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"LANIAKEA
TURTLE BEACH"

Who Killed Honey Girl?

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UNPUBLISHED DRAFT

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SHARED WITH GHBALAZS
FOR EDITORIAL COMMENT

E ho`opakele i na honu o ke kai
"Rescue the turtles of the Sea"

*For all who love and protect
the green sea turtle, whom the Hawaiians call honu.*

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Night

A silvery moon rises above the beach. It is the second night following a full moon; the white light embraces patches of golden sand interspersed between the rocky shoreline. An adult female green sea turtle known as Honey Girl, hauls herself onto the secluded beach, leaving tracks in the soft wet sand like tattoo marks.

As she has for the past few years, Honey Girl comes to bask under the moonlight, safe in the sanctuary. During the day volunteers from Malama Na Honu, a non-profit organization, stand vigilant over the basking turtles at Laniakea. By sunset, the last volunteer has taken down the red ropes and put them away. Now the beach is deserted. Even Honey Girl's fellow turtles prefer to sleep under water.

The surf breaks and then tumbles against the reef. The remainder of the wave swooshes as it glides along the sand and then retreats back into the dark sea erasing Honey Girl's tracks. Like other sea turtles, Honey Girl has no external ears but she can still hear the sound of footsteps approaching in the soft sand. While her eyes with their black transparent membranes provide superb sight underwater, she is myopic or nearsighted on land. She can see the rocks closest to her but beyond that objects are blurry. Only her sense of smell, which is keener than a dog's, is as strong on land as it is in the water.

Honey Girl nestles among the rock strewn beach, blending in with the landscape. Yet she remains vulnerable. All it takes is someone to flip her on her back and she is helpless. Once man began sailing the seas it quickly became common knowledge that even the largest green sea turtle could not right itself once on its back. That was how millions were caught, taken aboard ships, and slaughtered for food.

It's Friday, July 19, 2008. The last person to see Honey Girl alive is her attacker.

July 20, 2008: The Discovery

It's Saturday morning at Laniakea Beach on Oahu's North Shore.¹ Clouds swirl in the blue sky. Waves follow each other to the edge of the sand while palm tree fronds clack in the wind. Patrick Doyle, a pediatric nurse, prepares for the first shift as a volunteer for Malama Na Honu.² He checks to make sure the signs explaining the laws are in place and he organizes handout materials. As one of fifty volunteers, Patrick proudly wears his Malama Na Honu t-shirt.³ He enjoys responding to questions and explaining turtle viewing etiquette to tourists and residents.

It's a little before nine o'clock when early morning beach goers stop him. They report an odd mound of sand near the water's edge. Ants crawl over something that looks suspiciously like blood splattered across the sand.

Patrick rushes over. Something is definitely buried in this shallow grave. He peers closer. *Is that a turtle's flipper?* His heart races. He drops to his knees and carefully begins to remove sand. After moving aside two inches of sand, he freezes. A green sea turtle is on its back, dead.

¹ Laniakea means heavenly white surf in Hawaiian.

² Malama Na Honu became a non-profit organization on October 1, 2007.

³ Patrick grew up Near Long Island, New York. Like many transplants, he found Hawai'i to be the special place he could call home. He is always *in* the water. And Hawai'i's green sea turtles have come to hold a special place in his heart. "I have an affinity for the honu. I always encounter them whenever I'm in the water." When Patrick moved to Hawai'i in 2004, he had seen signs to volunteer and immediately trained to become a 'turtle docent.' He also serves as vice-president of the organization.

He proceeds no further as he realizes this may be a crime scene which should not be disturbed.

Listed on both the state's and federal's Endangered Species Act (ESA) as threatened, it is a crime to kill a green sea turtle.

Please don't let it be one of our turtles, Patrick thinks. There is only one way to know and that is to scan the turtle for an identification tag. Many green sea turtles have been tagged in one of two ways.⁴ Through tagging, scientists learn more about their behavior and habits to discover ways to protect them. One tagging system is a microchip embedded in the flippers known by its acronym PIT which stands for Passive Integrated Transponder. Since a flipper can be lost during a shark attack or amputated by fishing line, a PIT is placed in the turtle's two hind flippers increasing the chances of tracking. The turtle laying in its shallow grave is missing its left front flipper.

Patrick contacts Joanne Pettigrew, Malama Na Honu's educator coordinator, and asks her to bring a scanner.⁵ Joanne rushes down to the beach. She places the instrument over the partially uncovered mound, her heart pounding. Is it one of their turtles whom the volunteers work so hard to protect and educate the public about? She sweeps the remaining three flippers, one by one. Nothing from the first flipper. Silence over the second. All quiet over the third. Joanne and Patrick exhale sighs of relief.

Joanne scans the flippers a second time to be sure. This time the scanner beeps over the left hind flipper. A hit! A number appears on the screen. It's L20. A healthy female green sea

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The other tagging method is a satellite tag.

Flipper tags

⁵ Joanne Pettigrew, who lives in the area, had initially spotted the turtles when they first began basking at Laniakea in 1999. After witnessing people sitting on their backs, trying to ride them and feeding them, she became concerned for their safety. Joanne contacted the National Marine and Wildlife Fisheries. A program called Show Turtles Aloha was created to educate the public about the laws protecting the green sea turtles and to 'teach good manners to beach goers.'

turtle between 30 to 40 years old in the prime of her life. One of the green sea turtles who loved to bask at night. The one with the light colored shell. 'Honey Girl.'

Patrick and Joanne are stunned. [Dialogue?] Quickly they secure the area as tourists and visitors arrive. Patrick searches for other remains belonging to Honey Girl. He finds her plastron or breast plate floating in the ocean along with a portion of her intestines.

Investigators from the Hawai`i State Department of Land and Natural Resources (DLNR) and the National Oceanic and Atmospheric Administration (NOAA), the two governmental agencies charged with protecting green sea turtles, are called in to investigate. Honey Girl's remains are removed and a necropsy will be performed.

In the meantime, other volunteers arrive, devastated to find that one of Laniakea's turtles has been killed. A temporary memorial is set up. Community members express outrage over this senseless act. A reward is offered but there are no leads. No one can answer the questions: *Who killed Honey Girl? And why?*⁶

⁶ *Caption: Newspaper articles detailed the finding and the community response.*

Before the Dinosaurs

Honey Girl's ancestors date back hundreds of millions of years before dinosaurs ruled the land, air, and sea. Turtles also appeared before other fellow reptiles - snakes, lizards, crocodiles, and alligators. One of the earliest known turtle fossils, *Proganochelys*, is almost 220 million years old. This turtle measured approximately three feet long and had small horns on the back of its neck. It had a few teeth, lived in freshwater, and was much larger than today's snapping turtle.⁷

Based on studying fossils, scientists hypothesize turtles switched between the land and sea as their primary habitats over the next several millions years. Those remaining on land became known as tortoises; those migrating back to water, were the turtles. Some turtles sought lakes or streams while those that chose the ocean became sea or marine turtles.

Today's sea turtles may have descended from the ocean-going *Santanaghelys gaffneyi*, a small turtle living along the coast of eastern Brazil 110 million years ago. Eventually its shell flattened while its feet and legs became streamlined flippers. While their powerful flippers enabled them to flee predators in their watery world, those same flippers left them awkward and clumsy on land.

Alternating between the ocean and land explains why sea turtles have lungs and not gills. They must surface to breathe air just as whales, porpoises, and dolphins, whom scientists also believe switched between both habitats. In addition, turtles climb out of their watery sanctuary to deposit their eggs in the sand, leaving them and their offspring at risk.

Like all species, turtles continually faced extinction. In the dinosaur era, while large and

⁷ Caption: One of the largest turtle fossils is *Archelon*. It lived 100 million years ago in the Niobara Sea which is now the central plains between South Dakota and Texas. Two small cars parked side by side could fit between its front flippers.

small dinosaurs became extinct, four sea turtle families survived. Later two more families, Toxochelyidae and Protostegidae, disappeared, leaving only Cheloniidae and Dermochelyidae.

Fast forward to a time after all the dinosaurs vanished and man has not yet appeared on the oceans. Scientists believe tens of millions of sea turtles graced various seas worldwide. Although controversial, some estimate as many as 660 million green sea turtles swam in the Caribbean, Mediterranean, off the coast of South America, along Africa's tropical coast, various coastal areas in Southeast Asian, as well as the expanse stretching between Saudi Arabia to India. Beaches were crowded with turtles laying their eggs and then retreating into the foamy surf under quiet moons. By the time the sea turtles reached adulthood, they had very few natural predators and continued to flourish.

Then came the seafarers - conquerors, explorers, pirates, scientists, and whalers - who quickly discovered sea turtles provided a handy source of food. Slow moving on land, sea turtles proved to be easy prey. But more importantly, they could be kept alive for weeks in the ships' bellies, without food, surviving on special fatty lumps in their bodies. In particular, the green sea turtles were prized for their meat. Made green from algae and seaweed rich diets, their meat could be cut into thick turtle steaks while the fat beneath its shell could be stewed to make turtle soup. The green fat gave rise to its name - green sea turtle.

As humans harvested turtles and their eggs, the millions became depleted. Sea turtles had evolved and survived millions of years only to be threatened with extinction after a few centuries of human contact.

Today seven sea turtle species grace the oceans while hundreds of land turtle species exist.⁸ Six of the seven sea turtle species belong to the Cheloniidae family, which means all wet,

⁸ If the black sea turtle is counted as a separate species, there are eight sea turtle

while the prehistoric looking leatherback is the Dermochelyidae family's solitary member. All are listed on the endangered species list - either as endangered or threatened - because of humans.

During the early morning hours of July 20th while Honey Girl basked under a quiet moon, man remained the greatest threat to her survival.

species.

The Necropsy

Dr. Thierry M. Work, a wildlife disease specialist with the National Wildlife Health Center - Honolulu Field Station, examines Honey Girl's remains.⁹ Dr. Work is expert at performing necropsies on different animals.¹⁰ Since moving to Hawaii in 1992, he has done extensive research on fibropapillomatosis, a disease that causes internal and external tumors in green sea turtles, and often spells death. Over the years, he has performed all too many necropsies in which fibropapillomatosis has been the cause of death. But even from a cursory glance, Dr. Work can see that the dreaded tumors did not kill this turtle.

[A thorough necropsy involves careful observations of anything unusual - lesions, growths, and other abnormalities. "Note and record everything that you see; there can never be too much detail," Dr. Work advises in his manual.¹¹ In addition, tissue samples are labeled and stored for future research. Based on the results, specialists can identify causes of wildlife mortality. At the beginning of his manual, Dr. Work cautions that performing a necropsy on a green sea turtle is "hard work."]

External examination

⁹ As with other recently deceased turtles, Honey Girl's remains are taken to the animal quarantine facility in Halawa. A special examination, called a necropsy, will be conducted in an effort to learn more about her physical condition, including whether she had any diseases, and what caused her death.

¹⁰ Dr. Work has four different degrees including a Bachelors of Science degree and a Masters of Science degree in entomology, the study of insects. He also has a doctor of veterinary medicine and a masters of preventive veterinary medicine. Originally from Malibu, California, Dr. Work came to Hawai'i to establish the Honolulu station which covers the entire Pacific region.

¹¹ Dr. Work has written manuals on how to perform necropsies on several animals, including one on the green sea turtle.

In the lab, Dr. Work assembles the instruments and equipment he will need to conduct the necropsy. Assisting him is ~~Dr.~~ George Balazs, a well known and highly respected marine turtle biologist with NOAA. The two men lay out Honey Girl's frozen remains. It has been three days since she was found.

Normally Dr. Work begins by measuring the turtle and noting its physical condition.¹² Using a special device called calipers, the plastron and carapace would be measured. The lengthwise measurement runs from the base of the turtle's neck to its tail. Adult females have shorter tails than males. The carapace width is also measured. All measurements are taken in centimeters rather than inches. The turtle is also weighed; this measurement is recorded in kilograms rather than pounds.¹³

But this necropsy would be different. Dr. Work describes Honey Girl's remains as a "scavenged carcass...which appeared to have been slaughtered." Prior to her death, Honey Girl had weighed around 440 kilograms or 200 pounds and was one of the largest basking females at Laniakea.¹⁴

Among the remaining portions of Honey Girl is her head. Her beak is shaped like that of a parrot's. Her beak and scales are made of keratin. Like all green sea turtles, Honey Girl has no teeth. Long ago turtles' teeth developed into tooth-like serrations enabling them to seize and snip seaweed and algae. As they graze over stretches of seaweed and sea grasses, it's easy to see why turtles are considered the lawnmowers of the sea.

¹² A necropsy data sheet which is part of his manual would guide the examination and results would be recorded on the sheet.

¹³ *Caption: See illustrations in Dr. Work's manual*

¹⁴ Add conversion chart for kilograms to pounds and centimeters to inches.

Dr. Work also checks Honey Girl's skin. On her flippers, her skin is covered with smaller scutes while the skin around her neck is tough and leathery. Sometimes a turtle's skin is covered with lesions or growths. However, Dr. Work notes no unusual abnormalities.

Another item on Dr. Work's checklist is Honey Girl's flippers. "A turtle's front flippers are akin to a human wrist and forearm; the rest of the flipper bones which are comparable to our upper arm bones lie inside the turtle's shell," Dr. Work explains. "The same is true of the hind flippers; those are like our feet and lower legs with the rest of the upper leg bones hidden inside the shell."

Turtle flippers are lost to shark bites or are amputated by being caught in fishing lines. Without the ability to retract its head and flippers, a sea turtle's major defense in the water is its bursts of speed.¹⁵ Three of Honey Girl's flippers are intact; her left front flipper had been severed.

Internal Examination

To look inside a turtle, the plastron or belly plate must be separated from the carapace. Turtles are unique in that these two parts of its shell grow together around the turtle's body, protecting organs and other soft body parts. Essentially, turtles wear part of their skeleton on the outside. Thus, a turtle can never leave its shell just the same way a person cannot leave his or her skin. From the beginning while inside the egg, the carapace and plastron develop as the embryo develops. Ribs expand and fuse to the vertebral column while the plastron bones spread out under the shell. Thus, the rib cage and spinal cord are actually part of the shell. Remarkably the

¹⁵ Shaped like airplane wings, a turtle's flippers create lift, allowing it to fly through the water. The same principle which allows airplanes to create lift and fly is what allows turtles to speed through the water. As water flows above and below the flipper, different pressures are created. The low pressure pulls the turtle forward and upward. This is known as Bernoulli's principle.

plastron and the carapace grow as the turtle grows.

Normally the first order is to cut through cartilage and skeletal muscle that join the plastron and the carapace which can be hard work. But Honey Girl's assailant had already done that with a knife. Whoever did this knew something about turtle anatomy.

Once the turtle's plastron is removed, the pectoral muscles are visible. These powerful muscles provide the locomotion and thrust allowing turtles to glide through the water for short bursts of speed up to 20 miles per hour, faster than any human can swim or run. Dr. Work notes:

"The muscles from the pectoral girdles had been picked clean of meat (knife marks present on one girdle - a type of bone) as was the plastron."

With respect to Honey Girl's organs, Dr. Work observes: "Viscera were missing save for portions of right lung, both kidneys, ovaries, and segments of large and small intestines." If her heart had been recovered, Dr. Work would have examined it. While humans have four chambered hearts, turtles like most reptiles have three-chambered hearts. A green sea turtle's heart can slow down to one beat every nine minutes, thus conserving oxygen and allowing them to remain under water for hours. Over that same nine minute period, the average human heart beats at least 550 times.

Only portions of Honey Girl's right lung ^{were} recovered. Normally a turtle's lungs fill much of the body cavity, allowing it to remain under water for extended periods of time. The trade off is that unlike tortoises, sea turtles can no longer retract their head or flippers into their shells for protection. Second, a turtle's lungs are designed in such a way to enable it to dive to depths over 360 feet. At sea level, water is 800 times denser than air. Pressure increases below the water's surface. A turtle's lungs are structured to avoid getting the bends, a condition in which air bubbles form in the blood vessels, a painful and often fatal condition for human divers.

Honey Girl had been known to dive to depths of over 300 feet.

Dr. Work examines both of Honey Girl's kidneys. Along with her esophagus and salt glands located around her eyes, her kidneys help to rid her body of excess salt.

"All turtles need fresh water to survive but ocean water has a three percent salinity content which could be bad for turtles if ingested in large amounts. When they eat turtles have a spiny lining in the esophagus that retains the food while excess salt water exits through the nose thereby reducing limiting ingestion of sea water," Dr. Work explains. However, when turtles eat, salt water forces their food down as they have no swallowing muscles. In essence, turtles' bodies must function like desalination plants.¹⁶

Judging from the layers of fat, Honey Girl was in good condition. She did not suffer from fibropapilloma; she had no tumors, a disease which causes many other turtles to be euthanized.

Dr. Work concludes that Honey Girl "...was butchered and muscle and viscera taken....and died rapidly...."

Based on her PIT, Honey Girl's first recorded nesting in the French Frigate Shoals was in 2000. A healthy female sea turtle like Honey Girl could lay as many as 100 eggs in a single clutch. Some females lay as many as five to seven clutches in a season. Females lay eggs every other year. Although most females in the wild do not mature sexually until 15 to 20 or 25 years, they can live to be 50 or 60 years old. Honey Girl had at least 20, possibly 30, more years to produce offspring. It doesn't take much to calculate how many young died with Honey Girl that night.¹⁷

¹⁶ Turtles' blood, like ours, contains only a small amount of salt .085%.

¹⁷ *Caption: Illustrate the numbers of lost turtles as a result of Honey Girl's death*

George Balazs

One of the first scientists to do the math on Hawai'i's green sea turtle population was George Balazs, a marine biologist. Growing up in the Mojave Desert in California in the 1950s, an arid climate where everything thirsts for water, George had no inkling he would become a scientist, let alone a marine biologist. Tortoises populated the area but no marine turtles and even desert tortoises did not play a significant role in his childhood.

After graduating from high school and starting college, George married ^{NO} his high school sweetheart. One night at the movies, he and his wife, Linda, watched a travelogue on Tahiti's idyllic life. They saved enough funds for a seven month visit which turned out to be every bit as idyllic as they had imagined. Once their funds ran out, they returned to California to prepare for their permanent return.

In 1965, the couple arrived in Honolulu for what was to be a relatively brief stop on their way back to Tahiti. George worked part-time while studying animal science at the University of Hawai'i and Linda worked full time. After obtaining his masters degree in animal science from the university, he worked at various part time jobs, still planning to return to Tahiti.

Some people are born knowing what they want to do in life; others fall into their life's work while a few are pushed into something they never would have considered. George "fell" into the last category. The first push came from a former professor who encouraged him to apply for a temporary position with the Hawaii Institute of Marine Biology. The job was situated on Coconut Island located in Kaneohe Bay. By now George loved the ocean and the location sounded ideal.

His research consisted of developing foods for certain sea inhabitants - fish, shrimp, and

turtles. Needing sea turtle eggs for his research, George thought he could simply collect them in the wild. Only no one seemed to know where sea turtles nested. This lack of information triggered what every good scientist has: a keen curiosity for answers. George read everything he could find which wasn't much and then started asking questions. Although he didn't know it, he had already become hooked on the honu; he was what many scientists and researchers affectionately refer to as a "turtlehead."

But the final push came in 1972 at the hands of a petite Austrian woman by the name of Hilde Cherry.¹⁸ Born in Austria, Hilde moved to Hawai'i where she quickly became involved in environmental concerns. She helped establish Kokua Markets, the first cooperative market on O'ahu, which allowed farmers to sell their produce directly to consumers.

In the early 1970s, she turned her attention to the honu who were still hunted commercially. She wanted the state government to do more to protect them. Finally the Animal Species Advisory Committee (ASAC) agreed to hold a hearing to discuss the status of the honu. Government officials didn't believe there was a problem; and certainly no one thought a ban on commercial activity was necessary. After all, the vast ocean was full of sea turtles.

Ms. Cherry needed someone convincing to testify and share her concerns; someone who was a scientist. That someone turned out to be George Balazs, a marine biologist and her friend. When she invited him to testify, however, George politely declined. None of his work related directly to the green sea turtles. He did not know anything significant about the honu or its habits; nor did he have any scientific data. Without information or data, he could not be any more convincing than a lay person.

Ms. Cherry persisted; finally George relented. He would testify but he was skeptical he

¹⁸ Photograph of Hilde Cherry and George Balazs; courtesy of George Balazs.

could help. Unbeknownst to George Ms. Cherry had already added his name to the agenda. After agreeing, George could only wonder what he had gotten himself into. His misgivings intensified on the day of the hearing.

The December 1972 Hearing

Unbeknownst to tourists and residents, the Hawaiian Islands include a vast arc of islands, shoals, and atolls spanning over a thousand miles northwest of Kaua`i. Although remnants of ancient cultures have been found on a few islands, most remain uninhabited except by large colonies of seabirds, monk seals, and green sea turtles.

Over a hundred years ago President Theodore Roosevelt designated this remote area as the Hawaiian Islands Reservation to protect seabirds and their nesting sites.¹⁹ In 1940 his cousin and then 30th president, Franklin Delano Roosevelt, renamed it the Hawaiian Islands National Wildlife Refuge and broadened the protection to include marine inhabitants.²⁰ This refuge is now home to more than 90 percent of Hawai`i's nesting green sea turtles.

Protecting this area has always presented enormous challenges given the immense span of square miles and its remoteness. Back in 1959, officials discovered a massive slaughter of the nesting green sea turtles on the French Frigate Shoals but too late. A single fishing company had taken more than one fourth of all the nesting turtles. In the following years, state and federal officials patrolled the French Frigate Shoals preventing any further hunting of turtles at their nesting sites. However by 1972, constant hunting in the area had severely depleted the turtle population. At the time, no one knew how close the green sea turtle was to extinction. That

¹⁹ The Hawaiian Islands Reservations was created on February 3, 1909.

²⁰ On June 15, 2006, President George W. Bush established Papahānaumokuākea Marine National Monument protecting almost 140,000 square miles of federal lands and waters. The Hawaiian Islands National Wildlife Refuge and the Midway Atoll National Wildlife Refuge are now included under this national monument. The monument stretches 1,200 miles northwest of Kaua`I. Midway is the only island that is not part of the Hawaiian Islands.

finding would come from George Balazs the following year. At the ASAC hearing, Eugene Kridler, the manager of the Hawaiian Islands National Wildlife Refuge, testified that banning all commercial hunting of the green sea turtle was unnecessary. He estimated 5,200 breeding females. Admittedly this number was below pre-western European contact estimates but was still large enough to maintain a healthy population. However, he did agree turtle fishing should be banned in the leeward islands.

Waiting to testify, George was shocked to hear Kridler's testimony especially since there was no reliable data to support it. Without accurate information, George could not counter Kridler's statements. Months earlier when George had finally received a clutch of eggs from the U.S. Fish and Wildlife, on a whim he had buried a microphone with the eggs to hear the turtles hatching. What he discovered led him to write to Dr. Archie Carr, the preeminent biologist hailed as the father of sea turtle research.²¹

In 1954 Dr. Carr started a green turtle program at Tortugero, Costa Rica. It is the longest continuous population study of any vertebrate to date. Alarmed at the diminishing numbers of sea turtles, Dr. Carr began Operation Green Turtle in the late 1950s. It was to become one of the most unusual missions in naval history. Planes flew precious cargo consisting of more than 100,000 hatchlings from Turtle Bogue to twenty-eight beaches along the U.S. and Mexico gulf coasts, and along beaches in the Caribbean islands and Central and South America in an effort to repopulate the species.

Every scientist involved in turtle research today can trace his or her lineage back to Dr. Carr. George is no exception. From Dr. Carr, George learned that sea turtles everywhere else

²¹ Photo of Dr. Carr and George Balazs, courtesy of George Balazs.

were on the verge of becoming extinct. Dr. Carr wrote back to George, encouraging him to find out all he could about Hawai'i's sea turtles.

Now as George listened to Kridler's testimony, he silently questioned whether Hawai'i's green sea turtle population was any different from other sea turtle populations. Three years earlier, while in Lahaina, Maui on vacation with his wife, George had witnessed hundred pound turtles piled in the back of numerous pick up trucks bound for restaurants to satisfy tourists' demands for turtle steaks and turtle soup. He had wondered then if the turtle population could withstand such large scale harvesting.

Sitting at the hearing, George glanced down at his data regarding the amount of turtle meat harvested over a nine year span. In 1963, fisherman reported harvesting 380 pounds; in 1972, that amount soared to 25,583 pounds. Even with his limited knowledge, George knew it took years before females reached sexual maturity. He also knew females did not lay eggs every year. Further, only in the Hawaiian Islands both males and females basked and therefore not all turtles coming ashore could be counted as 'nesting females.'

George didn't remember exactly what he said at the hearing other than to emphatically state that sea turtles should be 'managed' and not 'mined.' However, without the data he needed, George could not be persuasive. So it was no surprise the committee failed to pass any measures protecting the turtles. After the meeting, George sprang into action. Like all dedicated scientists, he knew exactly what was needed. *Accurate scientific data. Reliable scientific data. Facts based on first hand observations.* To obtain that kind of data, he would have to travel to the remote and isolated beaches of the French Frigate Shoals where 90% of the Hawai'i's green sea turtles nested. There was only one problem: how to get there?

Summer 1973

Journey to the French Frigate Shoals

Long ago, in the 'mist land of time,' the Polynesians believed demi gods with supernatural abilities lived as commoners. One demi god was Maui, a good natured fellow but also a trickster at heart. One day while fishing with his brothers, he cast his great fish hook into the ocean. Instead of catching a large fish, he hooked the ocean floor. As the sea bottom rocked, great waves rose over the front and back of the canoe. As Maui's line strained under the great weight; he urged his brothers to keep paddling. As the tops of the islands appeared, he admonished his brothers to paddle harder. "Don't look back," he warned "or the great fish will be lost." Thinking that Maui had caught the largest fish ever, one brother turned to peek. The line broke and Maui's fish hook could pull the land no further. And that is why the main islands are fragments from the ocean's bottom and remain unconnected to this day.

Geologists tell a different story of the Hawaiian islands' birth. They divide the earth's crust into fourteen rigid plates; these plates rest on the earth's mantle, a fluid part of the earth. The plates move constantly as a result of plate tectonics. For the past 70 millions years, the Pacific Plate has drifted northwest at a slow rate of 2 inches a year which is the same rate as fingernail growth.

Located along the earth's mantle are hot spots; a volcanic island develops over a hot spot and then gradually drifts away and soon another volcanic island takes its place over the hot spot. Twenty five million years ago, fiery volcanoes pushed their way up from the Pacific Ocean floor, spewing lava and ash into the air, forming a bridge of islands. Eventually most of the volcanoes ceased erupting and the molten lava flows cooled. Lava poured from the cracks, spread rapidly,

and slowly built gigantic shield volcanoes which eventually peaked above the ocean's surface.

The eight major Hawaiian islands were built by more than one volcano; scientists estimate Kaua'i to be about 6 million years old and the Island of Hawai'i less than 700,000 years old. Active volcanoes continue to erupt, adding more land mass to the southeastern portion of the archipelago.²²

Ancient Hawaiians attributed the volcanic activity to Pele, the goddess of fire. She had a magic digging tool called Paoa. When she struck the earth, it made a pit fire. The first pits she made were too close to the ocean and they quickly filled with sea water. Finally she found a place where she could keep her fire pit going and that became her home. We know it as Kilauea on the Island of Hawai'i, and the site of one of Hawai'i's most active volcanoes.²³

Farther toward the northwest edge of the 1600 mile chain are the oldest of all the islands; some are so old that they have actually sunk part way back into the earth, leaving their flattened tops as much as 3,000 feet below the ocean surface. Closer to Kauai and Niihau, some no longer exist as islands; they have been worn down to sea level and are only shallow places in the ocean or shoals, including the French Frigate Shoals, George Balazs' destination.²⁴

²² *Caption: The Hawaiian islands are strewn over a sixteen hundred mile arc. Eight main islands cluster along the southeastern end while ten islands and atolls comprise the Northwestern Hawaiian Islands.*

²³ *Caption: Hawai'i's lavas reach 2200 Fahrenheit degrees; hotter than other lavas and consequently more fluid.*

²⁴ *Caption: The Hawaiian Islands stretch 1,600 miles across the middle of the North Pacific Ocean. The biggest volcanoes and the tallest peak on the planet is here. Mauna Kea rises 13,794 feet above sea level. While Mauna Kea is the highest, Mauna Loa is the most*

massive. Forty-five miles away the ocean is more than 3 miles deep; this rise of almost 6 miles in this short span is the greatest change in elevation on earth.

Scientists also know that eighty thousand years ago, the sea level was about 25 feet higher than it is now. For centuries, the coral flourished in the warm seas and built reefs around the islands. Meanwhile wind and wave eroded the hard volcanic rock forming sandy beaches along the coastlines. Wind and wave also brought flora and fauna to the islands. With luck and tenacity, species proliferated at an astonishing rate. Reef fish came to the Hawaiian islands from Southeast Asia where the waters are similar in temperature. Sea turtles too arrived. Unlike green sea turtles elsewhere that migrate thousands of miles, these turtles remained within the archipelago. If Charles Darwin had studied the Hawaiian Islands, he would have been amazed at the variety of species, far more than what he found on the Galapagos islands. No where else in the world would he have found such a rich diversity.

Eventually voyagers, explorers, and sailors discovered the Hawaiian Islands, the most remote formation of islands in the world. Canoes and ships landed, bringing more plants and animals. Today residents and tourists know little about the northern islands with the exception of Midway, a historic World War II battle site. Ironically, Midway is not part of the Hawaiian Islands. In the meantime, thousands of sea turtles nested along the various deserted island shores, eventually establishing their main nesting site on thin strips of beaches along tiny islands in the French Frigate Shoals.

These shoals might have remained undiscovered except in 1786, two French frigate ships nearly ran aground on their surrounding coral reefs. The *Astrolabe* and the *Boussole* were able to narrowly avert the reefs. At the time both ships were under the command of Count La Pérouse, whose name was given to a nearby piece of dense lava rising 122 feet above the sea and shaped like a ship under sail. During the whaling days, several American and British whaling ships were not as lucky; their skeletal remains dot the ocean's floor. In the early 1900s, one shipwrecked

crew of 30 men survived eight days by killing over 100 green sea turtles before being rescued.

Now deserted, the French Frigate Shoals are home to almost all of Hawai'i's green sea turtles. Turtles swim 500 miles or more from other islands to nest. George knew a definitive count would put the issue of the health of Hawai'i's green sea turtle population to rest once and for all. He hoped he was wrong about their numbers but he was also worried he was right.

The first thing he needed was funding. He would have to stay most of the nesting season which typically ran May through August; sometimes into September. George made inquiries; no state agency had financing. When he had just about given up hope, George received favorable news from the New York Zoological Society in the form of a small grant.

The next obstacle became transportation as commercial planes or ships did not travel to the French Frigate Shoals. George contacted the U.S. Coast Guard. On June 1, 1973, he hopped a ride on one of their DC-3 planes, a vintage World War II aircraft affectionately known as the "Gooney Bird." Destination: French Frigate Shoals; estimated flight time: four hours from Honolulu.

George's first stop was Tern Island, one of ten tiny islands in the French Frigate Shoals located on the northwest end. During World War II, the original eleven acre island had been enlarged with sand and coral to create a 3,000 foot gravel runway, expanding the island to fifty-seven acres. But the coral gravel and hard packed sand provided the worst possible habitat for nesting green sea turtles. After two days and no sign of turtles, George was ready to move on.

His second stop was East Island, six miles southwest of Tern Island, where he estimated that at least half of Hawai'i's green sea turtles nested. A U.S. Fish and Wildlife officer ferried him over. Sharks patrolled the waters off East island which had fared no better than Tern Island since the war. Once home to a radio-transmitting navigation station, not much remained. The

island had no fresh water source and no trees to provide shade from the relentless sun. And while the island had no human population, it was home to a large colony of nesting sooty terns, noisy and smelly.

George pitched his tent. That night he went for his first turtle walk and found one nesting turtle. After hauling herself up on the sand, she dug a pit a little larger than her body with her fore flippers. Using her hind flippers she dug another a hole, about two feet deep and wider on the bottom. This was her egg chamber. As she settled herself into the body pit, she slowly dropped her precious eggs, each about the size of a golf ball and thin shelled. Over the next twenty to thirty minutes, she laid approximately eighty eggs. Intent on her actions, she paid little attention to George. Once finished, she threw sand over her nest with her hind flippers. Satisfied her nest was fully covered, she retreated back into the surf. The whole process had taken about two hours.

If he had been hooked on turtles before, George was now completely snagged. Under the vast night sky filled with stars and the sound of waves tumbling ashore, George found his life's mission.

Final Count

The days on East Island were miserable, affording little escape from the heat, squawking birds, and the ammonia smell of their waste. The nights were equally miserable but for a different reason; the night brought despair in waiting for the nesting turtles. Where were the 5,200 turtles that Eugene Kridler had described? Could they have moved to a different location?

George knew that sand, air, and temperature were the three critical ingredients necessary for successful hatching. After the turtle lays her clutch of eggs, she covers them, hoping no predator will find them. Then she makes her way back to her watery world never to see them again. She does not guard the eggs, provide nourishment, or teach the hatchlings anything about the world. Her children are on their own from the moment she covers her nest.

The sand takes over some her duties and acts like an incubator. Unlike chicken eggs which have an internal pocket of air, the turtle embryo fastens itself to the shell's inside, breathing and absorbing water through the porous membrane. Depending on the size, sand particles can act as a barrier preventing the right amounts of moisture and gases from getting through.

The sun also contributes to the eggs' sexual development. Unlike other eggs in which sex is determined at the moment of inception, the first twenty to forty days is the critical time in which temperature determines the turtle's sex.²⁵ Warmer sand temperatures often produce females while cooler temperatures produce males. In this fashion, the sun and sand worked together to produce Honey Girl and her offspring.

Whether male or female, turtle eggs take approximately 60 days to hatch. For a successful

²⁵

Other reptiles such as crocodiles also lay eggs without a predetermined sex.

hatching, Honey Girl, her brothers and sisters would have to emerge from their shells around the same time. Using an egg tooth, a temporary protrusion called a caruncle, the hatchling frees itself from the shell over a period of days, a process known as pippin. During this period, the remaining egg yolk provides nourishment. Hatchlings then move upward scraping sand from the nest ceiling. The sand falls below and accumulates on the tops of empty shells causing the floor of the nest to rise.

In two to three days the hatchlings explode out of the nest like a small volcano erupting, usually at night. A few hatchlings remain trapped at the bottom of the nest, unable to climb out. Through some unknown mechanism and despite the darkness, the hatchlings head directly for their watery world. Weighing no more than a single ounce, the weight of an average letter, and no longer than 1 ½ inches long, they face hungry crabs and fish waiting for a tasty meal.

Of those hatchlings who successfully run the gauntlet from nest to open sea, escaping waiting predators, little is known of their 'lost years.' It is believed they continue to swim far out to sea for the first 24 to 48 hours, until they find an area rich in marine life among driftwood, sea foam, floating seaweed and other debris. At this stage, the ocean becomes its nursery. Two weeks later the egg tooth disappears; its shell begins to harden. Carnivorous during this period, they eat sea jellies, small shrimp and other tiny crustaceans, fish eggs, and small invertebrates. They begin to grow and never stop.

Covering its shell, are scutes or thin layers of keratin, the same substance found in people's fingernails. The plastron is lighter in color while the carapace is darker. This provides countershading making it difficult for predators to spot the turtle from above and below. Beneath the scutes lie bones, cartilage, and tissue which make the turtle's shell incredibly tough. In fact, no other backboned sea animal has such a strong suit of armor few can bite through.

Once they turn two, juveniles are the size of dinner plates. Their diet changes and they become herbivores, looking for tasty limu and sea grasses among the coral reefs. By now they have only a few natural predators. When they are three to four years old and are approximately 15 to 18 inches long, they return to the beaches. However to reach this point, their rate of survival is estimated to be one in a thousand.

George struggled to sleep during the day so as to remain awake at night to count the nesting turtles. He described each turtle in detail, making as many observations and notes as possible so as not to duplicate the count when a female nested a second or third time. After the end of the summer, George looked at his paperwork in utter shock and disbelief. He had faithfully counted the nesting females. That number was no where near Eugene Kridler's estimated 5,200 nesting females. That number was no where near a thousand. *In fact, that number was less than 100.* That number, to be exact, was 67. The green sea turtle species was in such critical danger that each slaughtered turtle brought it closer to extinction. With his scientific data, George knew not a moment could be wasted; the green sea turtle needed immediate legal protection.

But a scientist needs the help of politicians to create laws to protect the sea turtles. And the political process, George would discover, was anything but scientific. He had to speak for the honu for it had no voice of its own. But would anyone listen? Or was it too late?²⁶

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Caption: Illustration/Graphic:

Time Line to A Turtle

Turtles mate

Female lays eggs two weeks later or can carry fertilized eggs up to 2 months

Eggs laid; sand incubates for two to three months

Eggs hatch; takes 2 to 3 days to emerge to the top

Hatchlings emerge and head for the sea

Lost years

Sexual maturity

Starts cycle again

*Live 45-59 years in the wild; Might live as long as 100 years Time scale:
generation time that spans many decades*

Legal Protection

Once he returned to Oahu, George went into high gear. Armed with the scientific evidence he needed, George could now speak with conviction regarding the green sea turtles' plight. And speak he did - to public groups, to legislators, to anyone who would listen. The media was among the first to come to George's support. The local newspaper reported George's speeches; the public wrote letters to the editors and to George. George Balazs became the point person - if anyone wanted to know about the turtles or if anyone wanted to tell him about their experiences and observations, they contacted him. That's how he found out turtle hunters in Kauai used spear guns with explosives to kill 15 to 20 green sea turtles a day. That's how he learned which stores sold goods made from turtles. He heard from helicopter and airplane pilots about the decrease in turtle sightings from the air over the years.

Not everyone was happy with George's efforts, especially not the turtle hunters or the retailers but George would not give up. Finally in 1974, the Division of Fish and Game under the Department of Land and Natural Resources banned the commercial use of green turtles. Regulation 36, as it became known, made it illegal to hunt the green turtle for profit. This meant restaurants could not serve turtle steaks or soup and stores could not sell jewelry or purses made from the turtles' shells or skin.²⁷

²⁷

Regulation 36: find, describe, penalties; otherwise delete

For George, however, Regulation 36 was only the beginning of what the green sea turtles needed. He wanted what sea turtles had elsewhere - the kind of legal protection Dr. Carr and others had succeeded in obtaining for their green sea turtles. He wanted Hawai'i's green sea turtles listed under the state and federal Endangered Species Act. And he wanted that legislation passed now. George continued campaigning and public support increased. With public support comes pressure, the kind of pressure that results in change.

In 1975 Hawai'i passed its own Endangered Species Act. Sea turtles were included in the list of protected animals. Violators, if convicted, faced fines as well as imprisonment up to one year.²⁸ It would take another three years of unrelenting effort before federal officials included Hawai'i's green sea turtles as threatened under the federal ESA. Finally it became a federal crime to harass, hunt, or kill the honu.

²⁸ Hawaii Revised Statutes, Chapter 195D, prescribe the penalties. For a first conviction the fine is not less than \$250 but the court can impose a fine up to \$1,000; jail up to one year or both fines and jail can be imposed. For a second or subsequent conviction within five years, the fine is not less than \$500 or up to \$1,000; jail up to one year or both fines and jail. In addition, the court must impose a fine of \$500 for each specimen of a threatened species and \$1,000 for each specimen of an endangered species if the violator intentionally, knowingly, or recklessly killed the specimen or removed it from its original growing location. In addition, civil penalties of \$5,000 can be imposed. Under the federal law, fines up to \$50,000 can be imposed along with a year in jail.

Recovery and a New Peril

Despite this last legal victory, George and others knew their work was far from over. George made more summer visits to the French Frigate Shoals to count the nesting females. It was a lonely place but the increase in nesting females encouraged him. During his trips to the French Frigate Shoals, it's possible that George saw Honey Girl's mother, father, her aunts, uncles, and cousins. By 1984 the number of female nesting turtles had climbed to 300.

[REWORK: Who tagged Honey Girl? Was she tagged in 2000?]

In 2000, under a moon similar to the one she was born under, Honey Girl came ashore in the French Frigate Shoals to nest. At that time, she was tagged in her hind flippers. Although a green sea turtle's brain is the size of a large grape, science still has not unraveled the mystery of females' ability to navigate hundreds of miles back to her their beach. This loyalty to the birth place, known as philopatry, has spawned many theories - magnetism; particular color and scents of the birth beach that are ingrained in memory; and orientation to the stars and moon. However, to date, scientists do not have a definitive answer. What we do know is that during her short life, Honey Girl, like most of Hawai'i's green sea turtles, faithfully returned to the French Frigate Shoals to lay her eggs.

Under the same bright moon, that she loved to bask under, Honey Girl pulled herself above the high water mark to make her nest. With her powerful front flippers, she dug a body pit. Then with her hind flippers, she excavated the egg chamber. Belly pressed against the sand, Honey Girl dropped precious egg after egg into the chamber. She could have laid as many as 100 eggs in each clutch. After several hours, Honey Girl slipped back into the ocean. That first season, she could have laid as many as five to seven clutches.

Honey Girl would return every other year to her nesting beach. Her honey colored carapace made her easy to spot. In 2006 more than 500 females nested on East Island. Every year the green sea turtle population increased by five per cent Hawai`i's green sea turtle was definitely recovering and poised for a return. Little did George know that their recovery was to be a short lived victory.

As the turtle population increased, another danger had already made its way silently through the ocean waters. Invisible except under the eyes of microscopes. Floating in the water, it searched for a suitable host. Once it claimed a host green sea turtle, tumors grew and multiplied at an alarming rate - sometimes inside the turtle, choking its life from inside; sometimes growing on the outside; preventing nourishment from getting inside. Sometimes it attacked both inside and outside, showing no mercy.

It became known as a mysterious disease causing a worldwide epidemic among the green sea turtle population. And once a turtle was inflicted, it was just a matter of time before it died. Scientists frantically searched for answers to this silent killer. What was it? What caused it? And more importantly, could it be stopped?

Fibropapillomatosis

George checked his notes from his summers in the French Frigate Shoals. He had been careful to note every significant detail about each turtle he had seen. If he had seen any tumors in the turtles in those early years, he would have made note of something so unusual. But no mention of lesions or tumors appeared in his notes. When had these tumors started?

The earliest case was discovered in Florida's green turtles back in the 1920s. Large tumors appeared on the turtles' eyes, necks, flippers, mouths, and on internal organs. It usually meant a slow and painful death as the turtle experienced difficulty seeing, swimming, and feeding.

One day George stumbled across the first documented evidence of this deadly disease in Hawai'i. He found it in a family album. Six young boys had gone swimming in Kaneohe Bay on January 25, 1958. They found a turtle with some kind of growth on its body and thought it unusual enough to photograph it. In the black and white photo, two of the boys hold the turtle between them while the others look on. Afterwards they killed the turtle. One of the boys was John Naughton who was now involved in turtle research. He had casually mentioned the family photo to George.

As more and more cases were documented in Hawai'i, scientists estimated that as much as 40% of Hawai'i's green sea turtle population was afflicted. And yet there were places, like the west coast of the Big island, where turtles remained tumor free.

Slowly more pieces came together as scientists worldwide shared their research. First, they gave the silent killer a name: Fibropapillomatosis. Then they decided that there was a link

with a virus, in particular, a herpes virus. And pollution may be a contributing factor, “an environmental co-factor,” opined Dr. Thierry Work, who was now seeing a significant number of cases in Hawai`i.

Scientists raced against time to find a cause. Without the cause, they cannot find a cure. And without a cure, the tumors spell death for the turtle. Turtles are sentinel animals or gatekeepers. Often if something happens, it happens to them first before affecting other species. That is why it was so important to identify this terrible disease before it spreads to other species.

Over the last few years, Dr. Work and Dr. Balazs have noticed a significant drop in the number of cases. The reason for the decrease is just as puzzling as the cause of the disease. “The decrease doesn’t mean that the disease is going away since it continues to exist worldwide. Epidemics have been known to wax and wane,” Dr. Work explains. “For example, in Florida and Brazil, the cases have either stabilized or are increasing.”

Until July 19, 2008, Honey Girl had been lucky; she had not contracted fibropapillomatosis. When Dr. Work performed her necropsy, he did not find any evidence of the deadly tumors on the outside or inside of her body. Perhaps she was lucky that she did not die slowly with this affliction.

Other Threats

Once Honey Girl turned four, she had already survived tremendous odds. To reach that age, her estimated survival rate is one in a thousand. During her short life, Honey Girl may have escaped other dangers. The list of potential threats is long and most are caused by humans.

If Honey Girl had been injured, she would have been brought to Dr. Robert Morris, the veterinarian who has a contract with NOAA to provide treatment. Like George Balazs, Dr. Morris is a marine biologist and received his masters in marine biology from the University of Hawai`i.²⁹ And for over fifteen years, Dr. Morris has treated Hawai`i's sea turtles and is now the most knowledgeable veterinarian on turtles in the state.

On call 24 hours a day, seven days a week, Dr. Morris sees about seven to eight turtles a month. Although ninety percent of his patients are green sea turtles, he also treats the other four species of turtles found in the Hawaiian waters: leatherback, olive ridley, loggerhead and the hawksbill, considered the most endangered.

On this particular weekend, he tends to two turtles brought in by DNLR agents. One would have a happy ending and the other would not. The first turtle had a fish hook in its mouth. Fishing hooks and lines are a common problem for turtles. Sometimes the hook prevents the turtle from being able to open its mouth to feed. In this case, Dr. Morris carefully extracted the hook on the otherwise healthy young juvenile turtle. In a few days, the turtle would be released back into the ocean. Recently fishing hooks have been redesigned to cause less damage. Known

²⁹ After graduated from the University of Hawai`i, he attended Cornell Veterinary School. He has been an assistant director at the Waikiki Aquarium, a curator at Marineland in Florida and a curator at the New York Aquarium. For the past twenty seven years he worked at his Kailua clinic; recently he sold the business and retired.

as circle hooks, these hooks don't catch turtles as often and if a turtle is caught, the hook causes less damage or injury.

A second common injury is a flipper that is entangled in fishing line and requires amputation. Ocean currents swirling around the Hawaiian Islands draw in thousands of pounds of debris every year. Despite massive clean ups, the ocean fills with more. Turtles become entangled in debris such as ropes, fishing nets, fishing line, and other abandoned fishing gear. Dr. Morris has performed over 40 flipper amputations resulting from fishing line wrapped around the flipper.

If a turtle is trapped in fishing nets and not freed quickly, it will drown. Although able to stay under water for long periods of time, turtles often run out of air or die within minutes of being caught in nets. Trying to swim free of the net, their strong quick swimming depletes the oxygen in their lungs. If the turtle cannot reach the surface, it drowns. Long line fishing nets have been redesigned to add a turtle excluder device which allows the turtle to escape through a specially designed trap.

Plastic bags and six pack rings floating in the ocean pose another common threat. Turtles mistake plastic bags for sea jellies. Once ingested, a sea turtle's digestive system is quickly clogged. Turtles also poke their heads through holes in plastic six pack rings. As they grow larger, the plastic ring becomes stuck choking them.

Boat collisions are usually fatal, especially when the strike breaks the turtle's shell. If the slash is deep, the turtle's organs are damaged beyond repair. Recently a 300 pound female turtle was flown from Maui to Oahu. Although the wound was deep, the turtle still had use of her back legs and sensation in her tail. Despite quite a bit of tissue damage, its organs appeared in tact. After cleaning and disinfecting the wound, Dr. Morris drilled holes in the shell. Using stainless

steel wire, he closed the gap. He then sealed the cracks with dental acrylic. Immediately following surgery, the turtle was released. "Turtles do not like to eat in captivity and she would have a better chance of recuperating in the ocean," explained Dr. Morris. "Her chances of recovery are good given her strength and otherwise good health."

Over the years, Dr. Morris estimates he has probably saved over 500 turtles. He has treated everything from fish hooks to flipper amputations to shark bites to boat strike injuries. Since sea turtles are reptiles they are cold blooded. While performing surgery, Dr. Morris takes that into consideration in deciding how much anesthesia and medication to administer. Turtles take a very long time to recover from anesthesia and medication stays longer in their systems as well.

If an injured turtle is found on a neighbor island, the turtle is airlifted to Oahu although there have been times when Dr. Morris flies to the injured turtle. Since green sea turtles can get quite large, up to 400 pounds, Dr. Morris was flown to Maui to treat a large turtle that had been speared through its head, piercing it in such a way it was unable to eat. Fortunately the spear had missed everything vital in the turtle's head. Dr. Morris simply grabbed the end of the spear and yanked it out. After a few days of recovery, the turtle was set free minus the spear. But if Dr. Morris hadn't removed it, the turtle would have died.

Dr. Morris notes many calls are received on the National Marine Fisheries' hotline about turtles stranded on the beach. Fortunately sometimes it turns out that there is nothing wrong. The turtles are simply basking, enjoying another day at the beach.

The second turtle brought to Dr. Morris suffered from an advance case of fibropapillomatosis. Found floundering in the surf; it was already weak and unable to eat, its plastron collapsed. Upon examination, Dr. Morris suspected it was blind in both eyes. It would

be euthanized. Tumors are the most difficult to treat with any success.

Given the possible dangers, scientists estimate only one in a thousand hatchlings lives to be fully grown. Only one in five thousand females lays eggs. Thus, more than ninety percent of the green sea turtles die at a young age.

Up until July 19, 2008, Honey Girl had avoided all those dangers. The only one she had not escaped had been someone's knife.

Turtle Guardians

It has been over a year since Patrick Doyle discovered Honey Girl lying in her shallow grave. There are no leads in her death. And yet those who protect the honu continue to do their jobs. And those who work to conserve the species continue their work.

Protecting the Honu

Two government agencies are tasked with protecting the turtles and their habitats both on land and in the ocean. The National Oceanic and Atmospheric Administration (NOAA) is a federal governmental agency. The Department of Land and Natural Resources (DLNR) falls under Hawai'i's state government.

NOAA has overall responsibility for the well being and recovery of the green sea turtles under the Marine Mammal Act and Endangered Species Act. Within NOAA, there are departments or subdivisions that have specific responsibilities. To name just a few are the Pacific Islands Regional Office (PIRO) of the National Marine Fisheries Service and NOAA's Office of Law Enforcement.

PIRO's main responsibilities are to examine and review fishery management plans, as well as conservation and recovery of protected species and their habitats stretching over 1.5 square nautical miles. According to Wendy Goo, the agency's spokesperson, PIRO engages in turtle research, especially information relating to their nesting habitat in the French Frigate Shoals and collecting data on fibropapillomatosis.

Conserving the honu

Since 1976, Sea Life Park on O`ahu has hatched thousands of green sea turtles as part of its captive breeding program. The park has an AZA rating from the Association of Zoos and Aquariums, the highest accreditation rating that can be given to animal exhibitors. Fewer than ten percent of the 2,400 animal exhibitors in the United States have such a rating.

Located near the ocean at Makapu`u, the park pumps clean salt water directly from the ocean for its tanks. "We are aware of the danger and risk of fibropapillomatosis. The park does everything to ensure that its turtles remain tumor free," states Jeff Pawlowski, a marine biologist at the park.

When the turtles turn nine months, they are released into the ocean of Makapu`u beach. "Research has shown that juveniles have a higher rate of surviving being released into the wild than do hatchlings," Jeff explains. The park celebrates with day long festivities, culminating in a late afternoon release. One by one the turtles are carried down to the water's edge in a blue tarp. Then the turtle is lowered into the water. The first wave breaks over the turtle. Its strong flippers pull it forward in the shallow waters. The next wave crashes over it and it moves forward into deeper waters. The back wash pulls it into deeper waters until the turtle is submerged and swimming.³⁰

³⁰ Currently Sea Life Park is conducting research in conjunction with NOAA and the University of Alabama at Birmingham. Green sea turtle nests are cooler in Hawai`i than those of sea turtles found elsewhere. Temperature affects the sex of the embryo and the study is aimed at determining exactly how temperature affects the gender determination and if a direct correlation can be made between the nest's temperature and gender. After the hatchlings are born, it takes four months before researchers are able to tell the sex of the turtle. It takes another twenty years for the turtle to reach sexual maturity. Scientists hope that this research will help them predict how climate changes may affect the sea turtle population and aid conservation efforts.

Since 1989, the park has provided turtles as part of its Turtle Ambassador program. Young turtles about nine months old are provided to two hotels, Mauna Lani and Kahala, and the Maui Ocean Center. When the turtles reach a certain age and size, they are released from captivity.

Students at the Hawaii Preparatory Academy on the Island of Hawai`i assist in research on these and other green sea turtles. Marc Rice, a friend of George Balazs and the director of the school's Sea Turtle Research Program, oversees the program where students volunteer to help capture, tag, and record research on green sea turtles. Students have spent hundreds of hours collecting data. In 2008 eighth grader Meimei Nakahara was selected as one of Hawai`i's top volunteers for her work in the turtle research program. Excited about her participation in the program, Meimei hopes to follow in the footsteps of George Balazs and other marine biologists.

Honey Girl's Legacy

It is early morning. A shearwater skims the sea, its grace mirrored in the still water. A turtle pokes its head up for air. Another turtle hauls itself onto the sand, leaving tracks in the soft sand. Malama Na Honu volunteers set out the red ropes around the basking turtle. A few cars drive on the two laned road past Laniakea; one car stops and parks. Then another. Another day begins on Laniakea.

Although we may never solve the mystery of Honey Girl's death, there are lessons we can learn. We must continue to educate the public about the significance of every loss, especially an avoidable one. Healthy nesting females, in particular, are crucial to the species' survival.

Second, we must find additional ways to make fishing safer for turtles. Turtle excluder devices and circle hooks are good beginnings. However, floating debris remains a major problem for turtles. Each one of us can do our part to ensure that debris, especially fishing line, plastic bags, mylar balloons, and six pack rings do not find their way to the ocean.

Third, we must protect their habitats both on land and in the ocean. Saving the green sea turtle is only half the battle; we must save their habitats as well. As creatures of both land and a watery world, any threat to either habitat can have significant consequences. Turtles will not thrive unless they have abundant algae and seaweed to graze on and safe beaches to lay their eggs. In turn, this means surrounding coral reefs must remain healthy.³¹

While we may not be able to prevent natural disasters, there are other matters within our

³¹ Reefs keep our islands and atolls from sinking. If coral growth does not keep up with erosion, then the islands and atolls will slip beneath the sea.

control. Preventing environmental disasters such as oil spills, not altering beaches and coasts, removing alien seaweed, and preventing stress from divers, are things we can do. Criminal acts such as the illegal taking or poaching of turtles or their eggs are also preventable.

Fourth, the issue of global warming must be addressed. What will happen when the sea rises and the stretches of sand, their natal beaches, disappear?

Finally, we are all responsible for their recovery and continued survival. We must work together.³² For Joanne Pettigrew coming to Laniakea "makes a difference." She hopes one day the area will be designated as a sanctuary. And perhaps Malama Na Honu will have sufficient funds to create a discovery center. Once touched by the magic of Laniakea's turtles, more people may volunteer as turtle guardians and help educate others in return. *Every turtle deserves our protection.* For Meimei Nakahara, working with live animals has made her keenly aware of her responsibility to protect them. Four of the turtles she studied were recently released in the most recent Turtle Independence Day. As George Balazs says, "They're willing to share their habitat with the community but we need to live up to our responsibility and treat them with respect."

Every turtle counts.

³² Honua is the Hawaiian word for earth; it is similar to honu, the Hawaiian word for turtle. Ancient Hawaiians saw the earth curved like a turtle's back while navigators envisioned the map of the world on the back of a honu. And the honu was considered an `aumakua or a family guardian. In addition to representing wisdom, the honu was a navigator, pointing the way home. Protecting the earth and the honu is closely intertwined.

Epilogue

It is the Fourth of July. On this day, Americans celebrate their independence. At the Mauna Lani Hotel on the Island of Hawai`i, several juvenile turtles will celebrate their independence. First, they have to pass Dr. Morris' veterinary examination to make sure they are healthy. Then they are fitted with a microchip and an external identification tag so they can be tracked.

Since 1989, more than 160 turtles have gained their independence.³³ While waiting for their release, juveniles live in salt water ponds on the hotel's grounds.

It is mid-morning; visitors and residents line up to catch a glimpse of the young turtles as they begin their journey to freedom. Hawaiian chants mark the beginning of their special journey. Cameras click away as students ferry the turtles in special white slings from the salt water ponds to the ocean's edge. Adults then help lower the turtles into the waiting waves. Sea foam embraces the sojourners. The turtles pull themselves through the shorebreak until the foam covers their shells. The crowd claps and shouts words of encouragement. With a wave of a flipper that can only mean thanks, one by one the turtles swim into the open sea.

³³ In June 2009, a sea turtle that had been released from Mauna Lani in 1999 was discovered living in the wild at the Kaloko-Honokahau National Historic Park. The turtle is 14 years old and weighs 267 pounds.