SEA TURTLES OF SOUTH AMERICA

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From northern Colombia to Tierra del Fuego, the South American continent stretches some 7,149 kilometers (4,443 miles) and is 4,353 km (2,705 mi) at its broadest. The fourth-largest continent, South America is number one in biodiversity. It is home to the world's largest rainforest wilderness and river system (the Amazon) and to the world's largest wetland (the Pantanal), and it has 144,567 km (89,830 mi) of coastline.

Five of the world's seven sea turtle species (hawksbill, green, leatherback, loggerhead, and olive ridley) call the Pacific, Atlantic, and Caribbean waters and the beaches of South America their home for at least part of their life cycles. And although uncommon, even the range-restricted Kemp's ridley is an occasional visitor to South American waters, leaving just one sea turtle that is a complete stranger to the continent: the Australian flatback. Hybrid sea turtles are also known to occur among the hard-shelled species in South America (see box, p. 19).

Sea turtles are among the most migratory creatures on Earth. Thus, it is no surprise that many turtles found in South America arrive there from far away. Some have hatched on distant shores in Africa, the Caribbean, Central America, and the western Pacific. By the same token, turtles hatched on South American beaches are also known to travel throughout the Atlantic and Pacific Oceans and the Caribbean Sea. A total of 12 distinct sea turtle subpopulations (also called regional management units, or RMUs) are found in South America, out of 38 that are described globally (see maps, pp. 20–25).

All five of South America's resident sea turtles nest on the continent in a vast tropical arc that stretches clockwise from Piura in northern Peru to the Brazilian state of Rio de Janeiro; this encompasses the Galápagos and other offshore islands (see maps, pp. 20–23). Sea turtles range significantly farther south of this nesting arc as they forage in the Pacific off Peru and Chile and in the Atlantic off southernmost Brazil, Uruguay, and Argentina.

The maps that accompany this article show data that are provided by SWOT partners and that document sea turtle nesting abundance along this continuum (pp. 20–23). The maps also show in-water movements from satellite tags deployed in South America (pp. 24–25), as well as selected stranding data for the three South American coastal countries where nesting does not occur (see box, p. 27).

Sea turtles are important components of the culture and folklore of South American people. Turtles have been sought for food and for other traditional uses throughout the continent's human history. Over the centuries, what began as subsistence-level human exploitation has evolved into a variety of more severe and pervasive anthropogenic threats. Today, those threats include the effects of fisheries, loss of habitat to coastal development and to resource extraction, poaching, boat strikes, pollution, and climate change.

As a result of those mounting threats and of the increasing environmental consciousness globally, all 11 coastal South American countries have responded with some form of national protective legislation for sea turtles. All are also participating in related intergovernmental treaties, including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Migratory Species (CMS), and the Convention on Biological Diversity (CBD). Moreover, all but Colombia, France (French Guiana), Guyana, and Suriname are party to the Inter-American Convention (IAC) for the Protection and Conservation of Sea Turtles, which was established in 2001.

Regional networks also play an important role in organizing the South American sea turtle movement, including the Wider Caribbean Sea Turtle Conservation Network (WIDECAST), the Southwest Atlantic Sea Turtle Network (ASO), the Groupe Tortues Marines France (GTMF), the South Atlantic Sea Turtle Network (SASTN), and the Eastern Pacific Hawksbill Initiative (ICAPO), to name a few.

The 1992 "Earth Summit" in Rio de Janeiro marked a turning point in the global conservation movement. It spawned an explosion in the number of national and local nongovernmental organizations (NGOs) dedicated to conservation in South America. Dozens of those groups focus on sea turtles. Scientific investigation has also advanced enormously in recent decades, with researchers from many

AT LEFT: Volunteers with Equilibrio Azul pose with a hawksbill turtle after fitting it with a satellite tag on La Playita Beach in Machalilla National Park, Ecuador. © FELIPE VALLEJO / WWW.EQUILIBRIOAZUL.ORG
PREVIOUS SPREAD: Green turtles and Galápagos sea lions fill the scene near Santa Cruz Island in Ecuador's Galápagos Islands. © TUI DE ROY / MINDEN PICTURES

nations, institutions, and disciplines now hard at work helping to answer key questions about the natural history and conservation of sea turtles. Those efforts are helping us to build a brighter future for sea turtles and their habitats in South America and beyond.

The following sections highlight some of the many interesting aspects of South America's sea turtles and regional perspectives on the conservation and research movement dedicated to understanding and protecting sea turtles on that continent.

BRAZIL AND THE SOUTHWEST ATLANTIC

The Atlantic coast and adjacent seas of Brazil, Uruguay, and Argentina are important nesting and feeding areas for all five of South America's resident sea turtle species. Nesting in this region occurs from Atol das Rocas and the Fernando de Noronha archipelago off the northeastern tip of Brazil's Rio Grande do Norte state and extends south to Quissamã in the state of Rio de Janeiro. The only nesting population of leatherbacks in the southwest Atlantic can be found in the state of Espírito Santo, Brazil (not seen on the maps, p. 21, due to its size).

Foraging animals are found even farther south in the waters off Uruguay and Argentina, and stranding data gathered since the late 1990s provide a sense of how far turtles range in those temperate waters (see box, p. 27). The southwest Atlantic is a true melting pot of mixed stocks from six or more RMUs: (a) green turtles that breed off Ascension Island, French Guiana, Suriname, Trinidad and Aves Island; (b) loggerheads, hawksbills, and olive ridleys that nest in Brazil; and (c) leatherbacks from Ghana and Gabon, the Caribbean, and Brazil.

Sea turtles throughout this region face pressure from poaching, pollution, fisheries interactions, and degradation of nesting and foraging habitats, to name a few of the more significant threats. Although legislation exists to protect sea turtles in Brazil, Uruguay, and Argentina, governments do not always have the resources to enforce protective measures.

The Southwest Atlantic Sea Turtle Network (ASO) was created in 2003 to foster greater collaboration in southern Brazil, Uruguay, and Argentina for the protection of sea turtles and their habitats. ASO represents dozens of local and regional NGOs and government agencies as well as hundreds of community members. Every two years, ASO hosts a large gathering to share scientific news, conduct environmental education, and develop conservation strategies. As a result of their collective efforts in recent years, ASO and its partners have significantly advanced policies to protect sea turtles from fisheries interactions, which is one of the most severe threats in the region.

Brazil plays a major role in South American (and global) sea turtle conservation and research, and it serves as an example to other countries. Projeto TAMAR, a partnership of the Centro TAMAR/ICMBio, government agencies, and Fundacão Pró TAMAR, has been active since 1980. Today, the group carries out sea turtle research and conservation from 22 stations on the coast and the offshore islands of Brazil. The members monitor Brazil's major turtle rookeries and have amassed long-term datasets that have been extremely useful in defining RMUs.

Besides contributing to conservation, Projeto TAMAR has made great strides in promoting ecotourism and engaging local communities through art, music, and dance. An important innovation introduced by Projeto TAMAR is the social production chain that includes the manufacture of t-shirts and other items to provide alternative livelihoods to former turtle harvesters and their families. At the same time, the sale of those goods raises funds to support conservation (see *SWOT Report*, vol. II, pp. 26–27, and vol. VIII, p. 33).

Another NGO based in the southern Brazilian state of Rio Grande do Sul, called NEMA, has been collecting systematic sea turtle stranding data since 1990. Those data have been instrumental to conservation efforts in Brazil, and have shown that southern Brazil has the highest stranding rates for loggerheads in the western Atlantic Ocean.

THE GUIANAS

The Guianas (Guyana, French Guiana, and Suriname) are known for their shifting shorelines (see *SWOT Report*, vol. III, pp. 22–23). Enormous amounts of sediment pour from the mouth of the Amazon River about 500 km (300 mi) southeast of Brazil's border with French Guiana. Those sediments disperse northward with the North Brazil Current, which results in unstable nesting beaches that erode and grow in largely unpredictable patterns, thus causing great shifts in habitat use by sea turtles.

Today, the Guianas region is known for its important leatherback, olive ridley, and green turtle colonies. Although only 50 km of French Guiana's approximately 378 km (31 mi of approximately 235 mi) of coastline are suitable for turtle nesting, two areas have been sites of long-term monitoring. The first is near the capital city of Cayenne, and the second is at the extreme west of the country near its border with Suriname. The second site, Awala-Yalimapo, was discovered in the 1960s and has been regularly monitored since the early 1980s. The area was referred to by renowned sea turtle biologist, Peter Pritchard, as "the Holy Grail of [leatherback] nesting sites." When not breeding, leatherbacks from this region migrate to the North Atlantic, where they forage on the abundant jellyfish they find there (see map, pp. 24–25).

Just across the Maroni (Marowijne) River to the west are Suriname's best-documented nesting beaches, Galibi and Matapica, which are part of the same colony as Awala-Yalimapo. In addition to sharing this important leatherback rookery, this binational zone has some of the world's largest green turtles. Immature green turtles are also commonly observed around the offshore island here, although their genetic relation to the adults is unknown. Olive ridleys also nest and forage on those coasts and as far west as Venezuela. As in much of the rest of the continent, sporadic hawksbill nesting is also reported.

At the western edge of the Guianas, Guyana's best-known and most-studied nesting beach is Shell Beach, near the country's western border with Venezuela. This remote, pristine beach is lined by tropical forest and is accessible only by boat. Its distinctive orange sand, consisting of tiny shell fragments, is a nesting ground for green, hawksbill, leatherback, and olive ridley turtles. Local residents have been monitoring and protecting sea turtles on Shell Beach since 1988. The Guyana Marine Turtle Conservation Society was founded in 2000 to ensure continuity to those efforts. In 2011, Shell Beach was declared a protected area, and the responsibilities of management and monitoring were transferred to Guyana's Protected Areas Commission.

The Guianas are among the largest remaining coastal wilderness areas in the tropics. Large undeveloped extensions of shoreline remain in this region, often with unbroken rainforest leading right up to the sea's edge. This wildness is largely a blessing for turtles, because human interference is limited, but it also means that they occasionally fall victim to another predator—the jaguar.

One of the main threats to turtles throughout the Guianas, as elsewhere in the world, is bycatch from trawl, longline, and gillnet fisheries. As many as 25 percent of nesting leatherbacks in French Guiana show scars likely to have resulted from contact with fishing gear. Illegal, unreported, and unregulated fisheries activities are of particular concern, and efforts are under way to combat their effects in French Guiana and Suriname. Turtle excluder devices (TEDs) have been used by shrimp trawlers in Guyana and Suriname for more than 20 years, but they were not required in French Guiana until recently.

A collaborative fisheries research project between the French Guiana Regional Fishery and Ocean Farming Committee (CRPMEM), World Wildlife Fund, and others has looked carefully at bycatch reduction technologies for shrimp trawlers. That research has led to the development of the TTED, a trash and turtle excluder device. Beyond its role in protecting turtles, the TTED effectively minimizes injuries to other nontarget species such as sharks, rays, and other fish. At the same time, TTEDs save on fuel costs and improve the quality of shrimp catches. Building on that work, efforts are now under way to convince the European Union to tighten restrictions on shrimp imports from countries whose fisheries do not protect against sea turtle bycatch.

THE CARIBBEAN

In contrast to the wild coastline of the Guianas, the shores of Caribbean South America have seen significant human influence for more than 500 years, since those areas bore the brunt of Spanish colonization. Today, many major cities dot the shores of Venezuela and Caribbean Colombia, and nearly unbroken coastal highways flank the shores of both countries. Although nesting still occurs along South America's Caribbean coast, it has certainly been much reduced by centuries of human pressure.

CONTINUED ON P. 26

HYBRID TURTLES

Hybridization of sea turtle species is a phenomenon that has been known about for a century or more. Interspecific hybrids appear to be remarkably prevalent in Brazil and the southwestern Atlantic, where multiple species share foraging and nesting areas, and where hybrids have been documented and studied with increasing rigor since the 1990s. (Hybridization has also been recently documented in Pacific South America.)

In one study, more than 40 percent of the nesting hawksbills that were genetically sampled by scientists in Bahia, Brazil, were found to be hybrids with loggerheads or, to a lesser extent, with olive ridleys. This proportion is incredibly high when compared with studies elsewhere that exhibit top rates of about 2 percent. Juvenile loggerhead-hawksbill hybrids have also been reported from nearby Uruguay and Argentina. Another study documented loggerhead-olive ridley hybrids in 27 percent of the loggerhead nesting population that was assessed in the Brazilian state of Sergipe.

The causes of this southwestern Atlantic hybridization hotspot are not fully known, but human influences are one hypothesis. Although hybridization is a natural occurrence, it is often induced by disturbances. And human behaviors have been disturbing and creating imbalances in turtle habitats and life histories on a global scale for a prolonged period. Thus, studies of hybridization can potentially help to inform the design of conservation strategies. This region of South America is an ideal testing ground.

ABOVE: Turtles such as this loggerhead–olive ridley hybrid are not uncommon in parts of Brazil. © PROJETO TAMAR AT LEFT: An olive ridley turtle swims off the coast of Brazil. © PROJETO TAMAR

Nesting Biogeography of Sea Turtles in Northern South America [left] and Brazil [right, aggregated by state]

Caribbean Sea
Atlantic Ocean
Venezuela
Guyana
Suriname
French Guiana
Brazil
Ceará
Rio Grande do Norte
Piauí
Paraíba
Pernambuco
Alagoas
Sergipe
Bahia
Espírito Santo
Rio de Janeiro
Atlantic Ocean
N
5000 km
5000 km

Regional Management Units [Northern South America]

Regional Management Units [Brazil]

total clutches for all species combined (most recently available year)

- *greater than 5,000*
- *1,001-5,000*
- *501-1,000*
- *101-500*
- *51-100*
- *11-50*
- *1-10*
- *unquantified*

proportion species composition*

- loggerhead (*Caretta caretta*)
- *olive ridley* (*Lepidochelys olivacea*)
- hawksbill (*Eretmochelys imbricata*)
- green (*Chelonia mydas*)
- leatherback (*Dermochelys coriacea*)

country borders
Brazil state borders

main map extent

Northern South America
Brazil

loggerhead (*Caretta caretta*)
Northwest Atlantic

olive ridley (*Lepidochelys olivacea*)
West Atlantic

leatherback (*Dermochelys coriacea*)
Northwest Atlantic

hawksbill (*Eretmochelys imbricata*)
Western Caribbean

green (*Chelonia mydas*)
South Caribbean

hawksbill (*Eretmochelys imbricata*)
Southwest Atlantic

olive ridley (*Lepidochelys olivacea*)
West Atlantic

leatherback (*Dermochelys coriacea*)
Southwest Atlantic

loggerhead (*Caretta caretta*)
Southwest Atlantic

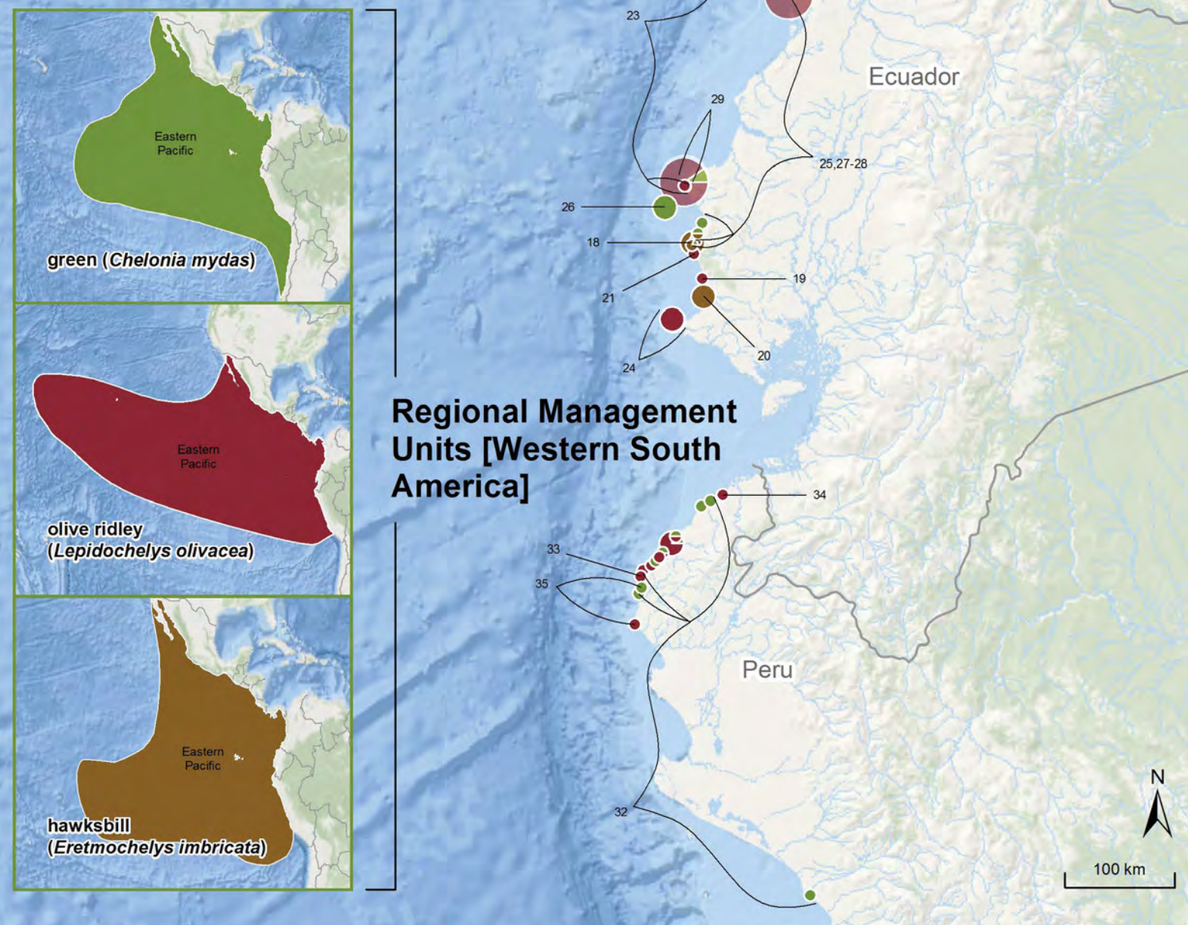
green (*Chelonia mydas*)
Southwest Atlantic

scale: 1:11,000,000 [both maps]
projection: South America Albers Equal Area Conic [left]; WGS 1984 UTM Zone 24S [right]
data: The SWOT team and reviewed literature (see end of report for citations); Ocean Basemap - Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors; Regional Management Units.
notes: species that comprise less than 5% of the clutches at nesting sites are not displayed on the map but are reflected in the data citations; data from the SWOT database greater than 10 years old are not displayed.
produced in partnership with: Oceanic Society, Duke University, and the IUCN-MTSG.

Nesting Biogeography of Sea Turtles in Western South America [left] and Caribbean Colombia [right]

scale: 1:5,250,000 [left]; 1:3,500,000 [right]
projection: UTM Zone 17 South WGS84 [left]; Colombia West Zone [right]
data: The SWOT team and reviewed literature (see end of report for citations); Ocean Basemap - Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors; Regional Management Units.
notes: species that comprise less than 5% of the clutches at nesting sites are not displayed on the map but are reflected in the data citations; data from the SWOT database greater than 10 years old are not displayed.
produced in partnership with: Oceanic Society, Duke University, and the IUCN-MTSG.

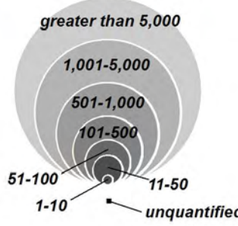
Galápagos Islands



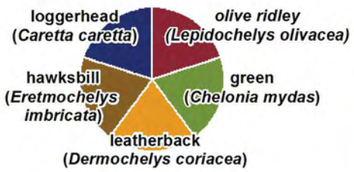
Regional Management Units [Western South America]

Regional Management Units [Caribbean Colombia]

total clutches for all species combined (most recently available year)

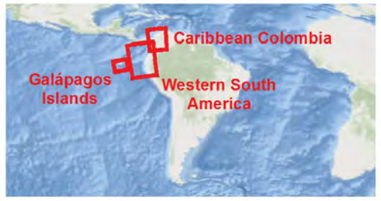


proportion species composition*

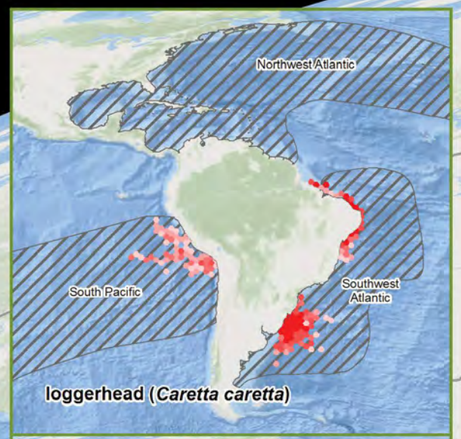


— country borders

main map extents



Sea Turtle Satellite Telemetry Data Originating in South America



loggerhead (*Caretta caretta*)

green (*Chelonia mydas*)

leatherback (*Dermochelys coriacea*)

hawksbill (*Eretmochelys imbricata*)

olive ridley (*Lepidochelys olivacea*)

Telemetry Data and Regional Management Units for Individual Species

Caribbean Sea
Pacific Ocean
Atlantic Ocean
Venezuela
Guyana
Colombia
Suriname
French Guiana
Ecuador
Brazil
Peru
Chile
Uruguay
Argentina

N

1000 km

scale: 1:37,000,000 **projection**: South America Albers Equal Area Conic
data: The SWOT team and reviewed literature (see p. 48 for citations); Ocean Basemap - Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors.
notes: Polygons are colored by the number of locations and the combination of species present. The maximum number of points in a polygon for each combination is given at the bottom of each color series. Bins were determined by splitting the count data into quintiles. This map is not intended to be a comprehensive representation of all telemetry data for South America or an authoritative source for the studies cited.
produced in partnership with: Oceanic Society, Duke University, and the IUCN-MTSG

telemetry color guide:
Cc - *Caretta caretta*
Cm - *Chelonia mydas*
Dc - *Dermochelys coriacea*
Ei - *Eretmochelys imbricata*
Lo - *Lepidochelys olivacea*

country borders
nesting sites
regional management units

single species — species combinations

low

high

Cc	Cm	Dc	Ei	Lo	Cc & Cm	Cc & Dc	Cc & Ei	Cc & Lo	Cm & Dc	Cm & Ei	Cm & Lo	Dc & Ei	Dc & Lo	Ei & Lo	3 species	4 species
3.4k	190	906	1.1k	373	31	3.6k	123	0	150	174	2.0k	1.1k	643	409	6.6k	2.2k

For instance, what was once a robust colony of nesting loggerheads (called *tortuga gogó* locally) that stretched from Colombia's Guajira Peninsula east into Venezuela is now reduced to only rare sightings. Hawksbills, which tend to nest on isolated beaches and in small numbers, still visit the region, but sadly they are widely harvested for their shells. Jewelry, trinkets, and cockfighting spurs made from hawksbill shell are still sold on the streets of Cartagena and elsewhere.

Until the 1990s, a turtle slaughterhouse was in full operation in Riohacha, Colombia. Its proprietress, the iconic Doña Fefa, sourced green turtles from more than a 100-mile radius (160-kilometer) and rendered them into meat, oil, and *chicharrón* (cracklings) for a local market. She reportedly wore a necklace of University of Florida flipper tags that had been originally affixed to green turtles in Tortuguero, Costa Rica, before they were caught in fishermen's nets in Colombia as they made their way to distant foraging grounds. Today, Conservation International–Colombia is working with Wayuu indigenous inhabitants in this region to monitor and protect turtles on the Guajira Peninsula, and the infamous slaughterhouse has been shuttered.

The leatherback is faring much better in this region, with a large nesting colony in the Gulf of Urabá, Colombia, and in nearby Armila, Panama. This leatherback colony is one of the largest in the greater Caribbean. Moderately sized nesting colonies also occur at a variety of sites in Venezuela. Leatherbacks that nest in Colombia and Panama migrate all the way to Canada, similar to the Guianas leatherback colony. In one case, a female named Red Rockette, who had been tagged with a transmitter in Canada months earlier, nested at Bobalito Beach in Colombia. When the transmitter was recovered and returned, it provided Canadian researchers with a treasure trove of data on Atlantic leatherback migrations.

In addition, Colombian NGOs and universities, including the Fundación Mamá Basilia and the JUSTSEA Foundation, have monitored leatherbacks at nearby Playona Beach since 2000. Those efforts contributed to the declaration of La Playona as a wildlife sanctuary in 2013.

The green turtle, despite its many threats in the Caribbean, is perhaps the most notable success story in this region. Foraging green turtles from rookeries in Aves Island, Venezuela; Tortuguero, Costa Rica; Mexico; and Panama are still abundant in those waters. Tiny Aves Island, located 670 km (416 mi) north of the Venezuelan mainland, is one of the most significant green turtle nesting sites in the hemisphere. Notwithstanding its extremely small size, the green turtle population nesting on Aves Island has doubled in just 30 years, to more than 1,000 nesting turtles per year. Green turtles on Aves have been protected since 1972, and they have been monitored for decades by researchers from the NGO FUDENA (*Fundación para la Defensa de la Naturaleza*), the Ministry of Environment and Natural Resources, and the Venezuelan Institute of Scientific Research.

Aves Island is a great example of how long-term conservation at nesting grounds can result in population recovery. Aves Island green turtles are believed to be a distinct and demographically isolated colony, and one where a curiously high number (hundreds) of breeding male turtles are typically present with breeding females. Curiously, when compared with other large rookeries, Aves Island adult females show a lower survival rate, thus suggesting exposure to high mortality outside of their nesting ground. Those findings highlight the need for conservationists to look beyond the nesting beach in designing management programs.

Sea turtle conservation and research have been growing in the region over the past decade. Venezuelan conservationists have taken important steps to (a) study the demography, genetics, ecology, foraging habitat use, and health of green turtles; (b) stem the loss of leatherback habitats; and (c) better understand the effects of bycatch. In Colombia, government authorities and NGOs also are investing in research and recovery efforts, and a new generation of researchers and conservationists is leading the charge.

THE PACIFIC

The sea turtle nesting beaches of Pacific South America form a gently reversed S-shaped coastline of rocky shore, mangrove swamps, sandy beaches, coastal promontories, inlets, and bays nearly 3,000 km (1,864 mi) long. In the north, the beaches lie alongside the planet's wettest and richest rainforests in the Colombian Chocó. After snaking south past rainforests, they transition to mangroves and dry forests in southern Ecuador and northern Peru. Well beyond the southernmost nesting beaches, turtles are found at sea for nearly the full length of Chile, and they frequent many of the offshore islands, such as Gorgona and Malpelo, Colombia; the Galápagos and Isla de la Plata, Ecuador; Lobos de Tierra, Peru; and distant Easter Island (Rapa Nui), Chile.

The Pacific coast abuts a vast tapestry of human development that ranges in scale from sparsely inhabited patches of virgin rainforest, to small towns and resorts along coastal highways, to swaths of shrimp farms built atop razed mangroves, to major coastal cities like Guayaquil and Lima. As on the rest of the continent, Pacific turtles are plagued by habitat degradation, fisheries bycatch, pollution, and the growing effects of climate change.

Olive ridley, green, hawksbill, and occasional leatherback turtles nest and feed along these shores. Leatherbacks from nesting colonies in Mexico and Central America, as well as young loggerheads from Australia, forage in the cold waters of the offshore Humboldt and South Equatorial Currents. Olive ridleys and green turtles are common on this side of the continent, and their populations are generally healthy, whereas leatherbacks, loggerheads, and hawksbills are rarer. The Eastern Pacific leatherback and hawksbill and the North Pacific loggerhead RMUs are among the most threatened on Earth (see *SWOT Report*, vol. VII, pp. 22–23).

In Pacific Colombia, researchers working toward temporal and spatial fishery closures and other protective measures have begun to analyze how turtles at sea use space for foraging and migration. Circle hooks have been introduced to diminish the effects of longline bycatch in the states of Chocó and Nariño. And in 2003, efforts were spearheaded to open new markets throughout Colombia for sustainably harvested and turtle-safe seafood.

Because of its remote location—1,000 km (620 mi) off the mainland—and the unique confluence of warm and cold waters, Ecuador's Galápagos Archipelago is as unique an environment for sea turtles as it is for all of its other native flora and fauna. The Galápagos is also a conservation success story for the local population of green (known locally as "black") turtles that are part of a long-monitored and protected RMU that includes nesters from Michoacán, Mexico.

In contrast, continental Ecuador has seen a construction boom caused by the success of Ecuador's main export, petroleum. That success has fueled uncontrolled development of beach homes, hotels, and boardwalks and has created threats to nesting turtles. In response, a young NGO, *Equilibrio Azul* (Blue Equilibrium), has been conducting sea turtle research, monitoring, and conservation projects on nesting green (black), hawksbill, and olive ridley turtles. Its work focuses on the protection of nests from feral animals and rising sea levels and on getting the word out about the importance of sea turtle conservation in Ecuador. The group is also helping Ecuador's government comply with its own laws—including enforcing the mandatory use of TEDs and honoring the regulations in Marine Protected Areas.

Peruvian waters are a foraging ground for green (black) turtles from the Galápagos and Mexico, young loggerheads from Australia, and leatherbacks from Costa Rica. Intensive fisheries, a major source of Peru's gross national product, unfortunately generate high bycatch of the foraging sea turtles in nets, longlines, and trawls.

Peru is also home to the southernmost nesting colonies of green (black) and olive ridley turtles in the American Pacific. This observation is a recent phenomenon. Although single olive ridley nests were documented in 1979 and in 1992, sea turtles were not known to nest in Peru until 2000. Since then, the NGO ecOceánica has found that nesting olive ridleys are on the rise and are seemingly moving southward. The first green turtle nest in Peru was seen in 2010, a range extension for that species. A second green turtle nest, in 2013, extended the species' nesting range even further. Whether those occurrences are in response to changes in global climate, to growth in turtle populations, to a loss of suitable habitat elsewhere, or merely to better monitoring is still unknown. But in this area of rapid coastal development, such an expansion creates new management challenges for the region.

Chile is the southernmost range of turtles at sea in the American Pacific. And greens, loggerheads, leatherbacks, and olive ridleys are found near shore, with the occasional hawksbill on offshore islands. Given the importance of the country's fisheries sector, bycatch effects on turtles are high in Chile. Pollution is also a problem because of runoff from large-scale mining, another of Chile's main industries. Both fisheries bycatch and pollution could be responsible for the high numbers of stranded turtles found along Chile's long coastline (see inset box above), though the exact causes are unknown. Unfortunately, Chile lacks strong protective legislation for turtles, apart from a poorly enforced 1995 ban on extraction of vertebrates. However, efforts to establish a protected area in Arica and another in the Atacama Region are under way. Those two important sanctuaries will help to protect important marine habitats for the southernmost foraging ground for greens in the entire Pacific. ■

STRANDINGS IN SOUTHERN SOUTH AMERICA

Dead, injured, or sick sea turtles often wash up on beaches or in shallow water around the world. In some places, elaborate networks of citizen scientists collaborate to gather data that help build a more concise understanding of threats, both natural and human induced. In addition, dead turtles offer a rare opportunity to learn about sea turtle biology, pathology, and much more. Understanding the species, age classes, and genders of sea turtles that wash ashore—in relation to where and when—can help researchers describe turtle biogeography. Those data also reveal the intensities and seasonality of threats such as fisheries bycatch, boat strikes, disease, and cold stunning.

Long-term studies of marine turtle strandings in South America have provided an essential baseline for broadly understanding threats in foraging areas. At a local level, such studies are also very important in raising awareness among stakeholders and engaging communities in the hands-on aspects of sea turtle research and conservation. In Uruguay, marine turtle stranding data have been collected since 1999 by the NGO Karumbé. The group's 24-hour hotline and e-mail notification system for citizen scientists has been augmented since 2003 by systematic weekly beach surveys.

In Argentina, nine public and private institutions collaborate to manage the PRICTMA (*Programa Regional de Investigación y Conservación de Tortugas Marinas de Argentina*) Stranding Network, which gathers and manages data about turtles that wash ashore in the province of Buenos Aires. The program engages local residents, tourists, fishermen, lifeguards, park rangers, the Coast Guard, and others. In Chile, a local NGO, Qarapara Tortugas Marinas Chile, created the first national stranding database in 2014. The group populated it with records going back to 1990 about strandings of the four species found in that country. The NGO is now building a national stranding network.

This map shows stranding data from the South American countries where no sea turtle nesting occurs, but where turtles occur as migrants and foragers only. Most sea turtle nesting countries in South America also manage national and local stranding networks and databases (including Peru and Brazil). This map helps to demonstrate what happens in those temperate waters well south of where turtles would be expected to occur for nesting. It also shows the southernmost latitudinal ranges of such species in South America. Argentina data used here are annual averages for 2003–2014, summarized by region. For Chile, data show strandings from 1990–2015, by beach, and exclude Easter Island data. The Uruguay data are shown as annual averages for 2003–2012, summarized by region. Hawksbill strandings have also been documented in Uruguay (13 in total), but these are not displayed on the map. The stranding data for this map were provided by Karumbé (Uruguay), PRICTMA (Argentina), and Qarapara Tortugas Marinas (Chile).