OCEANA | Protecting The World's Oceans

Forging a Future for

Pacific Sea Turtles

Pacific sea turtles

tell us a story about our ocean world…

Pacific sea turtles connect the human and the ocean worlds. Turtles show us that although the ocean seems endless and vast, its diversity and vulnerability is concentrated in focused, identifiable areas. After surviving over 100 million years, we are watching these ancient reptiles go extinct as a result of humans' inability to understand them and adequately protect them. Many people are overwhelmed by the thought of conserving a species that migrates across vast oceans given the gauntlet of threats turtles face. Yet turtles act as ocean ambassadors, introducing us to ideal ocean currents, nutrient upwellings, and hotspots for a host of highly migratory species. If we can protect key turtle habitats, we will also be protecting hundreds of other species like whales, dolphins, seals and sea lions, seabirds, fish, and living habitat. The plight of sea turtles demands a global cooperative effort integrating fisheries management, coastal land use, and nesting beach protection. Often referred to as "flagship" species, sea turtles require a conservation plan that connects all parts of the ocean ecosystem. By learning to protect sea turtles, we can prevent the extinction of these modern dinosaurs and pave the way for a new era of open ocean ecosystem conservation.

Sea turtles need our help

If current trends continue, leatherback and loggerhead sea turtles will probably go extinct in the Pacific in our lifetime. Eastern Pacific hawksbills are likely past the point of no return, while green turtles and olive Ridleys are at a fraction of their former populations. The turtle decline is clear evidence that human activities are causing loss of biodiversity on our planet. If we choose to save Pacific sea turtles, we must confront the challenges of international industrial fishing, widespread small-scale fisheries, traditional harvesting of turtles, illegal poaching markets, and our irresponsible use of plastics. If we succeed, sea turtles will unite people from different cultures across the world in a shared vision for conservation on planet Earth.

An adult loggerhead flies through coastal waters.
Photo: Steve Griffin, smugmug.com

Pacific leatherbacks emerge from their nest.
Photo: Suzanne R. Livingstone, University of Glasgow

We must act now

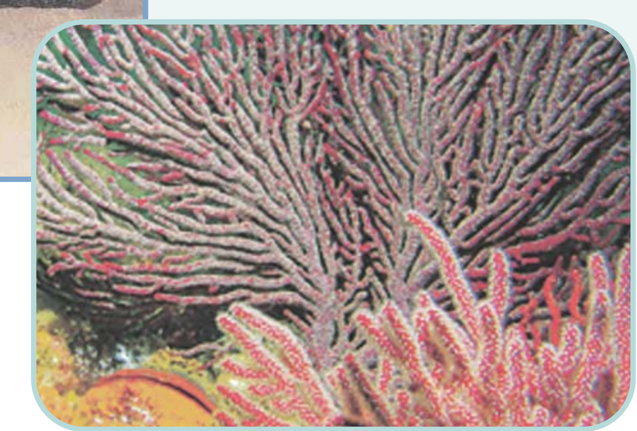
Many sea turtle populations are so depleted that further loss may be irreversible. All five species of Pacific sea turtles are listed in the IUCN Red List as Critically Endangered, Endangered or Vulnerable, and all marine turtles are included in Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). Some species are doing better than others, but they are all at mere fractions of former population sizes. For most of their lives, sea turtles are extremely difficult to census. While female turtles arriving at beaches to nest are relatively easy to count, males and juveniles do not go ashore. As a consequence, good population estimates do not exist for sea turtles. However, one thing is certain: all turtle species are in trouble.

Parallels between sea turtles and deep sea corals

At first glance, deep sea corals and sea turtles seem nothing alike. Deep sea corals provided a compelling story about the effects of destructive bottom trawling on the seafloor, leading to recent large-scale closures on the U.S. Pacific Coast. However, just as deep sea corals and sponges have paved the way for recent seafloor conservation measures in the Pacific (Shester and Warrenchuk 2007, Roberts and Hirshfield 2004), sea turtles demonstrate the need for open-ocean conservation for many of the same reasons.

Both deep sea corals and sea turtles are long-lived and particularly sensitive to fishing impacts due to their inherent biological characteristics. They also tend to aggregate in specific hotspots, indicating important ecological areas of the ocean that can be targeted in conservation efforts. Ironically, the ocean's most sedentary species and migratory species both tell us the same message: if we can target protections to specific, localized hotspot areas, we can meet conservation goals while maintaining vibrant fisheries.

Nesting adult female leatherback.
Photo: Herda Pamela Hutabarat

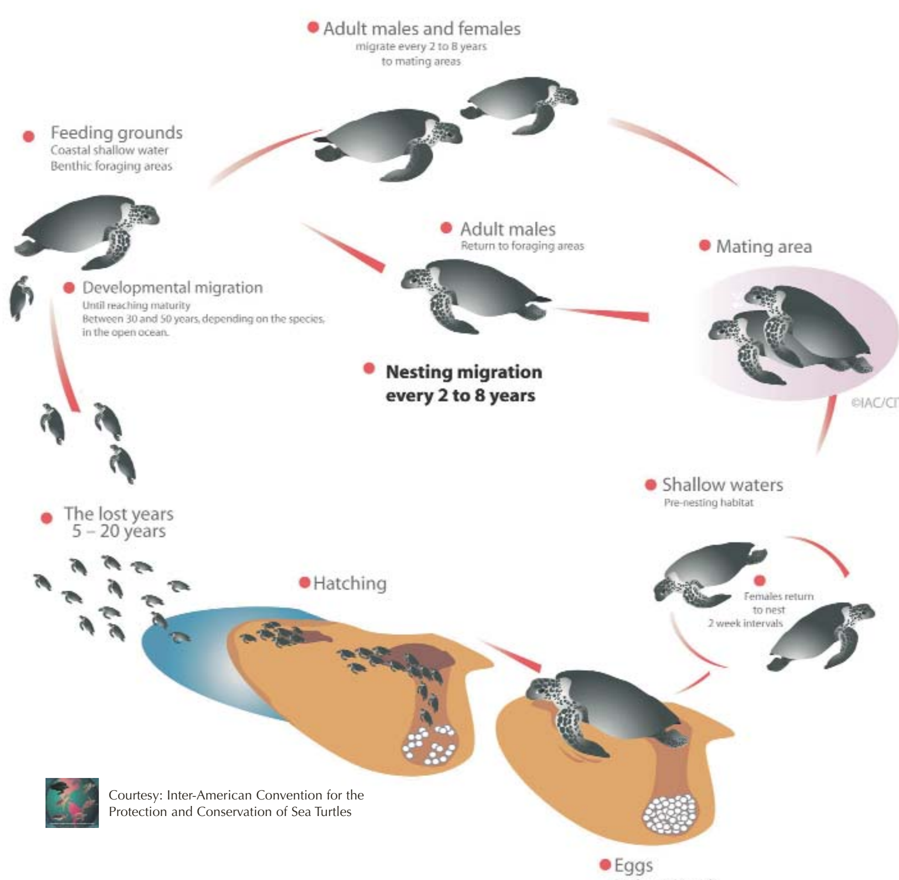


Cold-water gorgonian corals off Baja California.
Photo: Geoff Shester.

Sea turtles from eggs to adults

Due to sea turtles' life history, their conservation requires an integrated, transboundary approach. Sea turtles begin their lives as eggs buried by their mothers on a sandy beach. After 45-70 days of incubation, baby sea turtles emerge from their sandy nests and immediately head for the ocean. Juveniles journey across ocean basins sometimes swimming against currents, in search of productive feeding grounds that may be close to shore or far off on the high seas. We know very little about what sea turtles do as juveniles, leading some researchers to dub this time as the "lost years." Young adults move through coastal areas and migrate thousands of miles to feed in open-ocean pelagic waters in search of oceanic fronts, upwelling zones, and eddies where their food is concentrated. After mating, adult females often cross ocean basins back to their original nesting beaches to lay eggs and renew the cycle. They are excellent navigators, able to sense minute variations in the Earth's magnetic field. The chances of surviving to adulthood are extremely low, so turtles lay many eggs to ensure that some survive. This means that large juvenile and adult mortality can have a major impact on population growth and recovery (MTSG 1995; Crouse et al. 1987). For this reason, the conservation of eggs and hatchlings is a prerequisite to conservation, though populations will not recover unless large turtles are protected at sea (MTSC 1995).

Pacific leatherback feeding on a stinging jellyfish off the coast of San Francisco.
Photo: Thomas Literal



Courtesy: Inter-American Convention for the Protection and Conservation of Sea Turtles

Ecological roles of sea turtles

Aside from the wonder that turtles instill in us, they also play important ecological roles. Now at fractions of their historical populations, we may never know how sea turtles' disappearance has changed marine ecosystems (Bjorndal and Jackson 2003). Green turtles grazing on seagrass actually increase the productivity and nutrient content of the beds, thus benefiting other species (MTSG 2003). Some populations of turtles play an important role in nutrient transport, bringing substantial quantities of nutrients from feeding areas to nutrient-poor coastal habitats near nesting beaches (Bjorndal and Jackson 2003, MTSG 2003). By eating sponges, hawksbills keep the balance of sponges and corals on reefs. These turtles thus play a unique role in coral reef systems throughout the tropics (Meylan 1988, Bjorndal and Jackson 2003). Leatherbacks primarily eat jellyfish, and may prevent jellyfish "blooms" which harm other sea life including commercial fish larvae (Gulko and Eckert 2003). Given the variety of functions sea turtles play, we must restore these populations to provide for healthy marine ecosystems.

Leatherback sea turtles

(Dermochelys coriacea) are the sole species in the scientific family Dermochelyidae, completely different than all other sea turtles. Leatherbacks have a soft, leathery shell and a suite of adaptations allowing them to survive in colder temperatures and dive deeper. Leatherbacks have the largest range of any living reptile, from the North Atlantic to the South Pacific (PFMC and NMFS 2006). Leatherback muscles function at a wide range of temperatures. Scientists are studying this phenomenon in hopes of finding a cure for degenerative muscle diseases. Their adaptations to cold water, collectively called "gigantothermy," are believed to be a common trait sea turtles had with dinosaurs, and explains their wide geographic ranges. Leatherback turtles vie with the saltwater crocodile *(Crocodylus porosus)* as the largest living reptiles on Earth, growing up to 9 feet long and weighing over one ton (Safina 2006).

"The Pacific [leatherback] population is so low now that killing any turtle makes a difference."
Peter Dutton, NMFS (quoted in Safina 2006)

Since 1980, leatherbacks have declined by 95% at their major Pacific nesting beaches (NMFS and USFWS 1998, Crowder 2000, Spotila et al. 2000). If current trends continue, Pacific leatherbacks will go extinct within the next few decades (Spotila et al. 2000), and there is a 50% chance they will be gone within 11-12 years (Crowder pers. comm. 2006). Scientists and conservationists alike consider the plight of Pacific leatherbacks the topmost issue in sea turtle conservation today (SWoT 2006).

Pacific leatherbacks are split into two genetically distinct Eastern and Western populations, (Dutton 2006). The total remaining Pacific population is estimated to be 160,000 (Lewison et al. 2004), yet as few as 875 to 2,000 females nest annually at 25 sites in the Western Pacific (NMFS 2006).

One of the most significant nesting areas for the Western Pacific population, in Terengganu, Malaysia, has essentially been eradicated (PFMC and NMFS 2006). The Western stock's only major nesting areas are on Jamursba Medi and War-Mon beaches on the Bird's Head Peninsula in Papua, Indonesia. Even at these beaches, leatherback nesting has declined significantly since the 1970s (NMFS 2006). Enforced nest protections have been in place at these beaches since 1992, though there have been no signs of recovery. All leatherbacks that swim off the U.S. West Coast have crossed the ocean from Indonesia to feed on rich aggregations of jellyfish (see centerfold map).

"Bold measures are necessary. At this point the survival of each Pacific [leatherback] turtle counts."
Larry Crowder, Duke University
(www.sciencedaily.com)

Since 2000, leatherback populations at all major Mexican nesting beaches have completely crashed (NMFS 2006). The single major nesting beach left for the Eastern Pacific stock is at Las Baulas National Park, Costa Rica. Adults from this stock migrate south through the Galapagos to feeding sites throughout the southeast Pacific off South America (see centerfold map). Efforts by the Leatherback Trust have dramatically increased nesting success here through turtle ecotourism, education efforts, and beach conservation, though the population has not shown signs of recovery. For more, visit www.Leatherback.org.

"We don't need to study this problem to learn how much bycatch there is. We already know the Leatherbacks are declining fast, so the goal is no dead Leatherbacks."
Martin Hall, IATTC (quoted in Safina 2006)

Adult leatherback sea turtle swimming.
Photo: SeaTurtles.org

Adult leatherback sea turtle nesting on beach.
Photo: Smithsonian Museum

Leatherback hatchling swimming.
Photo: Suzanne R. Livingstone, University of Glasgow

Loggerhead sea turtles

(Caretta caretta) are found in the Atlantic, Pacific, and Indian Oceans. In the Eastern Pacific they range from Alaska to Chile, and are known to migrate 10,000 miles from nesting beaches in Japan to Baja California Sur where they feed on dense aggregations of pelagic red crabs (Nichols et al. 2000; Pitman 1990). Pacific loggerheads nest primarily in Japan and Australia, with minor nesting in some south Pacific Islands. Like Pacific salmon, Japanese loggerheads are genetically distinct nesting colonies and females nest at the same beaches on which they were born (Hatase et al. 2002). South Pacific nesting is concentrated in Eastern Australia, though some limited nesting occurs in New Caledonia, Vanuatu, and other Pacific Island nations (Limpus and Limpus 2003). Loggerheads typically do not reproduce until they reach 30 years old (Crowder pers. comm. 2006).

Pacific loggerheads have declined 80-86% over the last 15 years (Kamezaki et al. 2003, Limpus and Limpus 2003). Nesting beaches in Australia have declined 86% in one generation and there are now fewer than 500 females nesting there each year. The total population of Pacific loggerheads is estimated to be 335,000, yet only about 1,500 of these are nesting females (Lewison et al. 2004, Kamezaki et al. 2003). Given current trends, there is a 50% chance that loggerheads will be extinct in the Pacific Ocean within 60 years (Crowder pers. comm. 2006).

Green sea turtles in nearshore reef habitats off Kona, Hawaii. Photo: Geoff Shester

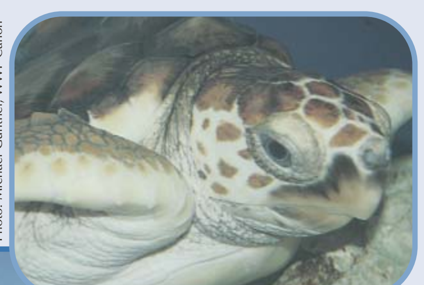


Photo: Michael Gunther, WWF-Canon

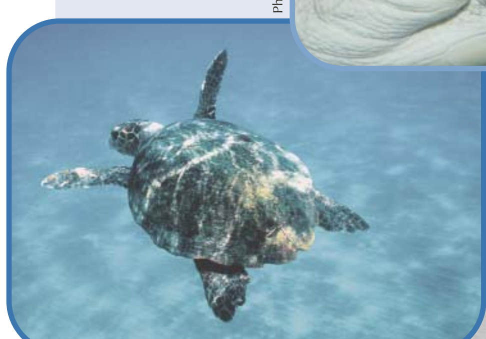


Photo: US Fish and Wildlife Service

Photo: Geoff Shester

Stranded loggerhead sea turtle off the Pacific Coast of Baja California Sur. Bycatch in local fisheries is the main source of mortality on Baja California beaches (Koch et al. 2006).

Green sea turtles

(*Chelonias mydas*) have declined globally from 34 to 80 percent over the last 150 years (Seminoff 2002, NMSF 2006). Green turtles reach sexual maturity at 25 to 50 years old (Chaloupka 1997, Zug et al. 2002). In the Pacific, there are two subspecies, the black turtle *(C. mydas agassizii*) and the green turtle *(C. mydas mydas*).

Breeding populations of black turtles off Mexico are listed as endangered under the Endangered Species Act. In the 1980s, black turtles at their major nesting beach, Colola Beach in Michoacán, Mexico, declined significantly from 5,500 nesting females to a low of 171. The population is now increasing, though numbers are still well below their natural levels (Alvarado-Diaz and Trejo 2003).

The other subspecies, green turtles range from Hawaii throughout the Western Pacific. In Hawaii, green turtles nest on six small islands called French Frigate Shoals (Balazs 1995). Following many years of exploitation, recent conservation actions have allowed Hawaiian nesting populations to gradually increase. This provides hope that if we take the right actions today, sea turtles may have a future in the Pacific (Balazs and Chaloupka 2003).

Olive Ridley sea turtles

(*Lepidochelys olivacea*) are regarded as the world's most abundant sea turtle, though they have declined significantly from their historic population of 10 million in the Eastern Pacific. Major declines have occurred in Costa Rica, while some populations in the Western Pacific are stable or increasing (PFMC and NMFS 2006). The largest nesting population in the world is located in India, with an average of 398,000 females nesting per year. In the Eastern Pacific, these turtles generally range from Baja California, Mexico to Chile (Silva-Batiz et al. 1996), though they sometimes travel north to the Gulf of Alaska (Hodge and Wing 2000). They are believed to reach maturity at 10-15 years old and live for 50-60 years (HSUS 2006). The main nesting grounds are on the shores of the Pacific Ocean around Costa Rica, Mexico, Nicaragua, and the Northern Indian Ocean, where the turtles nest abundantly in eastern India and Sri Lanka. Breeding colony populations on the Pacific Coast of Mexico are listed in the U.S. as Endangered while all others are listed as Threatened (Federal Register July 28, 1978). Olive Ridleys nest two to three times per nesting season, which occurs every one to two years.

Hawksbill sea turtle. Photo: The Ocean Conservancy

Olive ridley sea turtle hooked by longline. Photo: Oceana

Olive ridley sea turtle on beach at Tomales Bay, CA. Photo: Sea Turtle Restoration Project

Hawksbill sea turtles

(*Eretmochelys imbricata*) are found throughout the world's tropical regions. Hawksbills play a unique role in coral reef systems throughout the tropics, and are dependent on the health of such habitats (Meylan 1988). Upon leaving nesting beaches, hatchlings begin an oceanic phase drifting for several years, then live in coastal habitats until they reach maturity. Adult males and females migrate hundreds to thousands of miles between nesting and foraging sites (Meylan and Donnelly 1999, Ellis et al. 2000).

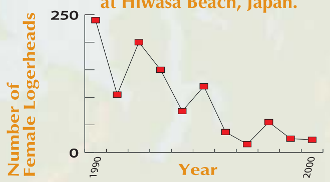
Of all the species of marine turtles, the hawksbill has endured the longest and most sustained history of exploitation (Meylan and Donnelly 1999). The largest remaining hawksbill nesting area in the world is in Australia, with annual nesting of 6,000 to 10,000 females per year (Meylan and Donnelly 1999). Extensive poaching for the highly prized hawksbill shell has resulted in excessive harvesting, causing hawksbill populations to plummet worldwide (Meylan and Donnelly 1999). In the Eastern Pacific, hawksbills were once common in coastal habitats from Mexico to Ecuador (Cliffton et al. 1982). However, the U.S. government admits it failed to recognize the severe depletion of Pacific hawksbills, stating that this species is "clearly of highest concern for the Pacific" (NMFS and USFWS 1998b). This population has been decimated by intentional and incidental catch, and now there are no major nesting beaches left in the Eastern Pacific. Pacific hawksbills are still caught occasionally off Baja California, where they are eaten or sold (Seminoff et al. 2003). Population levels are currently so low that scientists rarely encounter them.

Discovering leatherback and loggerhead hotspots and corridors in the Pacific

1 Japan

Japanese nesting loggerheads have declined by over 80% in the last 15 years (Kamezaki et al. 2003).

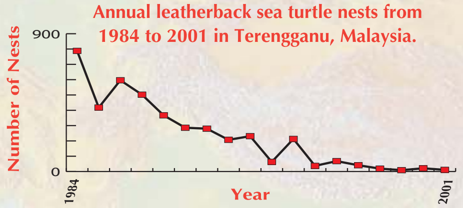
Annual census of nesting female loggerheads at Hiwasa Beach, Japan.



2 Malaysia

What was once one of two major nesting sites for western Pacific leatherbacks has disappeared within the last decade. The Terengganu, Malaysia, population is effectively extinct, with the number of nesting females perhaps as low as 2-5 (NMFS 2006).

Annual leatherback sea turtle nests from 1984 to 2001 in Terengganu, Malaysia.



Source: Department of Fisheries, Terengganu, Malaysia.

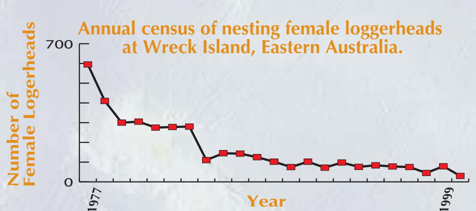
3 Indonesia

Though significantly reduced over the last 30 years, Jamursba Medi and War Mon beaches are the last remaining major nesting areas of western Pacific leatherbacks.

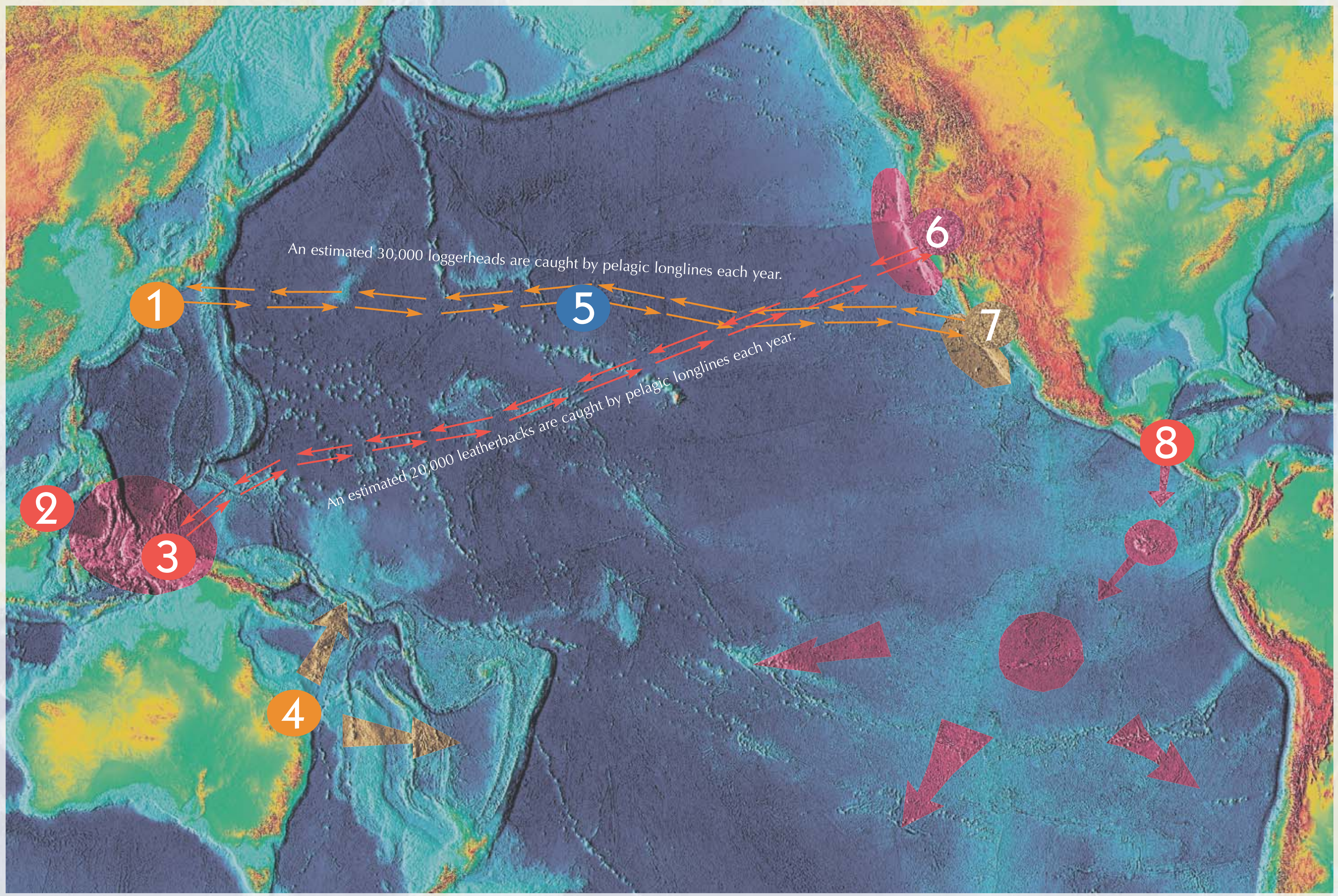
4 Eastern Australia

Until recently, eastern Australia hosted one of the major loggerhead breeding aggregations on the planet. Since 1977, nesting females declined by 86% (Limpus and Limpus 2003). These loggerheads travel throughout the southwest Pacific and sometimes migrate across the Pacific to Chile.

Annual census of nesting female loggerheads at Wreck Island, Eastern Australia.



Despite their wide distribution and migratory behavior, many turtles and other large ocean predators aggregate in concentrated hotspots that are surprisingly small and migrate in similar patterns each year. Preliminary analysis of Tagging Of Pacific Pelagics (TOPP) and NOAA tagging data suggests consistent patterns of movement over time and isolated hotspot areas where turtles spend the majority of their time. This information can be used to identify and protect important ecological areas for sea turtles as they move across ocean regions (Ferraroli et al. 2004).



Major loggerhead nesting areas
Major leatherback nesting areas
Selected loggerhead feeding areas
Selected leatherback feeding areas
Loggerhead migration
Leatherback migration

Seafloor relief map created by Peter Sloss, NOAA. Bycatch estimates for the Pacific Basin from Lewison et al. (2004).

5 Adelita's Trans-Pacific Migration

In 1996, Grupo Tortuguero satellite tracking documented the first loggerhead migration from Mexico to Japan, over 6,000 miles (Nichols et al. 2000).

6 U.S. West Coast

Each year, some western Pacific leatherbacks cross the entire Pacific Basin to feed in the nutrient-rich waters of the California Current. Attracted to congregations of jellyfish, their primary food source, these Asian-born travelers visit coastal areas like Monterey Bay, providing a rare opportunity to see these ancient Pacific reptiles. Since 2001, the U.S. government has annually closed a large area off the coast of California and Oregon to drift gillnetting during the fall when leatherback sea turtles are known to feed there, resulting in no reported leatherback catch. Illustrated migration route based on TOPP and NOAA leatherback taggings by Peter Dutton, Scott Eckert, Scott Benson, George Shillinger, Bryan Wallace, Jim Spotila, Frank Paladino, and Barbara Block.

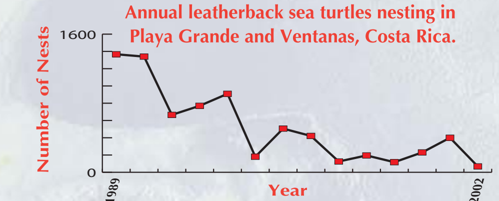
7 Baja California

Recent loggerhead satellite tagging has revealed that while loggerheads span ocean basins, they spend a surprising amount of their lives (over 95%) foraging in a small, localized area off the Pacific Coast of Baja California Sur, Mexico, where pelagic red crabs are found at high densities on the shallow continental shelf (Nichols et al. 2000).

8 Costa Rica

This last major eastern Pacific population of leatherbacks has plummeted in recent years and is in high danger of extinction. After nesting, adults migrate along a sea of underwater mountains, feed in the Galapagos Islands, and continue offshore of Chile where they disperse to feeding areas on the high seas. Illustration based on TOPP and NOAA leatherback tagging.

Annual leatherback sea turtles nesting in Playa Grande and Ventanas, Costa Rica.



From: Steyermark et al. 1996, and J. Spotila & F. Paladino, pers. comm.

Threats to sea turtles

The precipitous declines in turtle populations have undoubtedly been caused by human activities. Fisheries bycatch, deliberate capture for food and other uses, and egg poaching are serious threats to sea turtle populations worldwide (Eckert 1997, Sarti et al. 1996). These threats reduce population sizes, cause local extinctions, and prevent recovery of sea turtle populations (SWoT 2006).

Fisheries bycatch

As sea turtles cross the oceans from nesting beaches to foraging grounds and back again, they encounter a gauntlet of industrial and artisanal fisheries. The take and killing of sea turtles in fishing gear is a grave and serious threat to sea turtle populations worldwide. Some people assume that this is simply an industrial fisheries problem. However, small-scale, artisanal coastal fisheries are a major threat in some localized areas. Significant reductions in fisheries bycatch are necessary to stop the declines and allow sea turtle populations to recover. What we are learning, however, is that fishing gear modifications and strategically designed marine protected areas are invaluable tools that can protect sea turtles and allow for vibrant fisheries.

Pelagic longlines

Pelagic longlining is a fishing method where miles of lines and baited hooks are floated near the surface with buoys. Pelagic longlines catch the majority of the world's swordfish, bigeye tuna, and albacore tuna (Lewison et al. 2004). The Pacific Ocean hosts the largest tuna fishery in the world (Lawson 1993). Japan and Taiwan are the biggest players in the industrial catch, though artisanal and industrial fishermen from dozens of Pacific Rim nations also participate. An estimated 20,000 leatherbacks and 30,000 loggerheads are caught by pelagic longlines in the Pacific each year (Lewison et al. 2004). There is no centralized management body that governs high-seas fisheries throughout the Pacific. Two regional organizations are the Secretariat of the Pacific Community and the Inter-American Tropical Tuna Commission, which collect data and promote fishery development. However, at present, neither have the capacity nor authority to implement and enforce regulations to reduce turtle bycatch.

Olive ridley hooked in the mouth. Photo: R. Arauz

Leatherback caught by Costa Rican longliner. Photo: Roberto Vargas

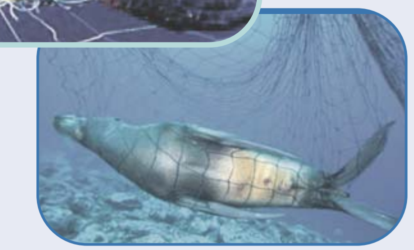
Leatherback entangled by a longline. Photo: Herb Segars

Purse seines

Purse seine vessels encircle aggregations of fish near the surface with small-mesh nets forming a "purse" that is then hauled onboard. The majority of the world's tuna catch is caught in this way. The international purse seine fleet for tuna in the Eastern Pacific has approximately 239 vessels, primarily from Mexico and Ecuador. The number of sea turtles killed in this fishery ranges between 17 and 172 each year, mostly olive ridleys. This is relatively low compared to longlines, given the size of the fishery (M. Hall, IATTC 2006 in NMFS 2006). Sea turtles are less likely to drown and do not get hooked by fisheries using purse seine gear.

Gillnets

Drift and set gillnets tangle and drown sea turtles, sea lions, whales, dolphins, and other large ocean animals.
Courtesy: Seawatch, NOAA



As sea turtles venture to coastal, nearshore habitats for feeding or nesting, they face what may be one of their greatest, yet least understood threats. Gillnets are curtains of mesh deployed by industrial and small-scale fishermen to entangle swordfish, sharks, halibut, and other migratory fish, but also can entangle and drown other species like sea turtles and marine mammals. They range in length between several hundreds to thousands of meters long and either drift through the water column (drift gillnets) or are anchored to the seafloor (set gillnets). Drift gill-nets have been banned on the high-seas since 1991 due to an international outcry over the high bycatch of marine mammals, turtles, and seabirds. On the U.S. West Coast, drift gillnets are still used to target swordfish and thresher sharks, though in 2001 two seasonal area closures were implemented to protect leatherback and loggerhead sea turtles. Gillnets are generally less selective than other gears because they tend to catch anything swimming through the water within a given size class. Since much coastal gillnetting is not managed, it is difficult to assess the magnitude of this threat, though we know in the localized loggerhead hotspot of southern Baja California, Mexico, set gillnets catch from 1,000-3,000 loggerheads annually (Koch et al. 2006).

Bottom trawls

Bottom trawls, particularly those targeting shrimp, remain a primary fishery threat to several sea turtle populations worldwide. Some U.S. East Coast trawl fisherman have reduced turtle bycatch by using turtle excluder devices, though they are still not used in many fisheries. In the early 1990s, several hundred loggerheads were killed each year by prawn trawl fisheries in northern and eastern Australian foraging areas (Poiner and Harris 1996, Robins 1995). Turtle excluder devices became compulsory in 2000 and there is now a seasonal trawl closure during nesting season at Mon Repos, the major loggerhead nesting beach in Australia (Limpus and Limpus 2003). Heavy bottom trawling activity occurs in the South China Sea and other areas throughout Asia where Pacific sea turtles migrate, but the overall mortality is difficult to assess (Kamezaki et al. 2003).

Summary of Findings

1. All Pacific sea turtle populations are severely depleted.
2. Pacific populations of leatherbacks, loggerheads, and hawksbills are on the brink of extinction.
3. Pacific sea turtles use consistent migratory corridors and feeding hotspots, subject to oceanic conditions.
4. Turtle bycatch rates vary significantly by when, where, and how each fishing gear is deployed.
5. Fishery bycatch in small-scale and industrial fisheries is a serious threat to sea turtles.
6. Satellite tracking data allows scientists to predict likely sea turtle locations in real time.
7. Sea turtle recovery requires protection of habitats used by each life stage.

Nesting habitat loss

Coastal development, vehicles on beaches, city lights, and human recreation have reduced nesting success and made many nesting beaches uninhabitable by sea turtles. Lights can disrupt nesting behavior and hatchling orientation leading to hatchling mortality (SWoT 2006). Alterations to shorelines and the seafloor near nesting sites can affect nesting behavior. Nearby vessel traffic and construction may lead to mortality or prevent females from nesting. What is more, secluded islands once free of predators now have invasive species like pigs, dogs, and jackals that raid sea turtle nests (Leslie et al. 1996).

Turtles as food

Since the dawn of man, humans have hunted and used sea turtles for their food, oil, leather, and shells. Today, many people still consume sea turtle adults and eggs based on traditional cultural practices. Sea turtles eggs are believed to be an aphrodisiac, though this myth has been widely debunked. Intentionally killing sea turtles has been prohibited in many countries, but still takes place throughout the world (Seminoff et al. 2003, Limpus 1997).

Plastics and marine debris

From its production to its disposal, our irresponsible use of plastic is killing and contaminating undersea creatures throughout the marine food web (Carr 1987, Bugoini et al. 2001). Numerous sea turtle carcasses have been found on beaches suffocated on plastics and marine debris (Bugoini et al. 2001). Since floating plastics resemble jellyfish, the leatherbacks' primary food source, plastics are likely the culprit of many unobserved sea turtle deaths.

Other threats

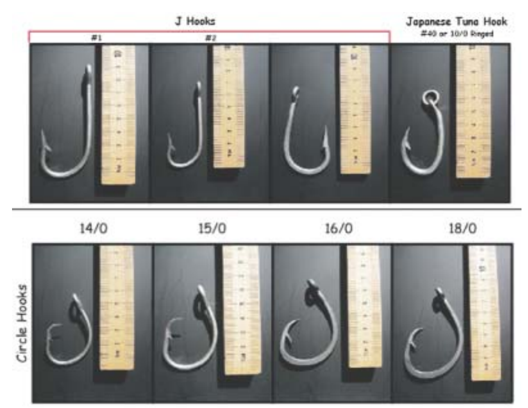
In the past, the sheer number of sea turtles and major nesting beaches provided protection from disease and natural disasters. However, at their current low numbers, sea turtles are highly susceptible to these natural events. Sea turtle gender is determined by incubation temperature. Global climate change may affect sea turtles as minute increases in temperature can change turtle gender ratios and sea level rise may eliminate nesting beaches. Large-scale oceanographic changes resulting from increased atmospheric carbon dioxide, though difficult to predict, will likely affect sea turtle migration and feeding patterns (SWoT 2006).

Ongoing turtle conservation efforts

There is no silver bullet for protecting sea turtles. Even if a threat is eliminated in one area, the migratory, multi-habitat nature of turtles requires they be protected on many fronts. While much more needs to be done, here are some of the steps currently being taken to protect Pacific sea turtles:

Gear modifications

A tremendous amount of scientific study and experimentation has been dedicated to finding ways for longline fishermen to keep fishing, but reduce their bycatch impacts through gear modifications (for review, see Gilman et al. 2006). One strategy to reduce sea turtle bycatch while maintaining fisheries is to change the design and deployment of fishing gear. Ideally, such modifications could reduce the probability of turtle interactions without changing the efficiency of the gear to catch target fish species. Hawaiian-based longliners have implemented gear modifications resulting in lower bycatch rates and distributed these technologies to other fleets throughout the Pacific (WPRFMC 2004, WPRFMC 2006). For example, in Ecuador, several NGOs worked with artisanal longline vessels to convert to circle hooks and train fishermen in reducing turtle mortality, resulting in estimated mortality reductions of over 41% (Largarcha et al. 2005).



J-hooks and circle-hooks are used in longline fishing. Circle hooks have been found to reduce sea turtle interactions and mortality per interaction, often with increases in target catch. From Lagarcha et al. 2005.

Examples of gear modifications to reduce turtle bycatch

- Using Turtle Excluder Devices (TEDs) on shrimp trawlers, to allow some turtles to escape the nets
- Changing longline hooks from smaller J-shaped to larger circle shaped, to reduce their chance of being swallowed by turtles
- Using bait that is less preferred by sea turtles, such as fish instead of squid
- Setting hooks and gillnets at depths where turtles are less likely to be (Polovina et al. 2003)

A green sea turtle escapes a trawl net through a Turtle Excluder Device (NOAA).
Photo: NOAA

The Eastern Tropical Pacific Seascape

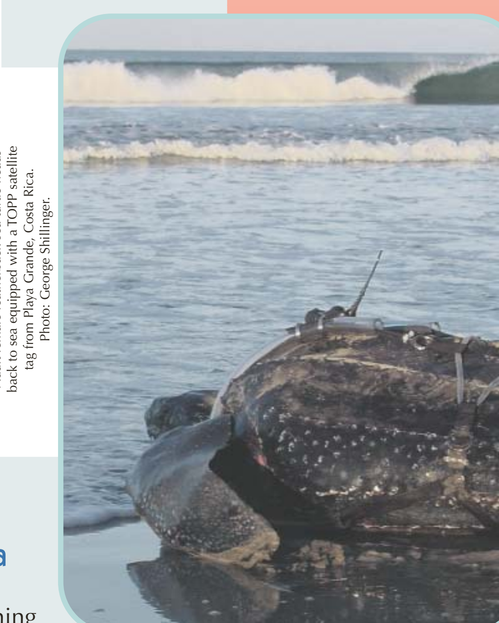
The Eastern Tropical Pacific Seascape Initiative, announced in 2004, represents the commitment of Costa Rica, Ecuador, Columbia, and Panama to establish marine protections at nesting beaches and key turtle migration corridors. Partners are currently investing $3.1 million in the initiative which spans 521 million acres of ocean and highlights leatherbacks as a flagship species (CI 2004). Tagging efforts are helping reveal critical inter-nesting and high-use feeding areas for leatherbacks across this 4-country region.

Project GloBAL

Based at Duke University, the Global Bycatch Assessment of Long-Lived Species (Project GloBAL) is now underway in developing the most comprehensive view of bycatch trends for sea turtles and other key species. The project aims to locate bycatch 'hotspots' for migratory species throughout the world's oceans and identify fisheries with greatest impacts. Combined with satellite tracking and ocean sensing, this project will provide the ability to pinpoint management and conservation efforts to the times and areas where sea turtle populations are most sensitive. The first key results are expected to be released in 2008. (http://bycatch.env.duke.edu/)

The TOPP Program

The Sea Turtle Working Group of the Tagging Of Pacific Pelagics (TOPP) program is providing the first glimpse at Pacific sea turtle migratory patterns and foraging hotspots. Part of the Census of Marine Life, TOPP expects to be able to predict where large pelagic species, including sea turtles, are likely to be based on oceanographic, climate, and animal tagging data by 2008 (B. Block, pers. comm. 2006). This information, paired with bycatch data, will provide the scientific foundation for a range of management interventions (i.e. closures, gear modifications) that could be moved according to where sea turtles are likely to be at any given time. Eventually, these patterns will be so well understood that it may not even be necessary to continue tagging turtles as long as there are enough sensors of oceanography and climate. As of January 2007, TOPP scientists have tagged and tracked over 2,000 large pelagic marine animals in the Pacific, including several dozen loggerhead and leatherback sea turtles. (http://toppcensus.org).



Adult female leatherback sea turtle heads back to sea equipped with a TOPP satellite tag from Playa Grande, Costa Rica.
Photo: George Shillinger.

The Baja Model:

Grupo Tortuguero and Proyecto Caguama

Since the 1990s, a network of turtle researchers and fishing community leaders called "Grupo Tortuguero" has tracked and monitored the status of sea turtles throughout Mexico's Baja California peninsula. After discovering a turtle hotspot off Bahía Magdalena, Proyecto Caguama ("Project Loggerhead") was established to educate fishermen about the loggerheads and use community-based tactics to find ways to reduce their incidental and intentional catch. The task force of local fishermen, managers, community members, and conservation biologists is collecting stranding and mortality estimates and experimenting with gillnet design and deployment. Now, Proyecto Caguama is gathering local support and lobbying the Mexican government to establish a federally recognized marine protected area to eliminate set gillnetting in the loggerhead feeding grounds. By building networks, knowledge, and communication, the Baja model provides a participatory conservation approach for coastal areas highly important to turtles. (www.grupotortuguero.org)

A local fisherman and member of Grupo Tortuguero releases a juvenile loggerhead after tagging and measurement as part of ongoing monitoring activities.
Photo: Hoyt Peckham

ProCaguama in Baja California Sur, Mexico. School children and their families in Punta Abreojos watch satellite-tagged loggerheads return to the ocean.
Photo: Hoyt Peckham

A Call to Action:

Here are ten things we can do now:

Everyone can play a role in forging a future for Pacific sea turtles.

1. Oppose the expansion of fishing activities that threaten sea turtles.
2. Never buy any product made from sea turtles and encourage others not to kill sea turtles for food or decoration.
3. Reduce your use of plastics and dispose of plastics responsibly.
4. Reduce your consumption of seafood from high bycatch fisheries.
5. Support efforts to identify Important Ecological Areas (IEAs) for Pacific sea turtles including nesting sites, migratory corridors, and feeding areas.
6. Support the development and distribution of techniques to reduce turtle interactions and mortality. These include turtle excluder devices, depth set, bait, hook type, and turtle handling techniques.
7. Identify, empower, and support a Pan-Pacific management body capable of:
   - Predicting Important Ecological Areas of high turtle density based on real-time data;
   - Enacting real time protections, such as fisheries closures, when and where turtles are likely to be;
   - Monitoring fishing behavior through observers and Vessel Monitoring Systems.
8. Support efforts of communities near sea turtle nesting beaches to reduce harmful development, vehicle traffic, poaching, predators, and other threats to sea turtle eggs and nesting females.
9. Support efforts of national governments, organizations, and local communities to establish and enforce management measures for Important Ecological Areas that occur within their jurisdictions.
10. Encourage and attend international symposia bringing together artisanal and industrial fishermen, scientists, conservationists, and government officials toward a common goal of sea turtle recovery.

Juvenile loggerhead hiding.
Photo: U. S. Fish and Wildlife Service

Photo: George Shillinger

Protecting the Pelagic Ecosystem of the Pacific

The same activities that impact turtles threaten the health of our oceans. While it is tempting to focus exclusively on sea turtle bycatch, the same longlines, gillnets, and trawls also catch a suite of marine mammals, seabirds, sharks, invertebrates and non-target fish, many of which will benefit directly from turtle conservation efforts. Many of these highly migratory species are top predators that control the structure and function of marine food webs. If we can figure out how to protect Pacific sea turtles, we will outfit future generations with the tools and the hope to protect the entire pelagic ecosystem.

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