAD AND TOBAGO
DATA RECORD: 89
Data Sources: (A) Bacon, P.R. 1971. Sea turtles in Trinidad and Toboago. In *Proceedings of the Second Working Meeting of the IUCN Marine Turtle Specialist Group*, pp. 79–83. IUCN Publications New Series Supplemental Paper 31; **(B)** Dow, W. E. and K. L. Eckert. 2007. Sea turtle nesting habitat: A spatial database for the wider Caribbean region. WIDECAST Technical Report No. 6, Wider Caribbean Sea Turtle Conservation Network (WIDECAST) and The Nature Conservancy, Beaufort NC; (C) Livingstone, S. R. 2005. Report of olive ridley (Lepidochelys olivacea) nesting on the north coast of Trinidad. *Marine Turtle Newsletter* 109: 6–7.
Nesting Beaches: (1) Cedros–Granville;[A,B] **(2)** Manzanilla Beach–Cocos Bay;[B] **(3)** Grand Riviere;[B] **(4)** Madamas;[C] **(5)** Matura[C]
Years: (1) 1970; **(2)** 2005; **(3)** 2006; **(4)** 1995; **(5)** 2004
Counts: (1–3) unquantified; **(4)** 1; (5) 10 clutches
SWOT Contacts: Dennis Sammy, Scott Eckert, and Stephen Poon

U.S.A.
DATA RECORD: 90
Data Source: Parker, D., and G. H. Balazs. 2015. Map guide to Hawaiian Marine Turtle Nesting and Basking. www.GeorgeHBalazs.com.
Nesting Beaches: (1) Heleloa (Pyramid Rock); **(2)** Kailua; **(3)** Pa'ia; **(4)** Hilo Bay Front; **(5)** Awili Point
Year: 2015
Count: (1–5) 0 average clutches per year
SWOT Contact: George Balazs

VANUATU
DATA RECORD: 91
Data Sources: Fletcher, M. 2008. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. V (2010).
Nesting Beaches: (1) Pentecost 4; **(2)** Pentecost 5; **(3)** Pentecost 6; **(4)** Epi 1; **(5)** Epi 2; **(6)** Epi 3; **(7)** Epi 4; **(8)** Epi 5
Year: 2007
Counts: (1–8) unquantified clutches
SWOT Contact: Michelle Fletcher

VIETNAM
DATA RECORD: 92
Data Sources: (A) Hamann, M., C. The Cuong, N. Duy Hong, P. Thuoc, and B. Thi Thuhien. 2006. Distribution and abundance of marine turtles in the Socialist Republic of Viet Nam. Biodiversity and Conservation 15: 3703–3720; **(B)** Shanker, K. and N.J. Pilcher. 2003. Marine turtle conservation in South and Southeast Asia: Hopeless cause or cause for hope? *Marine Turtle Newsletter* 100: 43–51.
Nesting Beaches: (1) Bai Tre;[A] **(2)** Son Tra Peninsula;[A] **(3)** Minh Chau and Quan Lan Islands–Gulf of Tonkin;[A] **(4)** Quan Lan Island–Quang Ninh;[A] **(5)** Quang Binh;[A] **(6)** Ha Trinh Province;A,B **(7)** Con Dao National Park[A,B]
Years: (1–3, 6–7) 2002; **(4, 5)** 2005
Counts: (1) 19; **(2)** 1–25; **(3)** 10; **(4)** 11; **(5)** 21; (6) 10; **(7)** 10 clutches
SWOT Contact: Mark Hamann

Telemetry Data Citations

The following data records refer to satellite telemetry datasets from tags that were deployed on olive ridley turtles worldwide. These records were combined to create the map on pp. 32–33. The data are organized by country of deployment. For information regarding data processing and filtering, see the sidebar on p. 31. These data were generously contributed to SWOT by the people and partners listed subsequently. Records that have a SWOT ID can be viewed in detail in the SWOT online database and mapping application at http://seamap.env.duke.edu/swot, which contains additional information about the projects and their methodologies.

To save space, we have used the following abbreviations in the data source fields: (1) "STAT" refers to Coyne, M. S., and B. J. Godley. 2005. Satellite Tracking and Analysis Tool (STAT): An integrated system for archiving, analyzing, and mapping animal tracking data. Marine Ecology Progress Series 301: 1–7. (2) "SWOT Database Online" refers to Kot, C. Y., E. Fujioka, A. DiMatteo, B. P. Wallace, et al. 2015. The State of the World's Sea Turtles Online Database. Data provided by the SWOT Team and hosted on OBIS-SEAMAP. Oceanic Society, IUCN Marine Turtle Specialist Group, and Marine Geospatial Ecology Lab, Duke University. http://seamap.env.duke.edu/swot. (3) "OBIS-SEAMAP" refers to Halpin, P. N., A. J. Read, E. Fujioka, B. D. Best, et al. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. Oceanography 22 (2): 104–115. When listed, these sources indicate that the dataset was contributed online through STAT, SWOT, or OBIS-SEAMAP.

ANGOLA

DATA RECORD 1 | SWOT ID: 1448

Project Title: Angola LNG Olive Ridley Tracking Project
Metadata: 10 nesting female *L. olivacea*
Data Sources: (A) Pendoley, K. 2016. Angola LNG Olive Ridley Tracking Project. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/1448) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=263). (B) STAT. (C) OBIS-SEAMAP (D) SWOT Database Online.
SWOT Contact: Kellie Pendoley

AUSTRALIA

DATA RECORD 2

Project Partners: Department of Biodiversity, Conservation and Attractions (DBCA)
Project Title: Olive Ridley Satellite Telemetry Data from Western Australia (or Terminating in the Indian Ocean)
Metadata: 1 rehabilitated adult female and 3 subadult *L. olivacea* of unknown sex
Data Source: Waayers, D., T. Tucker, S. Whiting, R. Groom, et al. 2019. Satellite tracking of marine turtles in the south-eastern Indian Ocean: A review of deployments spanning 1990–2016. *Indian Ocean Turtle Newsletter* 29: 23–37.
SWOT Contacts: Tony Tucker, Scott Whiting, and Sabrina Fossette

BELIZE

DATA RECORD 3 | SWOT ID: 769

Project Title: Hawksbill Hope & Marymount University
Metadata: 1 adult *L. olivacea*
Data Sources: **(A)** Rimkus, T. 2016. Hawksbill Hope & Marymount University. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/769) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=650). **(B)** STAT. **(C)** OBIS-SEAMAP.
SWOT Contact: Todd Rimkus

BRAZIL

DATA RECORD 4 | SWOT ID: 984

Project Partners: Projeto TAMAR (Tartarugas Marinhas)
Project Title: Study of the Biology of Sea Turtles in Brazil through Satellite Telemetry
Metadata: 10 nesting female *L. olivacea*
Data Sources: **(A)** López, G. 2016. Study of the Biology of Sea Turtles in Brazil through Satellite Telemetry. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/984) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=63); **(B)** da Silva, A. C. C. D., E. A. P. dos Santos, F. L. d. C. Oliveira, M. I. Weber, et al. 2011. Satellite-tracking reveals multiple foraging strategies and threats for olive ridley turtles in Brazil. Marine Ecology Progress Series 443: 237–247. https://doi.org/10.3354/meps09427. **(C)** STAT. (D) OBIS-SEAMAP. (E) SWOT Database Online.
SWOT Contact: Gustave López

DATA RECORD 5

Metadata: 40 nesting female *L. olivacea*
Data Sources: **(A)** Santos, E. A. P., A. C. C. D. Silva, R. Sforza, F. L. d. C. Oliveira, et al. 2019. Olive ridley inter-nesting and post-nesting movements along the Brazilian coast and Atlantic Ocean. *Endangered Species Research* 40: 149–162. https://doi.org/10.3354/esr00985. Data were collected as a condition of environmental licensing required by the Brazilian Institute of Environment and Renewable Resources (IBAMA). **(C)** SWOT Database Online.
SWOT Contact: Erik Santos

COLOMBIA

DATA RECORD 6 | SWOT ID: 1326

Project Partner: PRETOMA (Programa Restauración de Tortugas Marinas)
Project Title: Sea Turtles of Valle del Cauca–Bahía Málaga
Metadata: 1 juvenile *L. olivacea*
Data Sources: (A) Heidemeyer, M. 2016. Sea Turtles of Valle del Cauca–Bahía Málaga. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/1326) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=1164). **(B)** STAT. **(C)** OBIS-SEAMAP. **(D)** SWOT Database Online.
SWOT Contact: Maike Heidemeyer

DATA RECORD 7 | SWOT ID: 1306

Project Title: World Wide Fund for Nature (WWF) Sea Turtle Satellite Tracking in Latin America and the Caribbean
Metadata: 1 adult *L. olivacea*
Data Sources: **(A)** Amorocho, D. 2016. WWF Sea Turtle Satellite Tracking in Latin America and the Caribbean. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/1306) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=791). **(B)** STAT. **(C)** OBIS-SEAMAP. (D) SWOT Database Online.
SWOT Contact: Diego Amorocho

COSTA RICA

DATA RECORD 8 | SWOT ID: 1483

Project Title: Costa Rica Dome Expedition, April 2017
Metadata: 1 adult and 1 subadult *L. olivacea*
Data Sources: **(A)** Swimmer, Y. 2017. Costa Rica Dome Expedition, April 2017. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/1483) on February 8, 2021, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=1263). **(B)** STAT. **(C)** OBIS-SEAMAP. (D) SWOT Database Online.
SWOT Contact: Yonat Swimmer

DATA RECORD 9

Metadata: 21 female and 9 male *L. olivacea*
Data Source: Plotkin, P. T. 2010. Nomadic behaviour of the highly migratory olive ridley sea turtle *Lepidochelys olivacea* in the eastern tropical Pacific Ocean. *Endangered Species Research* 13: 33–40. https://doi.org/10.3354/esr00314.
SWOT Contact: Pamela Plotkin

DATA RECORD 10

Project Title: Postnesting Female Olive Ridleys from Costa Rica
Metadata: Postnesting female *L. olivacea*
Data Source: Figgener, C., and P. T. Plotkin. 2017. Unpublished olive ridley tracks. Personal Communication In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
SWOT Contacts: Christine Figgener and Pamela Plotkin

FRENCH GUIANA

DATA RECORD 11

Project Title: French Guiana Marine Turtle Tracking
Metadata: 20 adult *L. olivacea*
Data Source: Chevallier, D. 2020. **(A)** Satellite tracking of marine turtles in French Guiana. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XV (2020). **(B)** Chambault, P., B. de Thoisy, M. Huguin, J. Martin, et al. 2018. Connecting paths between juvenile and adult habitats in the Atlantic green turtle using genetics and satellite tracking. *Ecological Evolution* 8 (24): 1–13. https://doi.org/10.1002/ece3.4708.
SWOT Contact: Damien Chevallier

GABON

DATA RECORD 12 | SWOT ID: 1215

Project Title: Gabon 2014: Olive Ridley Sea Turtles
Metadata: 6 adult *L. olivacea*
Data Sources: **(A)** Maxwell, S. M. 2016. Gabon 2014: Olive Ridley Sea Turtles. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/1215) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=1047). **(B)** STAT. **(C)** OBIS-SEAMAP. (D) SWOT Database Online.
SWOT Contact: Sara Maxwell

DATA RECORD 13 | SWOT ID: 523

Project Title: Gabon Olive Ridley Project
Metadata: 13 adult *L. olivacea*
Data Sources: **(A)** Maxwell, S. M. 2016. Gabon Olive Ridley Project. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/523) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=146). **(B)** STAT. **(C)** OBIS-SEAMAP.
SWOT Contact: Sara Maxwell

DATA RECORD 14

Metadata: 18 Nesting female *L. olivacea*
Data Source: Maxwell, S. M., G. A. Breed, B. A. Nickel, J. Makanga-Bahouna, et al. 2011. Using satellite tracking to optimize protection of long-lived marine species: Olive ridley sea turtle conservation in Central Africa. *PLOS ONE* 6 (5): e19905. https://doi.org/10.1371/journal.pone.0019905.
SWOT Contact: Sara Maxwell

DATA RECORD 15 | SWOT ID: 1328

Project Title: Gabon Olive Ridley Tracking Project: Pongara National Park 2015
Metadata: 10 adult *L. olivacea*
Data Sources: **(A)** Maxwell, S.M. 2016. Gabon Olive Ridley Tracking Project: Pongara National Park 2015. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/1328) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=1165). **(B)** STAT. **(C)** OBIS-SEAMAP. (D) SWOT Database Online.
SWOT Contact: Sara Maxwell

GHANA

DATA RECORD 16 | SWOT ID: 1813

Project Title: Olive Ridley Sea Turtle Tracking Near Ghana, 2009
Metadata: 4 nesting female *L. olivacea*
Data Sources: **(A)** Allman, P., M. Coyne, and A. K. Amah. 2010. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. V (2010). **(B)** STAT. **(C)** OBIS-SEAMAP. (D) SWOT Database Online.
SWOT Contact: Phil Allman

HONDURAS

DATA RECORD 17 | SWOT ID: 783

Project Title: El Venado Satellite Tags
Metadata: 5 nesting female L. olivacea
Data Sources: **(A)** Dunbar, S. 2016. El Venado Satellite Tags. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/783) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=669). **(B)** STAT. **(C)** OBIS-SEAMAP.
SWOT Contact: Stephen Dunbar

INDIA

DATA RECORD 18

Project Title: Olive Ridleys Tracked from Rushikulya Nesting Beach and in Sri Lanka
Metadata: 22 nesting female *L. olivacea*
Data Source: Kumar, S., and B. C. Choudhury. 2021. Olive Ridleys Tracked from Rushikulya Nesting Beach and Sri Lanka. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
SWOT Contacts: Suresh Kumar and B. C. Choudhury

DATA RECORD 19 | SWOT ID: 575

Project Partners: Tree Foundation
Project Title: Chennai India, Olive Ridley Tracking
Metadata: 2 adult *L. olivacea*
Data Sources: **(A)** Tucker, S. 2016. Chennai India, Olive Ridley Tracking. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/575) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=477). **(B)** STAT. **(C)** OBIS-SEAMAP.
SWOT Contact: Supraja Tucker

MALDIVES

DATA RECORD 20 | SWOT ID: 850

Project Title: Maldivian Sea Turtle Conservation Program–Landaa Giraavaru (LG)
Metadata: 1 adult *L. olivacea*
Data Sources: **(A)** Fisher, J. 2016. Maldivian Sea Turtle Conservation Program–LG. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/850) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=750). **(B)** STAT. **(C)** OBIS-SEAMAP. (D) SWOT Database Online.
SWOT Contact: Jamie Fisher

MEXICO

DATA RECORD 21 | SWOT ID: 1217

Project Title: Seguimiento via Satélite del Desplazamiento de Tortugas Marinas, Anidando en Baja California Sur–México
Metadata: 1 adult *L. olivacea*
Data Sources: **(A)** Pintos, M. 2016. Seguimiento via Satélite del Desplazamiento de Tortugas Marinas, Anidando en Baja California Sur–Mexico. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/1217) on January 4, 2017, and originated from Satellite Tracking and STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=1057). **(B)** STAT. **(C)** OBIS-SEAMAP. (D) SWOT Database Online.
SWOT Contact: Graciela Tiburcio Pintos

DATA RECORD 22

Project Title: Migraciones de Golfinas en Sinaloa
Metadata: 9 female and 6 male *L. olivacea*
Data Source: Briseño Dueñas, R. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
SWOT Contact: Raquel Briseño Dueñas

DATA RECORD 23 | SWOT IDS: 843, 1025, 1419, AND 1552

Project Title: ¡Tras la Ruta de las Tortugas Golfinas!: Satellite Tracking Program for Olive Ridleys (*L. olivacea*) in Los Cabos, Baja California Sur–México
Metadata: 14 nesting female *L. olivacea*
Data Sources: **(A)** Tiburcio Pintos, G., P. Sanders, and A. J. L. Escalante. 2021. ¡Tras la Ruta de las Tortugas Golfinas!: Satellite Tracking Program for Olive Ridleys (*L. olivacea*) in Los Cabos, Baja California Sur–México. Comité Municipal Red para la Protección de la Tortuga Marina en Los Cabos, Baja California, Sur–México. **(B)** STAT. **(C)** OBIS-SEAMAP.
SWOT Contact: Graciela Tiburcio Pintos

DATA RECORD 24 | SWOT ID: 317

Project Title: Pacific Turtle Tracks: Grupo Tortuguero
Metadata: 1 adult *Lepidochelys olivacea*
Data Sources: **(A)** Nichols, W. J. 2016. Pacific Turtle Tracks: Grupo Tortuguero. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/317) on January 4, 2017, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=114). **(B)** STAT. **(C)** OBIS-SEAMAP.
SWOT Contact: Wallace J. Nichols

DATA RECORD 25

Project Title: Arribada Olive Ridleys Tagged in Oaxaca
Metadata: 7 nesting female *L. olivacea* tagged during an arribada
Data Source: Gómez-Cortés, A., E. Baudry, and M. Girondot. 2021. Personal communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
SWOT Contacts: Adriana Cortés-Gómez, Emmanuelle Baudry, and Marc Girondot

OMAN

DATA RECORD 26

Metadata: 9 nesting female *L. olivacea*
Data Source: Rees, A. F., A. Al-Kiyumi, A. C. Broderick, N. Papathanasopoulou, et al. 2012. Conservation related insights into the behaviour of the olive ridley sea turtle *Lepidochelys olivacea* nesting in Oman. *Marine Ecology Progress Series* 450: 195–205. https://doi.org/10.3354/meps09527.
SWOT Contact: ALan F. Rees

RÉUNION (FRANCE)

DATA RECORD 27

Project Title: Olive Ridleys in Réunion
Metadata: 4 postrehabilitated *L. olivacea*
Data Sources: **(A)** Barret, M., M. Dalleau, C. Jean, and S. Ciccione. 2021. Tracking of olive ridley turtles received in a care centre after accidental capture in Réunion Island (2016–2020); **(B)** Barret, M., and S. Ciccione. 2021. Location of olive ridley turtles bycatch received in a care centre in Réunion Island (2006–2020).
SWOT Contacts: Stephane Ciccione, Mathieu Barret, Claire Jean, and Mayeul Dalleau

UNITED ARAB EMIRATES

DATA RECORD 28 | SWOT ID: 802

Project Title: Dubai Turtle Rehabilitation Project
Metadata: 1 adult female *L. olivacea*
Data Sources: **(A)** Baverstock, W. 2020. Dubai Turtle Rehabilitation Project. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/802) on February 8, 2021, and originated from STAT (http://www.seaturtle.org/tracking/index.shtml?project_id=687). **(B)** STAT. **(C)** OBIS-SEAMAP. (D) SWOT Database Online.
SWOT Contact: Warren Baverstock

U.S.A.

DATA RECORD 29 | SWOT ID: 320

Project Title: National Marine Fisheries Service (NMFS) Turtle Tracking
Data Source: **(A)** Parker, D., G. Balazs, and J. Polovina. 2015. NMFS Turtle Tracking. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/320) on January 4, 2017. **(B)** OBIS-SEAMAP. **(C)** SWOT Database Online.
SWOT Contact: Denise Parker

DATA RECORD 30

Project Title: Stranded, Rehabilitated, and Released Ridley Track
Metadata: *L. olivacea* stranded in Florida, rehabbed, and released
Data Source: Hirsch, S., and Loggerhead Marinelife Center. 2019. Personal Communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
SWOT Contact: Sarah Hirsch

DATA RECORD 31

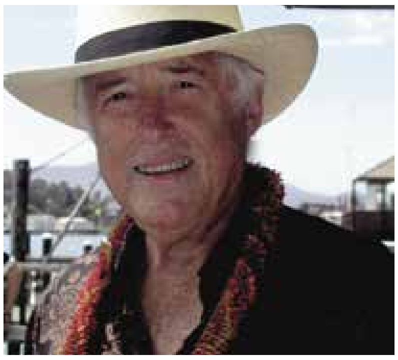
Project Partners: The Turtle Hospital and Loggerhead Marinelife Center
Project Title: Juvenile Ridley Stranded, Rehabilitated at the Turtle Hospital and Released
Metadata: 1 juvenile rehabilitated *L. olivacea*
Data Source: Hirsch, S., Loggerhead Marinelife Center, and The Turtle Hospital. 2021. Personal Communication. In *SWOT Report—State of the World's Sea Turtles*, vol. XVI (2021).
SWOT Contact: The Turtle Hospital and Sarah Hirsch

DATA RECORD 32

Project Partners: Friends of Gumbo Limbo Nature Center, City of Boca Raton's Sea Turtle Rehabilitation Team, and Inwater Research Group
Project Title: *L. olivacea* Tracking in USA
Metadata: 1 healthy male *L. olivacea*
Data Source: Friends of Gumbo Limbo Nature Center, City of Boca Raton's Sea Turtle Rehabilitation Team, and Inwater Research Group. 2020. Tracking Jasper, the olive ridley. https://www.inwater.org/research/trackingjasper/.
SWOT Contacts: Ryan Welsh, Cody Mott, and Jeff Guertin

In Memoriam

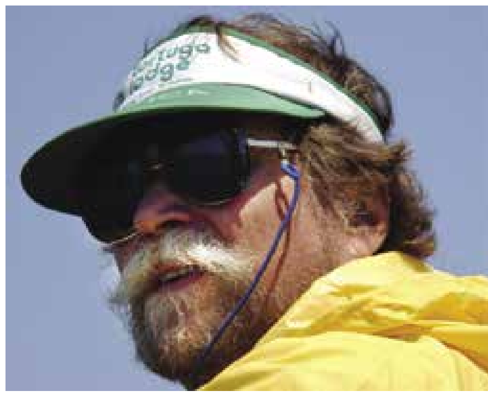
Beyond the vast global drama and loss of human lives wrought by COVID-19 since the previous volume of *SWOT Report*, our clan has seen the passing of a shocking number of our own brothers and sisters, including some of the most stalwart and iconic leaders our field has ever known. Please take a solemn moment to consider not only how the following seven people changed the world and advanced the field of sea turtle conservation, but also how they influenced us all as friends and colleagues. Recapture the special moments you may have had with each of them, and consider how to cherish all the moments we will continue to share among those of us who remain. Special thanks go to Ken Broadbent, Ray Carthy, Peter Dutton, Faye Frazer, Kate Mansfield, Judi Reichart, Manjula Tiwari, and Blair Witherington for assisting with the content that follows.



HENK REICHART (1926–2020)

Henk is best known in the sea turtle community for his work in the 1970s as director of Suriname's foremost nature group, Stinasu, where he led a sea turtle program with another iconic Dutch-born scientist, Joop Schulz. We owe much of our basic understanding about temperature–dependent sex determination and sea turtle–based ecotourism to that early research. Henk was also among the first to draw attention to bycatch as a serious threat, and he promoted the use of turtle excluder devices in the Guianas. A former pro soccer player (Blauw-Wit Amsterdam), engineer, wildlife manager, pilot, and multilingual problem solver, Henk was known for his community-based efforts to build Suriname's (and later Indonesia's) system of protected areas, which have resulted in millions of hectares of rainforest remaining intact to this day. Driven from his beloved Suriname by civil war in 1984, Henk led equally heroic conservation efforts for World Wide Fund for Nature Indonesia, then returned to help rebuild Stinasu before retiring to California. Revered as one of the founders of conservation in Suriname, "Sir Henk" was knighted by Prince Bernhard of the Netherlands in 1994; bestowed with an International Sea Turtle Society Lifetime Achievement Award in 2015; and blessed with the love, respect, and admiration of several generations of sea turtle and nature lovers worldwide.

JACK MUSICK (1941–2021)



In a posthumous tribute, colleagues remarked that "Jack's entire life was a lesson in excellence and the many spiritual and intellectual rewards to be gained by following your bliss no matter where it leads." During a career as a marine scientist, conservationist, and professor at the Virginia Institute of Marine Science that spanned four decades, Jack built a sea turtle program that advanced satellite tracking studies and much more. But his curiosity and intellect did not end with turtles. A nature polymath, Jack authored 170 papers and 22 books spanning taxa from fish, to cetaceans, to sea turtles. He advised, inspired, and entertained thousands of students and was a perpetual source of engaging stories and jokes, melded with sage advice and wisdom derived from vast and varied life experiences. His smile was disarming, and his wit and intelligence were without bounds. In a single conversation, he could move adeptly from sea turtle protection to whale taxonomy, next expertly segue to American eel biology, and then end with a fish story from his latest angling adventure. He was the life of any party, meeting, or symposium and will be fondly remembered by the people whose lives he touched, especially the students he mentored, who are his legacy in marine conservation.

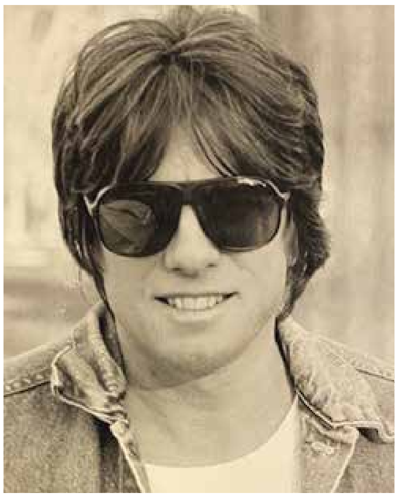
PETER PRITCHARD (1943–2020)

Peter was the world authority on turtles, tortoises, and terrapins, both extant and extinct, and his impact on modern chelonian biology and conservation is unparalleled. Besides conducting extensive fieldwork on all continents, he wrote numerous classic turtle books and publications, established a permanent sea turtle project in Guyana, and built one of the world's largest turtle and tortoise museum collections, containing more than 14,000 specimens and more than three-fourths of the world's turtle species. He was recognized as a "Champion of the Wild" by Discovery TV, "Hero of the Planet" by *Time Magazine*, and "Floridian of the Year" by the *Orlando Sentinel*. He also received the prestigious Behler Turtle Conservation Award from the International Union for Conservation of Nature Species Survival Commission's Tortoise and Freshwater Turtle Specialist Group, as well as the International Sea Turtle Society's Lifetime Achievement Award and the Turtle Conservancy's Conservation Achievement Award. Moreover, three turtle species have scientific names honoring Peter. His wisdom, kindness, humility, charm, humor, and generosity of spirit left an indelible mark on the lives of many, and his curiosity and love for life, turtles, and people made him a giant among men.

ALAN BOLTEN (1945–2021)

Although lives are fragile, deeds are resolute. In his work to conserve sea turtles, Alan Bolten understood this consequence of vulnerability and the value of persistence. To reach sea turtles, Alan took a meandering path through entomology, tropical botany, and Africanized honey bees to meet a student of Professor Archie Carr named Karen Bjorndal, whom he married. The partnership began an eminently productive academic relationship between Alan, Karen, and sea turtles. Yet the results were more than academic. Many fall in love with sea turtles and then feel compelled to save them. Alan seemed to directly fall in love with saving sea turtles. This difference in emotional imperative drove the directness and effectiveness of Alan's conservation work with Karen, which culminated in a ban on Bahamian turtle harvest, fishing gear changes to reduce sea turtle bycatch, and contributions to how sea turtle life histories unfold, with profound implications for sea turtle conservation. In search of conservation solutions, Alan attracted diverse partners, conducted pivotal research, and interpreted that influential work for those who might make a difference. Alan leaves not only a great legacy of professional accomplishment and scientific leadership, but also one of impassioned and persistent connections among colleagues, students, and friends.

NAT FRAZER (1949–2020)



A well-loved, highly respected, and vital member of our community, Nat was a "Georgia Turtle Boy," whose passion for sea turtles was born in 1979 when he saw his first loggerhead on Little Cumberland Island. During the ensuing decades, he presented and published prolifically on sea turtle conservation, with a strong focus on growth and population modeling. He jokingly claimed to have a "firm grasp on the obvious," and he helped us to think and see in new ways through his commonsense, thoughtful, yet scientifically rigorous observations and moving speeches and essays, including "Sea Turtle Conservation and Halfway Technology: Confessions of an Academic Parasite" and "Zen and the Art of Sea Turtle Conservation." Those creations ultimately earned him the affectionate moniker of "Dr. Cosmic." Nat's good humor, optimism, and passion for learning and educating enhanced the lives of countless students and colleagues throughout his long and storied career as a researcher, professor, lecturer, and university administrator. In his final speech, "Hope and Optimism," he shared one of his deepest truths: "[T]here are things that the Earth and the universe can teach us if we will be quiet and pay attention."

DONNA BROADBENT (1957–2020)

Donna was not working actively on the front lines of conservation policy, innovative field research, or ecological syntheses, but she was the unifying element for almost every major sea turtle meeting held in North America in the past decade and a half. As event coordinator for the International Sea Turtle Society and the Southeast Regional Sea Turtle Network, Donna planned our conferences and managed venues, and she quickly engaged us with her incredible level of organization, professionalism, and initiative. In her years of working with our community, she learned a lot about us as individuals and as a group, and she developed a deep fondness for our organizations, history, culture, and goals. This affection translated into an exceptional level of care and attention at our meetings and her commitment to making sure that every attendee had a wonderful and memorable experience. Donna's behind-the-scenes magic and her service, positivity, and friendliness will be remembered by the sea turtle community, and her legacy will live on through each symposium that we hold and attend.

MIGUEL DONOSO (1961–2021)

Miguel spent much of his life at sea on fishing boats and research vessels, where he observed, collected, and assessed everything from swordfish to marine mammals and sea turtles. His keen eye and curiosity first alerted the world to the extensive presence of sea turtles in Chilean waters. In the 1990s, Miguel spoke to an audience of skeptical fisheries experts about clusters of "small brown turtles" that he commonly saw in the open ocean, an observation that led to defining a conservation hotspot that helped protect juvenile loggerheads from longline. He also helped to create Red Laúd OPO (Océano Pacífico Oriental), the leading network of scientists dedicated to the recovery of the Eastern Pacific leatherback. Over his lifetime, Miguel cultivated an extensive network of ocean experts, and he gained the confidence and trust of countless fishers and communities in his efforts to help sea turtles. His friendly demeanor and love for food, song, dance, and soccer will be remembered by all who knew him, and his life is a testament to the importance of genuine human relationships in advancing conservation.

Authors and Affiliations

ALBERTO ABREU-GROBOIS, Instituto de Ciencias del Mar y Limnología, México

ERNESTO ALBAVERA, Comisión Nacional de Áreas Naturales Protegidas, México

TINA ALDERSON, Queensland Department of Environment and Science, Australia

RANDALL ARAUZ, Fins Attached Marine Research and Conservation; Centro de Rescate de Especies Marinas Amenazadas (CREMA), Costa Rica

GEORGE BALAZS, Golden Honu Services of Oceania, Hawaii, U.S.A.

BLAIR P. BENTLEY, Department of Environmental Conservation, University of Massachusetts Amherst, Massachusetts, U.S.A.

VANESSA BEZY, Wildlife Conservation Organization, Costa Rica

DAVID BOOTH, School of Biological Sciences, The University of Queensland, Australia

RAQUEL BRISEÑO, Instituto de Ciencias del Mar y Limnología, México

DIDIHER CHACÓN, Latin American Sea Turtles, Costa Rica

OWEN COFFEE, Queensland Department of Environment and Science, Australia

LILIANA COLMAN, Centre for Ecology and Conservation, University of Exeter, United Kingdom

JAMIE DICHAVES, Ten Knots Group, Philippines

ANDREW DUNSTAN, Queensland Department of Environment and Science, Australia

PETER H. DUTTON, Southwest Fisheries Science Center, NOAA, California, U.S.A.

SCOTT ECKERT, Wider Caribbean Sea Turtle Conservation Network, U.S.A.

LUIS G. FONSECA, Latin American Sea Turtles, Costa Rica

ALEXANDRE GIRARD, Réseau des Acteurs de la Sauvegarde des Tortues Marines en Afrique Centrale (Rastoma), Cameroon; Laboratoire Ecologie, Systématique et Évolution, Équipe de Processus Écologiques et Pressions Anthropiques, CNRS, AgroParisTech et Université Paris-Saclay, France

MARC GIRONDOT, Laboratoire Ecologie, Systématique et Évolution, Équipe de Processus Écologiques et Pressions Anthropiques, CNRS, AgroParisTech et Université Paris-Saclay, France

DAVID GODFREY, Sea Turtle Conservancy, U.S.A.

BRENDAN GODLEY, University of Exeter, United Kingdom

MARK HAMANN, College of Science and Engineering, James Cook University, Australia

JILLIAN HUDGINS, Olive Ridley Project, Maldives

MICHAEL JENSEN, Department of Chemistry and Bioscience, Aalborg University, Denmark

NUPUR KALE, Wildlife Conservation Society, India

LISA M. KOMOROSKE, Department of Environmental Conservation, University of Massachusetts Amherst, Massachusetts, U.S.A.

COLIN J. LIMPUS, Queensland Department of Environment and Science, Australia

CATHERINE M. F. LOHMANN, Department of Biology, University of North Carolina at Chapel Hill, North Carolina, U.S.A.

KENNETH J. LOHMANN, Department of Biology, University of North Carolina at Chapel Hill, North Carolina, U.S.A.

TERE LUNA, Comisión Nacional de Áreas Naturales Protegidas, México

MURALIDHARAN MANOHARAKRISHNAN, Dakshin Foundation, India

NECA MARCOVALDI, Fundação Projeto TAMAR, Brazil

RODERIC B. MAST, Oceanic Society, California, U.S.A.

ALEX McGHEE, Linnaeus, United Kingdom

FABIENNE McLELLEN, OceanCare, Switzerland

KYLE MITCHELL, Nature Seekers, Trinidad and Tobago

THE MERIAM NATION PEOPLE of Cape York, Australia

BRAD NAHILL, SEE Turtles, Oregon, U.S.A.

SARAH NELMS, University of Exeter, United Kingdom

CARLOS MARIO ORREGO VASQUEZ, Ministerio del Ambiente y Energía (MINAE), Costa Rica

ALIKI PANAGOPOULOU, ARCHELON, the Sea Turtle Protection Society of Greece, Greece

ERIKA PERALTA, Comisión Nacional de Áreas Naturales Protegidas, México

THOMAS PESCHAK, National Geographic; International League of Conservation Photographers; Save our Seas Foundation, South Africa

ASHWINI PETCHIAPPAN, Dakshin Foundation, India

CLAIRE PETROS, Olive Ridley Project, Maldives

MAXIMILIAN POLYAK, Loggerhead Marinelife Center, Florida, U.S.A.

ALESSANDRO PONZO, Large Marine Vertebrates Research Institute Philippines (LAMAVE), Philippines

WILFREDO POVEDA, Ministerio del Ambiente, Panamá

CHANDANA PUSAPATI, Dakshin Foundation, India

CHETAN RAO, Dakshin Foundation, India

MARK READ, Great Barrier Reef Marine Park Authority, Australia

JANIE REAVIS, School of Life Sciences, Arizona State University, Arizona, U.S.A.

CÉSAR REYES, Campamento Tortuguero “Punta Ixtal”

JUAN M. RGUEZ-BARON, JUSTSEA Foundation, Colombia; Marine Biology and Biology Program, University of North Carolina Wilmington, U.S.A.

KATHARINE ROBERTSON, Queensland Department of Environment and Science, Australia

DANIELA ROJAS, Centro de Rescate de Especies Marinas Amenazadas, Costa Rica

LAURA SARTI, Comisión Nacional de Áreas Naturales Protegidas, México

JESSE F. SENKO, School for Future of Innovation in Society, Arizona State University, Arizona, U.S.A.

WAYNE SENTMAN, Oceanic Society, California, U.S.A.

KARTIK SHANKER, Indian Institute of Science & Dakshin Foundation, India

SCOTT SMITHERS, College of Science and Engineering, James Cook University, Australia

ADHITH SWAMINATHAN, Dakshin Foundation, India

GANESH THANNOO, Nature Seekers, Trinidad and Tobago

JOCA THOME, Centro Tamar/ICMBio, Brazil

CHRISTINA ULLRICH, Harvard Medical School and Dana-Farber Cancer Institute, Massachusetts, U.S.A.

ROLDAN A. VÁLVERDE, Sea Turtle Conservancy, Costa Rica; Department of Biological Sciences, Southeastern Louisiana University, Louisiana, U.S.A.

BRYAN P. WALLACE, Ecolibrium Inc.; University of Colorado Boulder, Colorado, U.S.A.

LINDSEY WEST, Sea Sense, Tanzania

BLAIR WITHERINGTON, Inwater Research Group, Inc., Florida, U.S.A.

THE WUTHATHI PEOPLE of Torres Strait, Australia

JEANETTE WYNEKEN, Department of Biological Sciences, Florida Atlantic University, Florida, U.S.A.

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An adult olive ridley turtle heads back to sea along with hatchlings from a previous arribada. © Saurabh Chakraborty

SWOT report

The State of the World's Sea Turtles

State of the World's Sea Turtles
Oceanic Society
P.O. Box 844
Ross, CA 94957
U.S.A.

www.SeaTurtleStatus.org