

A large sea turtle, likely a Hawaiian monk seal, is swimming in clear blue water. The turtle's head and front flipper are visible, showing a distinctive pattern of dark and light patches. The background consists of a sandy ocean floor with scattered coral and other marine life.

The Return of KAUULA

**In Hawaiian legends,
a turtle named
Kauula watched over
children playing
on the shore.
Now people are
returning the
favor.**



In Hawaii, the green turtle's fortunes have improved steadily over the past two decades under the protection of the Endangered Species Act. See page 40.

By Anne Rillero



GEORGE H. BALAZS

DOLLOP OF SAND in an azure sea, remote East Island (above) is a haven for green turtles and endangered monk seals. The uninhabited 12-acre key is one of a group of islands called French Frigate Shoals, nearly 500 miles northwest of Honolulu. About 90 percent of Hawaii's green turtles come here to lay their eggs in the sand. Farther west in the Hawaiian chain, a green turtle (right), surrounded by young black-footed albatrosses, basks on the beach at Laysan Island. Until recently, the northwestern Hawaiian Islands were among the few places where sea turtles basked on land.

WORKING BY MOONLIGHT, Tim Clark waved an electronic scanner over the green sea turtle's flippers. He was looking for a signal from a tiny identification tag, but there was no reading. Then he examined her dark brown shell for an etched identification mark. There were beautiful dappled streaks of gold, green and tan, but no marks.

The turtle was unfazed by Clark's investigation that summer evening. Perched over the deep hole she had carved in the sand with her leathery flippers, she was preoccupied with laying approximately 100 small eggs. But Clark, a research technician for the U.S. Fish and Wildlife Service, was delighted. The turtle's lack of identifying marks or tags meant she was a newly arrived nesting female that season at East Island, an uninhabited sand islet 480 miles northwest of Honolulu.

The 300-pound female was one of 504 Hawaiian green turtles that arrived in the summer 1997 nesting season—a record-setting number for East Island. This was welcome news for Clark's boss, George Balazs. Balazs, 55, has devoted his career to Hawaii's green turtles. He has tagged and tracked the life histories of nearly 6,000 of these marine reptiles in Hawaii. In the last two and a half decades, he has watched the turtles' numbers increase steadily—a trend he attributes primarily to the U.S. Endangered Species Act.

"I've seen a species I know and love grow in numbers and become more accepting of people," says Balazs, head of the marine turtle research program at the National Marine Fisheries Service in Honolulu. "The increasing numbers of nesting turtles are an example of what can happen when the state, federal government and community work together to protect a species."

Named for their green-colored fat (tinged by the plants they eat), green turtles are found in warm waters worldwide, including those around California, Texas and Florida. Adults can weigh as much as 500 pounds. Unlike their terrestrial relatives, these turtles cannot draw their heads and flippers into their shells. Camouflage is



their best protection against predators: Their carapaces are shades of brown, often with radiating wavy or mottled markings that help disguise the turtles among the coral and rocks where they hide.

Sea turtles begin their lives by digging their way out of the sand where they have hatched and then scurrying oceanward past predatory birds and crabs. The wayfaring survivors drift on sea currents, subsisting on fish eggs and small crustaceans. As juveniles and adults, they settle into coastal waters where they forage on algae and sea grasses. (This migratory life-style, similar in all green turtles, has made it virtually im-



MITSUKI WAKEN / WOODFIN CAMPBELL / PREVIOUS PAGES: DAVID B. FLEETHAM

possible for researchers to count the number of these animals worldwide.)

Hawaiian green turtle feeding pastures are found primarily around the major Hawaiian Islands and Johnston Atoll. By tagging and measuring turtles over the years in these areas, Balazs has found that they grow extremely slowly, taking an average of 25 years to reach sexual maturity. About every two to three years, the sexually mature female turtle returns to her birthplace to nest on land at night. Nesting typically occurs from May through August. Males make the journey every year or two, mating with the females offshore.

About 90 percent of Hawaii's green turtles nest at East Island and its neighboring islets. Known collectively as French Frigate Shoals, these islands are the remains of an ancient volcano that sank over time, leaving a series of sand spits and a basalt pinnacle around which a crescent-shaped barrier reef has formed. French Frigate Shoals is also an important habitat for endangered monk seals and seabirds.

In addition to nesting at French Frigate Shoals, green turtles also come ashore to bask here—something rarely seen elsewhere in the world. Both males and females engage in this activity, possibly as a way to

warm themselves and relax out of reach of sharks.

"Explorers that sailed to French Frigate Shoals in the 1800s described the basking turtles as so abundant that one couldn't walk around the island," says Balazs. This behavior—combined with the delicious flavor of the turtle's flesh and the ease with which they could be stored alive—made them prime targets for hungry sailors and commercial hunters.

Mass killings of turtles on the beaches at French Frigate Shoals occurred as late as 1959, when a fishing company took more than 25 percent of the nesting turtles in one season. In the 1960s, state and federal wildlife officials began year-round patrols at French Frigate Shoals (which is part of the Hawaiian Islands National Wildlife Refuge), ending the hunting of turtles at their nesting beaches.

Turtle harvesting continued around the other, larger Hawaiian islands, however. In ancient Hawaii, hunting of turtles was permitted, although the number of turtles taken was strictly regulated by the *ali'i*, or royalty. Some families revered turtles as their *amakua*, or personal family deities, and wouldn't eat them at all. But newcomers to the islands had little respect for tradition. That and the rise of tourism in Hawaii led to a keen demand for green turtle meat, which was promoted as a novelty food at restaurants throughout the main islands.

It was the sight of fishing boats loaded with stacks of sea turtles at Maui's Lahaina Harbor in 1969 that first compelled Balazs to study the turtles. "I wondered how many turtles could be out there if they were harvesting so many for turtle steak," says Balazs, who had recently graduated from the University of Hawaii. A year later, while working at the Hawaii Institute of Marine Biology on a study of the nutritional needs of green turtle hatchlings, he found himself wondering again about the status of turtles in the wild.

An outgoing, gregarious family man with aviator glasses and graying hair, Balazs is not someone you would imagine living alone on a deserted island. But after learning from historical accounts that Hawaii's

green turtles nested at French Frigate Shoals, his curiosity drew him to the isolated islands. Getting there was not easy; the islands were remote and off-limits to visitors. After receiving a small grant from the New York Zoological Society, Balazs convinced the U.S. Fish and Wildlife Service to allow him access. On June 1, 1973, he hitched a ride on a Coast Guard DC-3 "Gooney Bird"—a plane of World War II vintage—to Tern Island in French Frigate Shoals, a four-hour trip from his home in Honolulu.

From Tern Island (which had been enlarged with packed sand and coral during World War II to accommodate a 3,000-foot gravel runway), a U.S. Fish and Wildlife officer ferried Balazs to East Island. "Just before we reached shore, a 10-foot tiger shark swam up and bumped the propeller on our outboard motor," Balazs recalls with a shudder.

Despite being part of the Hawaiian Islands, 12-acre East Island is no vacation haven. The turquoise sea is inviting, but swimming is foolhardy given the resident shark population. There are no buildings, just rusting metal and old concrete from the island's former days as a radio-transmitting navigation station. It has no fresh water and not a single tree—just a

handful of small shrubs, plus sea grasses and vines that were home to a large colony of nesting sooty terns. One of the island's most noticeable traits is an ammonia odor arising from decaying bird droppings and other organic matter. "Paradise and prison all in one," Balazs wrote of East Island in his journal.

Alone, Balazs recorded the arrival of female turtles each night, sleeping by day in his primitive campsite. He found only 67 nesting turtles that first season. With turtle hunting continuing unabated throughout the main Hawaiian Islands, Balazs worried that the population had little chance of recovery. His data were instrumental in convincing Hawaii state lawmakers to outlaw the sale of green turtles for commercial use in 1974.

Summer after summer, Balazs returned to East Island, counting nesting turtles. Finally, in 1978, federal officials listed green



GEORGE H. BALAZS

TROUBLE IN HAND, a green turtle hatchling wriggles in the palm of biologist George Balazs on East Island. Balazs rescued the 1-ounce hatchling from its underground nest, where it was trapped by debris, and released it into the sea. Young turtles face a variety of challenges in their first hours of life: tunneling through the sand to the surface; scurrying past birds and crabs on the shore; and avoiding sharks and other predators in the sea. Only an average of one or two hatchlings from 100 to 150 eggs in each nest survive to reach sexual maturity at age 25.



AMY MACKAY

Green Times in the Virgin Islands

Things are looking up for green sea turtles in the easternmost part of their U.S. range, too. About 40 females nested last summer on East End Bay Beach in St. Croix—more than twice the number of past years, says Amy Mackay of the St. Croix Marine Turtle Conservation Project.

Green sea turtle numbers in the Caribbean have fallen dramatically, so the 1998 increase was “very encouraging,” says Mackay.

Mackay and her partner, James Rebholz, can take partial credit. With Hurricane Georges bearing down on the island in September and threatening to wash away turtle nests, the pair spent two nights digging up hundreds of eggs and loading them into several Styrofoam coolers. Back in the safety of their dining room, Mackay and Rebholz served as midwives to the hatchlings (above), which they released into the sea afterwards.

Having lost many turtle eggs in previous seasons to disasters both natural and human-caused, “this time we were determined to do something about it,” Mackay recalls.

turtles as threatened (except in Florida and the Pacific Coast of Mexico, where they are listed as endangered) under the United States Endangered Species Act. This action made it illegal to hunt, harass, kill or capture the turtles. The number of nesting females counted at East Island has trended upwards since then: 150 turtles in 1981, nearly 300 in 1989, 384 in 1992 and 504 turtles in 1997.

But not every year has seen an increase. In 1998, for example, fewer than 100 turtles nested at East Island. Such dips, seen in green turtle populations elsewhere, are caused by varying reproductive cycles within the female turtle population.

Despite the dips, “what I’m seeing now, compared to those first nights on East Island, is very gratifying, very satisfying,” says Balazs. “The road to recovery is indeed possible, given some patience, the passage of time and hard work by many individuals.”

In addition to his work with nesting turtles at French Frigate Shoals, Balazs has also gathered data about the animals at other points in their life cycles. By attaching radio transmitters to turtles departing from their nesting beaches, Balazs found that they navigate hundreds of miles back to feeding areas near the main Hawaiian Islands—without the benefit of landmarks. Since 1976, Balazs has studied the turtles at their near-shore feeding habitats. With the help of volunteers and students, he has tagged, measured, weighed and examined 3,900 turtles in coastal areas, adding to his computerized database of 2,000 nesting females that have been tagged at French Frigate Shoals.

While doing so, Balazs has observed the behavior of turtles changing since they were protected under the Endangered Species Act. For example, prior to the mid-1980s, he rarely saw turtles foraging close to shore during the day, even though their food grows mainly in shallow, near-shore waters. Feeding only occurred at night, except in places that were very remote or inaccessible to humans. Now young turtles are exhibiting a new behavior, feeding close to shore both day and night. And basking, once limited to French Frigate Shoals, is now seen in the main Hawaiian Islands. The turtles emerge during the day along the shoreline or rest on top of bare coral heads.

The biggest threat to Hawaii’s green turtles is no longer hunting by humans, but a disease known as fibropapilloma. The disease, first discovered in Florida’s green turtles in the 1930s, causes large tumors on the turtles’ eyes, necks, flippers, mouths



and internal organs. The tumors interfere with the reptiles’ ability to feed, see and swim, relegating them to a slow, painful death. “I get lots of calls about turtles [with tumors] that have become beached, that are either so weak that they can’t swim or are already dead,” says Skippy Hau, wildlife biologist for Hawaii’s Division of Aquatic Resources.

In parts of Hawaii, the disease has stricken 60 percent of the green turtles. Similar severe outbreaks of fibropapilloma have also been reported in Florida, several Caribbean nations and at a few other sites worldwide. Curiously, there are places, such as the west coast of the island of Hawaii, where the disease is absent.



DAVID PERRINE/INTERSPACE VISIONS

Fibropapilloma is particularly troubling because it strikes turtles while they are young, before they have reproduced. Because green turtles live for many decades (no one knows exactly how long), a disease killing juvenile turtles today could have a significant impact on population levels in the future. More than 15 researchers in the United States are racing to identify the cause and possible cures for the disease. One of them, Thierry Work, a wildlife disease specialist with the U.S. Geological Survey, reports that fibropapilloma may be caused by a herpes virus. But he cautions that this has not yet been proven.

Pollution may be a contributing factor. "We see that the disease is present in areas

that appear ecologically compromised in some way," Work adds.

And so the fate of Hawaii's green turtles, as with that of many imperiled species, may ultimately be determined by humanity's ability to protect the ecosystem.

"To Polynesians, the Earth is curved like a turtle's back," remarks Hawaiian historian and songwriter Danny Akaka. "*Honua*, the Hawaiian word for Earth, is very similar to *honu*, the word for turtle." Today, the protection of *honu* and the protection of Earth are as closely intertwined as ever.

Writer Anne Rillero lived in Hawaii for four years and helped Balazs tag turtles, but recently left the tropics for Vermont.

WAKING FROM WATERY NAPS, two green turtles off the coast of the Big Island of Hawaii start ascending to the surface 50 feet above. The turtles sleep on the bottom for 25 minutes or so, come up to breathe and then descend for another snooze. Since hunting of the species was outlawed in the 1970s, green turtles have become less wary of humans and have begun to rest above water, too. The chief threat to the turtles now is fibropapilloma, an often-fatal disease that afflicts 60 percent of the creatures in parts of Hawaii.

Helping Kemp's Ridley Escape the Dragnet

FOR BIOLOGISTS studying the Kemp's ridley, the world's smallest and most endangered sea turtle, the 1998 nesting season offered hope that the species may survive. Nearly 4,000 Kemp's ridleys' nests were counted last year—a fourfold increase since the late 1970s, when researchers thought the species could be extinct within 10 years.

"I wouldn't say the Kemp's ridleys are out of danger, but they are definitely showing encouraging signs of improvement," says Barbara Schroeder, sea turtle coordinator for the National Marine Fisheries Service.

One of the biggest heroes in the turnaround is named

TED—not a person, but an inexpensive invention with an acronym standing for Turtle Excluder Device. The TED, mandatory for U.S. shrimp fishermen, is essentially a trapdoor that allows sea turtles to escape when caught in the sock-shaped nets of shrimp trawlers. Turtles and large fish activate the trapdoor and are shunted outside. Small creatures, such as shrimp, remain inside.

Worldwide, shrimping is a leading human-related cause of death for all sea turtles, killing an estimated 150,000 turtles annually. (Turtles are just part of the yearly 60 billion pounds of global "bycatch"—creatures unintentionally snared by fishermen's nets.) The Kemp's ridley is especially vulnerable to capture in shrimp nets because most adults of this species live in the Gulf of Mexico, a prime shrimp fishery. Before TEDs were introduced, an estimated 500 to 5,000 Kemp's drowned in shrimp nets each year. The devices, which cost from \$50 to \$400, reduce this death rate by as much as 97 percent.

Kemp's ridleys are also vulnerable because they have just one significant nesting area—Rancho Nuevo, Mexico, about 150 miles south of Brownsville, Texas. In the 1940s, some 40,000 turtles were filmed coming ashore there to nest. But over the ensuing decades their numbers fell because of shrimping, hunting and predation from animals. In

1970, the turtles were listed as endangered under the U.S. Endangered Species Act.

As the number of nests dwindled to just 924 in 1978, the Mexican and U.S. governments joined forces to enhance protection efforts at Rancho Nuevo and establish a backup nesting site in the United States. More than 22,000 eggs were gathered at Rancho Nuevo from 1978 to 1988 and hatched at Padre Island National Seashore in Texas; 13,000 hatchlings were later released into the Gulf. Because their release occurred prior to the mandatory use of TEDs, however, only a few are believed to be alive today.



G. ALLEN MORGAN (DRK)

LAYING THE FOUNDATIONS for the next generation, a female Kemp's ridley sea turtle covers her eggs at a beach near Rancho Nuevo, Mexico. Thousands of Kemp's ridleys died in shrimp nets in the Gulf of Mexico before turtle excluder devices were required on United States shrimp boats in 1989.

Meanwhile, the National Marine Fisheries Service introduced the TED in 1980, hoping that shrimpers would volunteer to use it. Few in the Gulf of Mexico did. It took nearly a decade of political wrangling (including a lawsuit in 1989 by the National Wildlife Federation against the U.S. Department of Commerce) before TEDs became a permanent requirement for U.S. warm-water shrimpers. The number of Kemp's ridley nests has increased steadily since then, from 1,178 in 1991 to 3,845 in 1998. "We certainly think TEDs have

played a part in getting the population to increase," says David Bernhart, a biologist with the National Marine Fisheries Service.

To encourage other countries to adopt this turtle-saving technique, Congress passed a law in 1989 requiring nations to mandate use of TEDs if they wish to export shrimp here. Because the United States is the world's largest importer of shrimp, this requirement has had tremendous clout. But the World Trade Organization (WTO) ruled in April 1998 that the law violated international free-trade agreements. The Clinton administration filed an appeal, but an appellate court upheld the WTO decision last October.

Partly as a result of the WTO action, the U.S. State Department has adopted an older, less restrictive policy of certifying TED use on imported shrimp on a "shipment by shipment" basis. The problem with this policy, says Amanda Johnson, NWF's trade program associate, is that only those shrimpers wishing to export their catch to the United States will be motivated to use TEDs. "Sea turtles which escaped one net equipped with a TED could simply be caught in the next net that is not equipped with a TED," she says. Johnson points to a study by the National Academy of Sciences that emphasizes the use of TEDs as a major component of effective sea turtle conservation programs.

Fortunately for the Kemp's ridley, shrimp trawlers in domestic waters are still bound by federal law to use TEDs. Mexico has a mandatory TED use policy as well. But for other sea turtles around the world, the WTO ruling means that shrimping will continue to pose a serious threat. —Anne Rillero

For more information about sea turtles and how you can help protect them, contact: Sea Turtles Campaign, NWF, 1400 16th Street NW, Washington, D.C. 20036; or you can visit the web site: www.nwf.org/international/trade/turtles.

Tough Job, Harsh Place

EAST ISLAND sounds like the sort of place people dream of visiting: an undeveloped Hawaiian island located hundreds of miles away from civilization. So by all appearances, George Balazs could be considered one of the luckiest guys in the country. Almost every year since 1973, he has had the opportunity to visit this remote Pacific island, which happens to be the nesting site for the majority of green turtles that range throughout the Aloha State.

"It sounds a lot more alluring than it really is," says Balazs, a National Marine Fisheries Service biologist who has had to cope with East Island's unrelenting heat, biting ticks, marine predators, lack of fresh water and sheer isolation for weeks at a time while studying this population of the threatened sea turtles.

Balazs is one of hundreds of hard-working scientists all across the country who have dedicated their lives to restoring populations of imperiled animals or trying to solve environmental problems that are plaguing both people and wildlife. In this issue, you can read about some of those researchers.

In the case of the green turtle, Balazs' efforts clearly have paid off. As the article "The Return of Kauila" explains, the species is making a strong comeback in Hawaii. "The increasing numbers of nesting turtles are an example of what can happen when the state, federal government and community work together," says Balazs, who has had more than his share of hair-raising experiences over the years.

"Once," he recalls, "my work took me to Necker Island, a big rock in the middle of the Pacific." The scientist had arranged for a fishing crew to pick him up, but the surf was too high that day for the boat to steer close to shore. "I had no choice. I jumped off a cliff into the sea and it turned into a race over who would get me first—the waves crashing on the rocks, the sharks or the sailors." Fortunately, for Balazs and his beloved green turtles, the sailors won.

The Editors



MARCO PRICE



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