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The State of the World's Sea Turtles

特集：日本のウミガメ

SPECIAL FEATURE

Japan

INSIDE: PACIFIC LOGGERHEADS | FRENCH TERRITORIES | BYCATCH SOLUTIONS | AND MORE …

The **Pacific Loggerhead**, So Excellent a Connector

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It has been 20 years since the satellite track of Adelita hit the mainstream media and newly birthed internet, sharing the real-time migration of a loggerhead sea turtle from Baja California, Mexico to Japan with millions of people worldwide. Captured in Mexico's Gulf of California as a small juvenile and reared in captivity for more than a decade, Adelita couldn't wait to return home once released. Up to that point, nobody could have imagined that a turtle could swim more than 11,500 kilometers (7,145 miles) in only 368 days.

Satellite telemetry was still in its early years, and having a track of this magnitude highlighted the value of this technology for visualizing ocean connectivity and for revealing obscure aspects of sea turtle life histories. Moreover, Adelita became a *spokesturtle*, showing the world just how magnificent Pacific loggerheads could be. In fact, hers was the first track of *any* animal swimming across *any* ocean, and the simplicity of that remarkably straight path slicing across the vast Pacific was inspiring. Adelita not only demonstrated the value of satellite telemetry for understanding sea turtles; her odyssey also reminded conservationists of the power of using captivating animal stories to create enthusiasm among local and international audiences through media, children's books, and more. Her name was Adelita—not tag #07667—and she became one of the world's most famous living sea turtles.

Today, Pacific loggerheads are by far the most satellite-tracked creatures on Earth. Nearly 400 loggerheads have been followed in the North Pacific using satellites since Adelita's maiden track, and at least 200 more have been tracked in the South Pacific. We now have a stunning map resembling a network of crisscrossed circuits connecting the furthest stretches of the eastern and western North Pacific—a level of connectivity rarely observed in the natural world—as well as a huge swath of loggerhead tracks on both sides of the South Pacific (see pp. 16–17). This map is derived from the largest collection of Pacific loggerhead tracks ever assembled, and, when combined with overlays of oceanography and fisheries data, the priority areas for conservation action nearly leap off the screen.

The Pacific is the largest, most dynamic ocean basin in the world, and that makes the migrations of these turtles so amazing. From the time hatchling loggerheads depart nesting beaches in Japan, Australia, and New Caledonia to some 30 years later when they return as adults, each individual will have traveled tens of thousands of kilometers, interacting with countless habitats and dodging myriad human threats. From east to west, the Pacific stretches roughly 17,000 kilometers (10,563 miles) at its widest. It's an enigmatic sea: its submarine trenches are deeper (10,994 meters/36,069 feet) than the highest mountains. The Kuroshio Current off Japan can rage at nearly 11 kmph (7 mph). And in the abnormally cold eastern tropical equatorial waters, penguins swim with green turtles and iguanas. Taking this all in helps us understand the fascinating story of Pacific loggerheads.

There are two distinct loggerhead populations in the Pacific: (1) a northern group that nests almost exclusively in Japan, with many young traversing the North Pacific to U.S. and Mexican waters, and (2) a southern group that nests in Australia and New Caledonia and spans the South Pacific all the way to Peru and Chile. These two populations mirror each other across the equator. During the 1970s and 1980s, Pacific loggerheads in both hemispheres were declining fast because of threats on nesting beaches and in the sea. The conservation outlook was very bleak for both populations, and by the 1990s some scientists were forecasting that they would be functionally extinct within less than one human lifetime.

The alarming declines in annual loggerhead nesting throughout the western Pacific put conservation biologists on red alert, and both the eastern and western Pacific populations became the focus of important research and conservation efforts. Pioneers such as George Balazs, Jeffrey Polovina, and Don Kobayashi began studying loggerheads in the open ocean, while others such as Colin Limpus and Naoki Kamezaki were expanding protection on nesting beaches and in coastal foraging areas and conducting massive flipper-tagging and recapture programs. Later, Brian Bowen, Alberto Abreu-Grobois, Peter Dutton, and Michelle Boyle began to establish the east-west genetic links for loggerheads on both sides of the equator. The combined work of these early luminaries built a foundation of biological information that revealed the population structures of the North and South Pacific loggerhead subpopulations long before satellite telemetry studies provided indisputable proof of transoceanic migrations.

Significant progress has been made in understanding the ecology and movements of loggerheads in the northern and southern hemispheres since, but each question answered seems to yield a dozen more. What proportion of turtles in the North Pacific eventually makes it from Japan to Mexico's Baja California Peninsula? What is the age of maturity for loggerheads in the Pacific, and is it different in the north and south? Why has the return of subadult loggerhead turtles to coastal habitats of the southwest Pacific declined markedly over the past two decades? Why do adult loggerheads in the North Pacific feed in both oceanic and coastal habitats whereas those in the South Pacific are almost all coastal foragers? Is ingestion of plastic debris an important threat for juvenile loggerheads? What is the impact on loggerheads of illegal, unreported, and unregulated (IUU) fishing in the high seas? How will climate change affect nesting beaches and sex ratios of emerging hatchlings?

We don't have all the answers, but it's clear that the more we look, the more we learn. For example, new discoveries in the eastern North Pacific have revealed that loggerheads are present in a wider range of areas than previously known. They occur in the tens of thousands along the U.S. coast of southern California during El Niño periods, and they gather in the Gulf of California more than we knew just a few years ago. Long-term tracking of individual loggerheads in Australia has also revealed that they mature later and live longer than we realized. And, to the north in Japan, research has shown that the environment within which loggerheads forage can dramatically affect their size and reproductive outputs.

There is still much to learn about Pacific loggerhead biology, and many hurdles remain for their conservation. Clearly a huge challenge to their survival is bycatch mortality in fisheries. Given their delayed maturity, their transpacific movements, and the fact that fishing occurs almost everywhere, it is a near certainty that huge numbers of turtles will interact with fishing gear during their lives. But what then is their probability of survival? Intuition would suggest that it's low, but recent research has shed a sobering light on just how low survivorship can be. For example, the Gulf of Ulloa along the Pacific coast of

A loggerhead turtle that has been seen for three consecutive years on the same reef patch off the shores of Amami-Oshima, Japan. © KATSUKI OKI; PREVIOUS SPREAD: A barnacle-encrusted loggerhead exhales as it surfaces off the coast of Baja California Sur, Mexico. © WEDGE CREATIVE I WEDGECREATIVE.COM

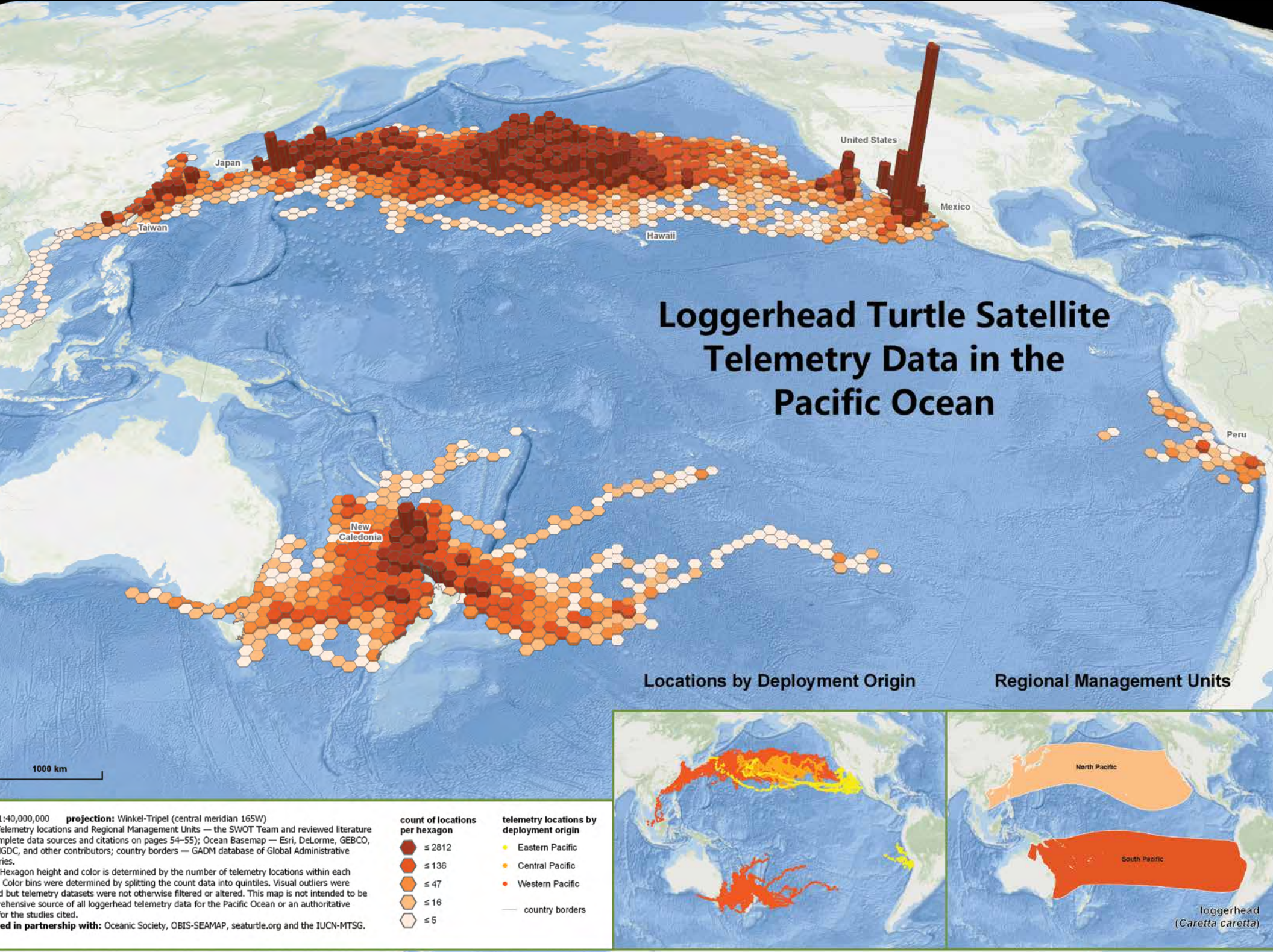
the Baja California Peninsula is the site of the highest bycatch mortality rates among artisanal fisheries worldwide (see *SWOT Report*, vol. III, p. 14). Today, the predicted survivorship of loggerheads spending more than 20 years in that area is less than 10 percent, emphasizing the urgent need for conservation measures.

Thankfully, several bright spots appear in this literal sea of bycatch. The use of circle hooks in place of J hooks is a perfect example; whereas circle hooks don't always stop turtles from interacting with hooks, they can lower mortality among turtles by reducing the incidence of deep hooking. Illuminating gillnets with LEDs has proven to reduce turtle bycatch by more than 60 percent in Peru. And in the South Pacific, the compulsory use of turtle excluder devices has coincided with an increase of nesting females at index beaches. In the North Pacific, TurtleWatch—a mapping tool that integrates fisheries effort and loggerhead habitat preferences to give real-time estimates of loggerhead hotspots (see *SWOT Report*, vol. IV, pp. 36–37)—has improved predictive abilities and allowed fishers to avoid bycatch in the Hawaii-based longline fisheries. Those are just a few of the many technological advances in bycatch reduction that most fishers are eager to adopt, because they too look to minimize interactions with turtles that can ruin their gear and slow their operations.

Assuring the success of these new technologies requires broad scale buy-in from stakeholders. North Pacific loggerheads may traverse the waters of three or more nations during their lives, and their South Pacific counterparts may pass through a dozen or more countries and territories. This fact has sparked several important cross-border management alliances. The North Pacific Loggerhead Trinational Recovery Team, for instance, brings together policymakers from Japan, Mexico, and the United States to manage a multinational conservation action plan. The Convention on Migratory Species plays a similar role among the South Pacific nations of Australia, Chile, Ecuador, Fiji, New Caledonia, Peru, and Tonga.

Of course, much conservation *planning* occurs at the state, national, and international levels, but a significant amount of conservation action occurs at the community level. Local support is built through field-based collaboration, trust building, artful leadership, and the often-slow shifting of narratives and paradigms. In eastern Australia, for example, more than 50,000 loggerhead hatchlings enter the sea, in addition to those from in situ nests, thanks to hundreds of trained volunteers who rescue doomed eggs and relocate them to safer sand following protocols from the Queensland Department of Environment and Heritage Protection. In Peru, the nonprofit ProDelphinus has used high-frequency (HF) radio to connect Peruvian fishers at sea with biologists on shore to promote the safe release of turtles and to gather and share information on turtle captures (see *SWOT Report,* vol. VII, p. 15). And an international fisher exchange program between Japan, Mexico, and Hawaii led to conservation breakthroughs in Baja California, Mexico, where one major fishing cooperative retired its bottom-set longline gear to adopt adopt bycatch-free fishing methods, thus sparing hundreds of turtles. In Japan, a similar exchange resulted in fishers teaming with scientists to develop turtle-friendly pound nets (see *SWOT Report*, vol. VII, pp. 16–17).

We are at an exciting time in the history of Pacific loggerhead research and conservation. The wealth of new knowledge and early signs of population increases at the nesting beaches after decades of decline are extremely encouraging. These gains can be attributed to a combination of (1) long-term indefatigable nesting beach protection by locals; (2) at-sea efforts led by policymakers and implemented by countless fishers who work the nets and longlines in more than a dozen Pacific countries; and (3) the goodwill and commitment of hundreds of nonprofits, communities, and individuals who care about the future of loggerheads and the health of their habitats. From individuals to organizations to nations, we've seen countless examples of people uniting to study and save this species. ¡Viva Adelita! ■



1:40,000,000 **projection:** Winkel-Tripel (central meridian 165W)
elemetry locations and Regional Management Units — the SWOT Team and reviewed literature
mplete data sources and citations on pages 54–55); Ocean Basemap — Esri, DeLorme, GEBCO,
GDC, and other contributors; country borders — GADM database of Global Administrative
ries.
Hexagon height and color is determined by the number of telemetry locations within each
Color bins were determined by splitting the count data into quintiles. Visual outliers were
d but telemetry datasets were not otherwise filtered or altered. This map is not intended to be
rehensive source of all loggerhead telemetry data for the Pacific Ocean or an authoritative
or the studies cited.
ed in partnership with: Oceanic Society, OBIS-SEAMAP, seaturtle.org and the IUCN-MTSG.

count of locations per hexagon
- ≤ 2812
- ≤ 136
- ≤ 47
- ≤ 16
- ≤ 5

telemetry locations by deployment origin
- Eastern Pacific
- Central Pacific
- Western Pacific

country borders