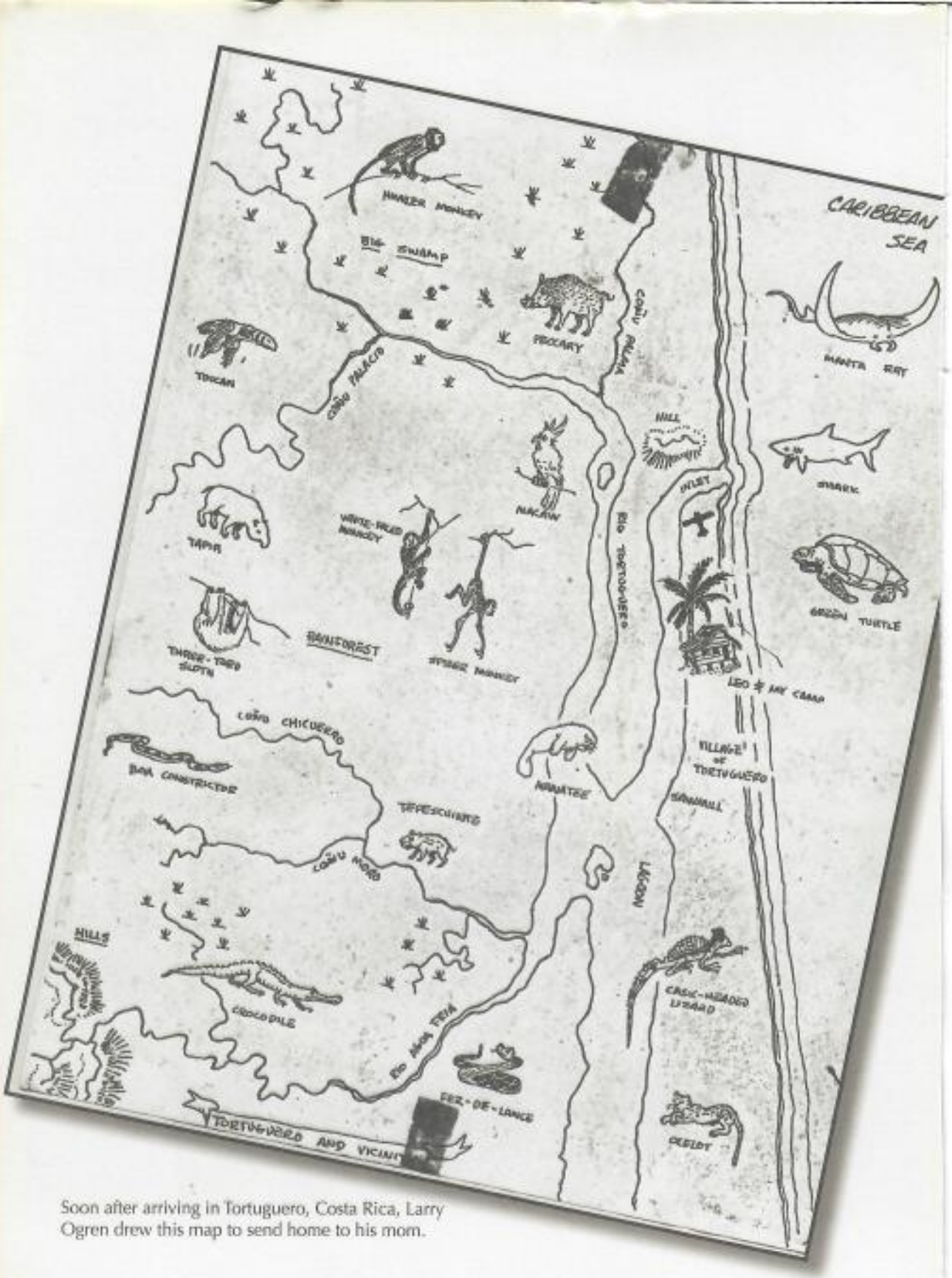
Turning Turtles in Tortuguero

Stories From the Origins of Sea Turtle Conservation

Anne Ake

Larry Ogren consultant

Foreword by Dr. Archie Carr III



Soon after arriving in Tortuguero, Costa Rica, Larry Ogren drew this map to send home to his mom.

TURNING TURTLES IN TORTUGUERO

For George Balazs,
An intrepid sailor
bound for Tahiti with
his bride who stopped
for provisions in
Hawaii and never left!
The green turtles
were very happy.

Jamy Ollen

Praise For Turning Turtles

This is a remarkable narrative, told with none of the stridency that infects lesser environmental writings. It speaks almost in a whisper and focuses on the close-at-hand – the turtles, a man, a village. Yes, it is about an heroic half-century-plus effort to save turtles, but it is really about saving ourselves, our habitat and the future. It is about the importance of education and sensitization to changing a culture and its habits of consumption – a lesson that can be applied to global warming, energy, and so many other complex environmental issues. The writing is clear and engaging, offering a narrative that is informative without being dogmatic, and that blends cultural anthropology, conservation science, and good old fashioned story-telling. Hats off to Anne Ake!"

Ted Gup
Harvard fellow, award winning author, Pulitzer Prize nominee, investigative reporter, Emerson College journalism department chair.

In *Turning Turtles in Tortuguero*, Anne Ake captures the essence of life in a small village on the Caribbean coast of Costa Rica sixty years ago. Readers feel the salt spray and the mosquito bites, enjoy the camaraderie of village life, and admire the beauty and hardships of that past time. We see through the eyes of Larry Ogren, a biology student who Archie Carr sent to the remote village of Tortuguero to study the nesting biology of green turtles. Despite limited preparation, Larry thrives and becomes an inspiration to those of us who have had the honor of following in his footsteps.

Karen A. Bjorndal
Distinguished Professor, Department of Biology, and
Director, Archie Carr Center for Sea Turtle Research, University of Florida

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Anne Ake's *Turning Turtles* accurately captures the challenges and adventure surrounding the launch of the world's first sea turtle conservation program. Attracted by some mysterious force to the black sands of Tortuguero, Costa Rica, green turtles return by the thousands each summer to lay their precious eggs on this remote stretch of Caribbean shore. For over five decades, conservationists beginning with Archie Carr and Larry Ogren have been traveling to Tortuguero to study and protect the turtles. Turning Turtles is a fascinating journey through the history of this place and the people who have dedicated their lives to recovering Tortuguero's renowned sea turtles.

David Godfrey
Executive Director, Sea Turtle Conservancy

The book is very interesting. In spite of everything I have going on I simply could not give it up. At first, it has a very strong flavor reminiscent of the *Windward Road* (my favorite sea turtle book). But then, it makes great strides toward becoming its own book, its own story. For a Costa Rican sea turtle biologist who began his career in 1987, the year Dr. Carr passed away, this book summarizes a lifetime of groundbreaking work, one that has lasted and will continue to last for generations.

Roldán Valverde
President International Sea Turtle Society
Associate Professor Southeastern Louisiana University

Turning Turtles in Tortuguero

Anne Ake

Larry Ogren consultant
Foreword by Dr. Archie Carr III

To George
Thanks for all your
love done for the turtles!
Anne Ake

Edgemark Press

Thank You

I am truly grateful to each of the many people who supported this project. Brenda Griffing, my editor and friend, has held my hand—and slapped it as needed. She does not brook lazy writing. This would be a far lesser book without you, Brenda. Without Mark Hendrick to guide me through the jungles of InDesign, I would likely be confined to a padded room by now. Kim Ogren—cheerleader, publicist, girl Friday, friend, and Larry's daughter. Mary Thieme has followed the book from the beginning with friendship, advice, critiques, and more.

Chuck Carr not only wrote a beautiful foreword and shared his delightful writings about Tortuguero, but he read and critiqued the manuscript at several stages. His brother Tom told great stories and dug out old photos. Emma Harrison was a wealth of information and she knows all the best places for food and drink in San José.

Thanks go to Ted Gup, Karen Bjorndal, David Godfrey, and Roldán Valverde for taking time out of their busy schedules to review my manuscript.

My traveling companions on various trips to Tortuguero included my brother Russ and his wife Deborah, my brother Joe and his friend Becky, my friends Mary Thieme, and Elaine Anderson—they said "Where? You want to go where? NO roads!" But they went, and each trip was special.

To my children Mollie Drew, John and Nichole Drew, and my delightful grandchildren Tyler and Chloe: Thank you for keeping me sane and bringing joy to my life. And thanks to my mom for always thinking I am wonderful even when I am not.

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We will review them and share them on our website.

For

Larry Ogren
whose humor, compassion, and great stories
are the reason for this book.

for
all of the Tortuguero marooners
past, present, and future

and for
the good people of Tortuguero village

Foreword

WHAT FOLLOWS IS not one story but three, artfully braided together by the author into a single narrative. It is the story of a young man, Larry Ogren; the story of a community, the village of Tortuguero in Costa Rica; and the story of an evolving scientific program, marine turtle research and conservation. The story begins in the mid-1950s, and it so happens that it tracks the rise of modern conservation and environmentalism. As you read along, it is useful—impressive, in fact—to remember that the Endangered Species Act was not passed out of the US Congress until 1973. The ESA is considered a major bench mark in the awakening of society to the risk of extinction faced by plants and animals on a planet grown accustomed to abuse by humankind. That makes the story of Larry Ogren the story of a pioneer, not just on a remote turtle beach, but in an emerging rush to address the crisis of environmental degradation.

Chuck Carr, an active member of the board of directors of the Sea Turtle Conservancy, enjoys growing vegetables and tending bees on the family farm or exploring Paynes Prairie State Preserve near Micanopy, Florida.

Also in 1973, the world agreed to

adopt CITES, the Convention in International Trade of Endangered Species. CITES was enormously important to curtailing international marketing of sea turtle products, but it would come into being almost 20 years after Larry began his work at Tortuguero, where killing nesting green turtles for domestic and international trade was believed to predict certain extirpation of the population.

It's very satisfying for me to make this sort of analysis of the history and progress of conservation. I've worked in this field for over 30 years, and witnessed parallel tales of individuals struggling to save giant pandas, mountain gorillas, African elephants, and so many others. All together, it is a grand story, and one we humans deserve to be somewhat proud of: At least some of us tried to help!

But, it is difficult for me to remain dispassionate and analytical in recalling the story of Larry Ogren and the turtles of Tortuguero. Larry was a hero of mine. This story begins when I was about 10 years old. My sister was 2 years older; my 3 brothers were all younger, and my father, Archie Carr, was Larry Ogren's mentor! My father was quite an adventurer in his own right, of course, and into our lives he brings this stocky Nordic student with a huge smile and a flair for telling a good story. In fact, with Archie Carr and Larry Ogren in the same room, the scene became a raconteurs' convention, and the family became enthralled.

Larry could also draw clever cartoons, and he would illustrate some of his tall tales with these drawings, further fueling the hero-worship in the Carr family!

What's more, I have walked the black beach at Tortuguero. I was there with Larry a couple of times, and many more, besides, and I benefitted from his pioneering ways

with the turtles and the people of the village. I have turned the turtles, fished the rivers and hunted in the old rainforest, now a national park. I have seen the village rise from a hard-scrabble community of impoverished lumber jacks, to a bustling town, wholly caught up in "eco-tourism," a term never heard of when Larry was a young man.

So, I am intimate with the three plaits of Anne Ake's story, *Turning Turtles*. I have known the man, Larry Ogren; I have watched the growth of the coastal community, Tortuguero; and, of course, I have followed the evolution of the turtle story very closely—and with some awe.

Chuck
Dr. Archie Fairly Carr III

Chuck Carr looks at home guiding a boat down the Tortuguero lagoon in 1972.

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Shortly after the Endangered Species Act was passed Larry Ogren drew this cartoon and sent it to colleagues reminding them of the importance of beach encroachment issues to the recovery of sea turtles.

Introduction

THIS BOOK IS not about turtles. It is about people. It is about the struggles and limitations of life and science in the world's longest running turtle research station. It is about a little village that might have disappeared along with the turtles but instead opened its doors to the world. Thanks to resourceful and determined people both turtles and village have survived.

In the early 1950s University of Florida biologist Dr. Archie Carr traveled the Caribbean in search of a favorable spot to study sea turtles. He popped into dozens of coastal settlements and in fluent Spanish chatted up fishermen, asking questions about turtles: How many? How many different kinds? What do they eat? Where do they come from? His search ended on the Caribbean coast of Costa Rica in the tiny village of Tortuguero where he found the largest remaining green turtle nesting beach—and a village dependent on killing the turtles.

In 1955 Carr accompanied by one of his former professors, Leonard Giovannolli, went to Tortuguero to set up a turtle study and tagging station. The next year he sent University of Florida sophomore Larry Ogren to operate the station. The villagers, turtle harvesters to a man, were more than a little leery of these gringos nosing around asking about their turtles. But they were also kind, decent people living on an isolated shore, who knew that survival depended on helping one another. Gradually they opened their homes and their hearts to the strangers. Their trust was well placed. One of Carr's initial goals was to learn how to manage the remaining turtle population so that it could be a sustainable food resource for Caribbean people.

Soon after establishing the research station Carr took a leave of absence from the University of Florida to teach at the University of Costa Rica. He and his wife, Marjorie, packed up their five children, Mimi, Chuck, Stephen, Tom, and David, and moved to San José. Tortuguero became almost a second home to the family—especially to the three older boys, who in the summers would spend weeks under the loose supervision of Larry Ogren or Harry Hirth and the village adults. They lived a Peter Pan existence of adventure and exploration while developing self-reliance and appreciation of the natural world. All four Carr sons built careers in conservation and returned to Tortuguero from time to time to continue their research as adult biologists.

Almost 60 years have passed. The turtle station now boasts several concrete block buildings, a permanent staff, a revolving flow of research assistants from around the world, and volunteers who pay to come and help with the annual tagging and nesting program. The village too has changed. Gone are the unpainted thatched houses—replaced by concrete walls and tin roofs. Many surfaces are painted with colorful murals of local wildlife. The village has become a popular ecotourism center where the turtle is king—more valuable now alive than dead.

No one has done more to study, protect, and conserve sea turtles than Dr. Archie Carr, who died in 1987. The sea turtle research center of the University of Florida is named for him—its director, Karen Bjorndal, is one of his former students. The Archie Carr National Wildlife Refuge stretches more than 20 miles along Florida's east coast, protecting the most significant area for loggerhead sea turtle nesting in the

Western Hemisphere, which is also the most significant area for green turtle nesting in North America. World Sea Turtle Day is celebrated internationally on June 16, Carr's birthday. Most of the world's outstanding turtle biologists began as Carr's students who stepped up to pass on Carr's methods and philosophy to new generations of biologists. For many, such as Larry Ogren, Tortuguero was a life-changing experience. Carr wrote, "Many of the tagging crew members have gone on to high places in sea turtle research, conservation, and management. Larry Ogren who was the spirit of the place during several of the earliest lonely years, is now Sea Turtle Specialist for the U.S. National Marine Fisheries Service."[1] In 2009 Larry, now retired, was honored with the Archie Carr Lifetime Achievement Award.

Carr was a storyteller, and perhaps his most important contribution was in the telling. He saw life as a series of adventures viewed through a veil of wry humor. His books draw readers in and without preaching or haranguing gently lead them to caring about the world around them. *The Windward Road,* first published in 1956, sparked the formation of The Brotherhood of the Green Turtle which, under the present name of Sea Turtle Conservancy, continues to have a huge impact on turtle conservation. The book has gone through many reprints, the most recent in March 2013, and is as popular today as it was in 1956. It was this book that introduced me to Tortuguero. The name was somehow magical and it lodged in the spot in my brain reserved for little treasures. Some twenty years later I met Larry Ogren. He was the turtle guy, and I was moderately interested in sea turtles and their plight. But when Larry mentioned Tortuguero the ember in my brain swooshed into flame and I knew I had to go there.

On the first trip I just wanted to see. I was researching another book and had no thoughts of writing about life in a biological field research station or about a little village that

learned to survive by not eating the turtles. But I couldn't stop. I plied Larry with questions, pushed him to tell more and more stories. I reread *The Windward Road* and *The Sea Turtle: So Excellent a Fishe* and searched for articles and research papers by Archie Carr or Larry Ogren. Through Larry I contacted Chuck and Tom Carr. I gained more good stories about Tortuguero and two new friends.

Now that the turtle station is thriving, turtle populations are slowly increasing, and the village has reinvented itself, it is time to recognize the resourceful and determined people who made it all happen. The list of scientists who put in their time at Tortuguero is a role call of distinguished conservation biologists and ecologists. In addition to Larry Ogren, they include Harry Hirth; Karen Bjorndal; Anne Meylan, Jeanne Mortimer, David Ehrenfeld, Peter Pritchard, James Spotila to name but a few—and of course the Carr children. Carr passed on not only his scientific lore, but his ability to say what is true and important in a simple and entertaining way. Several of Carr's academic progeny have written popular books in an understated readable style for the general public and young audiences and all have passed their knowledge and enthusiasm for conservation on to scores of younger scientists.

In the village Larry's assistant and friend Leo and his sister Sibella Martinez are gone, but their legacy lives on. Sibella's daughter, Miss Junie, owns a hotel and restaurant on property near the research station and the family is still the backbone of Tortuguero village. When preparing for a visit in 2012, I was firmly told that Miss Junie did not do interviews, but when my friend Mary and I arrived bearing greetings from Larry and a collection of his old photos, Miss Junie invited us into her home. It was not an interview. I took no notes nor recordings. It was new friends sharing old stories and concerns about families and aging while savoring delicious cake from Dorling's bakery. A lovely evening, a memory I hold dear.

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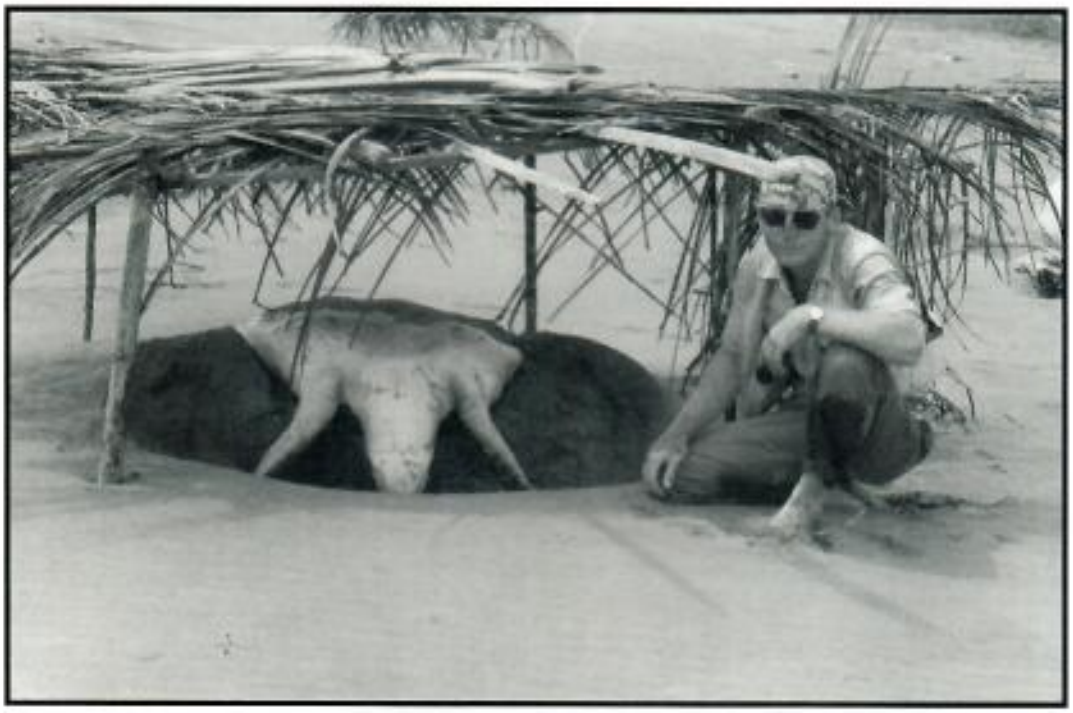


Larry Ogren checks out a green turtle "turned" during the night by a local turtle harvester. The green turtle had provided sustenance to the people of the Caribbean for hundreds of years, and in their efforts to save the turtles Archie Carr and his biologists never became desensitized to the needs of the local culture. Today, as in 1955, the task of balancing immediate human needs with the long-term welfare of people and the environment challenges and inspires professional biologists, volunteers, and local residents alike.

Tortuguero, Costa Rica 1956

THE IDLING RUMBLE of the little tail-dragging Cessna 170 changed to a high-pitched whine. Larry was stacking gear on the beach with his back to the plane. He spun around as it began to taxi. Archie, with his hair blowing in the breeze and his gangly frame hanging half in and half out of the door, was waving cheerfully. His shouted words broke through the engine noise, "Go through the coconut grove, you will find a shack. Bertie Downs lives there. He can tell you what to do. Have a good summer." He called "See ya" and ducked into the plane as it began to lift.

Larry thought, "Well, shit."

So much for orientation, training, and introductions. Larry Ogren was to spend the next few months on this isolated Caribbean shore tagging sea turtles and researching their life history. He had never tagged a sea turtle and didn't speak Spanish. He kicked a toe into the black volcanic sand,

The green turtle was a cultural icon as well as a dietary mainstay of the Caribbean people. In addition, sailing ships from Europe since the time of Columbus had depended on replenishing their galleys with green turtles.

shrugged, slung his duffle onto his back, and marched resolutely toward the coconut grove. When a pack of snarling dogs rushed him from Bertie's camp beneath the palms, Larry, a man not given to vulgar language, uttered another "Shit!"

Larry's contact, Bertie Downs, was a large Nicaraguan with a mysterious past; he lived in a thatched house on the Tortuguero peninsula and farmed coconuts. When passengers were dropped off on the beach landing strip or walked down from Barra del Colorado, he charged a small fee to paddle them the two miles up the river to the village. Travelers who happened to arrive on a Saturday would be sleeping on the beach that night, as Bertie was a Seventh Day Adventist and never worked on his church's Sabbath. Archie, recalling that detail, had made sure that Larry arrived in the middle of the week.

After Bertie had calmed his dogs, he helped Larry load his belongings in a dugout canoe called a cayuca. Larry later wrote to his mother, "My god, was that something, all loaded down in that tippy, hacked-out, dug out with all my bags! Then it started to rain on top of that."

Powerful muscles rippled in strong black arms as Bertie propelled the cayuca toward the village. As rain soaked through his clothes, Larry scanned the water and the surrounding jungle seeking crocodiles and colorful jungle birds. He couldn't believe his luck to be here. Just a few weeks before, he was in Gainesville, Florida, walking a crowded hallway in the biology building of the University of Florida (UF). Dr. Archie Carr approached him. Larry knew who Dr. Carr was—everyone in the biology department did. Carr said, "You Ogren?" Puzzled,

BERTIE DOWNS

In April of 1982 Bertie Downs was murdered. Two strangers, one a Panamanian and one a Costa Rican, came to the village and hung around for a few days taking unfair advantage of village hospitality. Then they began to steal things. They made their way down the peninsula to Bertie's coconut grove and brutally killed him, perhaps for defending his property. Harry Lefever, the author of *Turtle Bogue*, writes that Bertie had a son, Sam Hudson, who lived in Barra del Colorado. Mr. Hudson offered a brief, blunt, yet loving summation of his father's life and death: "He was old. I think he had eighty-seven years. But he was strong yet, you know. Two of them did that, tied him up, like you tie a pig. Sad. He was a nice guy—and strong. He was made of good material, like the old-time Atlas Motors."

Larry nodded that he was. Carr continued, "I hear you like snakes, is that right?" Larry confirmed that he did like snakes. Then Carr casually dropped the question that would shape Larry Ogren's life: "Do you want to go to Tortuguero and tag turtles for me?" Larry said, "When do I leave?" Larry later learned that his name had been suggested by his friend and academic advisor, Walter Aufenburg, when Carr complained that none of his graduate students were available to go to Tortuguero. Thanks to that recommendation, Larry was now gliding through the jungle in a tippy boat at the beginning of a new life.

The Journey

Getting to Tortuguero hadn't been easy. Larry recalls that he and Carr took a train from Gainesville to Miami, where they stayed overnight. Archie introduced him to Latin food at a Miami restaurant, saying, "You will be eating a lot of it—though maybe not as good as this." The next morning they boarded an old twin-engine DC3—the pride of LACSA Airline's fleet. With one stop for refueling, they finally landed in San José, Costa Rica. From San José they took the jungle railroad to Limón. Hanging over the rail of the outdoor viewing platform, the two biologists seemed to fly like exotic birds over cloud-cloaked mountains, white-water rivers, and dense, muggy rainforest. In a letter home Larry wrote, "—what a ride. The railroad twists & squirms it's way around the mountains around 7,000–8,000 feet & then shoots down & follows a ravine cut by a river all the way to the coast through the rain forest & on through the coconut palms to the beach & then to Limón." The biologist's eyes glowed with exhilaration as they breathed in wild tropical Costa Rica. They hardly noticed the billowing smoke whipping backward from the coal-burning engine. When they stepped from the train in Limón, they looked at each other and laughed out loud at their sooty hair, ash-crested ears, and eyes rimmed with black raccoon-like circles.

After checking into lodging owned by the United Fruit Company in Limón, and washing away the soot, they walked to Parque Vargas and sat on a bench. Archie pointed out the sloths hanging from the trees. Archie had always been fascinated by the slow-moving mammals. He said he couldn't imagine how they ever managed to procreate at that speed. He kept hoping to catch them at it, to see how they did it.

Moving On

There were two ways to get from Limón to Tortuguero in 1956. You could take a donkey cart designed for use on the abandoned narrow-gage rail lines belonging to United Fruit Company. The sure-footed donkeys walked the crossties, pulling the cart down the track. If you met an oncoming cart, everyone joined in sizing up the loads. The cart with the lightest load had to be lifted off the track to allow the other cart to pass. Arriving at the river, you could hire a man to take you in a cayuca to Parismina. From Parismina it was only an 18-mile walk to Turtle Bogue, as village was known locally.—18 miles with the sea on one side and jungle on the other. The walking was best done at night, for the heat of the day was blistering. Although jaguars were prowling for their dinner at night, most walkers were willing to accept the risk.

The second option was Aerovias Costarricenses a small regional airline belonging to Francisco Vanoli. Vanoli's only airplane was an ancient Cessna with a set of spraddled-out wheels under the cockpit and a tail dragger, a small third wheel supporting the tail just above ground level. The Cessna made one regular flight to Tortuguero to deliver the weekly supply of guaro, a local rum. A little rum helped keep the sawmill workers content, so they wouldn't head for Parismina on Friday night and never return. If you happened to be there at the right time, there might be room for a passenger. To make an unscheduled trip to Tortuguero, you had to charter the Cessna.

When you wished to return to Limón, you waited for the guaro flight, or you spread a sheet on the beach to attract the attention of the pilot of Vanoli's regular run up the coast to Barra del Colorado, near the Nicaraguan border. If there was room for a passenger, the pilot would swing low over Tortuguero looking for a sheet. If a sheet was out, he would land. If he did not have room, he'd fly high over Tortuguero—leaving a disappointed traveler staring into the sky.

For Larry's first visit to Tortuguero, the Cessna was the better choice. Having made the trip before, Archie knew that Paco, the pilot, would dip low over the waves so the biologists could count turtles. On his own first trip to Tortuguero, Archie had arrived in Limón only to be informed that the

On departing Tortuguero in the early 1960s on a U.S. Navy plane, Archie Carr wrote: "For now, I just want to recollect how, that day, I looked back out of the bubble-port of the plane and saw Tortuguero down there sprinkled among the palms and breadfruit trees, more like one of my dreams than like any real place anywhere..."
Archie Carr, *The Sea Turtle*

Cessna was "discomposed." He spent five days waiting for the "recomposition" of the little plane and watching the sloths. When he was quite sure they were about to begin their lovemaking, a messenger arrived to tell him that the plane was ready and the passenger must hurry to board. With a last reluctant glance at the sloths hanging placidly over his head, Archie grabbed his gear and headed for the airstrip. This was the guaro run, so he packed himself and his gear in around the rum. In his book *The Windward Road,* Carr tells about that first trip in the Cessna:

> The little engine skipped and spat, then caught with a roar. Paco leaned over and slammed the door on my side and twisted the ends of a loop of wire together to hold it shut. . . . He waggled his tail surfaces and revved the engine up to 1500 and let it warm there awhile. He tried one magneto alone, then the other one, and it was all the same sound. He held his brakes and opened her up and she took 2000 without quibbling. He looked at me happily. "Everything is composed," he said. . . . He pushed the throttle forward, the airplane shook itself and moved off, and the fat little wheels left rim-deep furrows in the damp sand. . . . I said. "Let's fly a quarter of a mile offshore, or maybe less. If you see a turtle, circle him. How low can you fly?"
>
> "It is better not to splash salt water on the engine," Paco said.[2]

Now, several years later, Larry and Archie were in luck, the airplane was "composed" and ready when they arrived at the airfield. Staying just high enough to keep the salt spray off the engine, they watched for turtles swimming in the clear blue of the Caribbean. The water muddied where the Tortuguero River emptied into the sea, and soon Archie was pointing out the tiny thatched roofs of the village clinging to a long sliver of land separating the Tortuguero lagoon from the sea. The airplane angled sharply down toward the beach. As a group

of scavenging dogs ambled out of the way, the wheels hit the sand with a whump and crunched across branches and beach rubble. Paco always stayed in the plane in Tortuguero. He would sit in the cockpit with the motor idling, his eyes on the sea. The narrow strip of coastal rainforest between the sea and the Cordillera Central range of volcanic mountains was subject to frequent and violent weather shifts. If Paco saw fog or a storm sweeping in from the sea, he'd taxi the Cessna down the beach before blinding clouds could engulf it.

Home Sweet Home

At last, after the meeting at Bertie's dog-guarded shack and the cayuca trip through the rainforest, Larry had arrived in Turtle Bogue. Observing his guide's interactions with the villagers, Larry could see that although Bertie lived in isolation north of the village, the big Nicaraguan was a respected elder in Tortuguero. However, Larry wrote, "His language was colorful, but crude; much to the embarrassment of the village matriarchs." Larry was expecting to occupy the house that Archie and his professor and later assistant, Leonard Giovannoli, had lived in the previous summer. But the manager of the Atlantic Trading Company, which operated the sawmill, said he had a room available at the mill. When Larry asked about staying in the house, Don Yoyo Quiroz simply said, "No. You must stay at the sawmill." It was a ruling Larry soon questioned. At night, when he was on the beach searching for turtles, the sawmill was quiet. At dawn, he would drop exhausted onto his cot just as the sawmill began its day. Soon the walls of his room trembled with the whine of saws and the shouts of workers. After a few hours of fitful sleep wrapped in the incessant noise of the mill, he'd get up and begin his daylight duties. He wrote home,

> . . . . the turtles haven't started coming in yet; only two laid so far & about 4 crawled up & then back without laying. I've marked off the 2 miles of beach into eighths with

> poles & white flags & transplanted both nests of eggs to a place in front of the village. Had to board up the nests to keep the dogs out. I hope they hatch out before I leave. Been raining every day so far.

The rain and general dampness caused unexpected problems. Larry wrote to Dr. Carr in August: "I guess I did forget to mention that my feet are in fine shape now. I had visions at one time of all the skin sloughing off though it only lasted a few days and cleared up fine after I exposed them to some sunshine that trickled through the clouds."[3]

Through the summer Larry would look longingly at the empty house on the beach, but when he arrived for his second summer, the house was no more than a mound of moldering bits of damp wood. In the jungle, heat, humidity, and termites quickly claim any structure left untended. Don Yoyo had known the house was too far gone for human habitation.

Turning and Tagging

The previous summer Archie and Leonard Giovannoli had begun work at what would become the world's longest running sea turtle research field station and turtle-tagging program. At that time, green sea turtles came ashore on Tortuguero beach in great numbers to construct their nests and lay their eggs. Hawksbills in much smaller numbers often laid their eggs along with the greens. Leatherbacks, the biggest of the marine turtles, nested here also in smaller numbers, a little earlier in the year. Female sea turtles come ashore at night to nest. Adult males also journey to the waters off Tortuguero, but their purpose is to mate with the females, a goal they achieve several times in each nesting season. At no point in life, however, do the males return to the beach.

After helping Leonard establish procedures for tagging the turtles, Archie moved on to other projects and left Leonard in charge of the tagging program. Leonard hired Sam Martinez, along with a few other local men, to go out to the

VANISHING FOREST

In the 1950s, when exotic woods were in demand by furniture manufacturers around the globe, Costa Rica's rainforests were being sacrificed to fuel the demand. Outside interests were also taking note of the warm, moist climate, the rich soil, and the cheap land. Banana and mango plantations were replacing native forests, and land was cleared to make room for beef cattle to produce meat that would be shipped out of the country.

Approximately 80 percent of Costa Rica's forest has been cut, but today the country is a leader in initiating conservation efforts. Of the remaining forest, 50 percent is now protected as national forests, parks, and wildlife reserves. However, the privately owned forests are still being felled, and illegal cutting on protected lands continues. Deforestation in Costa Rica has wide-reaching consequences because the carbon dioxide released when forests are cut enhances the greenhouse effect, which in turn plays a role in global climate and in weather patterns.

Tortuguero village is now nestled in a huge national park; its sawmill, a scattering of huge pieces of rusting machinery, is not unattractive. Rusting proceeds in interesting colors and patterns, with lush vines claiming the useless equipment as their own. These pieces have become abstract sculpture, speaking of the past without marring the present.

The sawmill. Larry's room was on the second floor far right. His one window looked out over the lagoon.

beach and immobilize the turtles by turning them over on their back during the night—few turtles can right themselves when their flippers are in the air. When Leonard returned in the morning, the turtles would be waiting. After attaching a tag to a turtle's flipper, Leonard flipped the unwieldy female right side up, to begin her slow crawl back to the water.

Turning turtles was a primary source of income for the local men, who were adept at the work. During the nesting season, when the turtles came ashore by the thousands, each turtle turner, or velador (literally: stayer awake) contracted for a mile of beach south of Tortuguero. The veladors took up their stations and watched the beach for incoming turtles. As the females came ashore, the men waited until they'd progressed beyond the tide line, then turned them on their backs and built a temporary low thatched shelter to protect the captives from the heat of the rising sun.

Trussed green turtles stacked and awaiting shipment. (Circa 1950s)

Periodically, a surplus WWII landing craft, the "Bessie," came along to collect the turtles. The crew of the Bessie tossed lines and buoys into the water just beyond the breakers, and the veladors on the beach collected this gear when it washed ashore. They approached each turtle and tied a buoy or a chunk of driftwood to one of her flippers, then flipped the creature back over and allowed her to make her own way to the sea. The crew aboard the Bessie would watch for the buoys and drag the live turtles aboard. There was no refrigeration,

and butchering in the moist Caribbean heat would cause the valuable turtle meat to spoil quickly. But the big reptiles could live a long time on the deck of a boat, with just an occasional dousing with seawater on their way to the soup pots of Key West and New Jersey, or to the canneries in Nicaragua.

Getting Started

On that first day, when Bertie brought him to the sawmill, quite a few men were standing around, doing nothing. Larry asked the supervisor if it was payday. He said, "No. They are waiting for you to hire them." Money was short, and Larry could afford to hire only a couple of men to help, so he decided not to pick one or two randomly from the crowd and disappoint the others. Knowing that Leonard's assistant, Sam Martinez, had injured his back and was not able to do heavy work Larrry decided to work alone for a while until he understood his needs better.

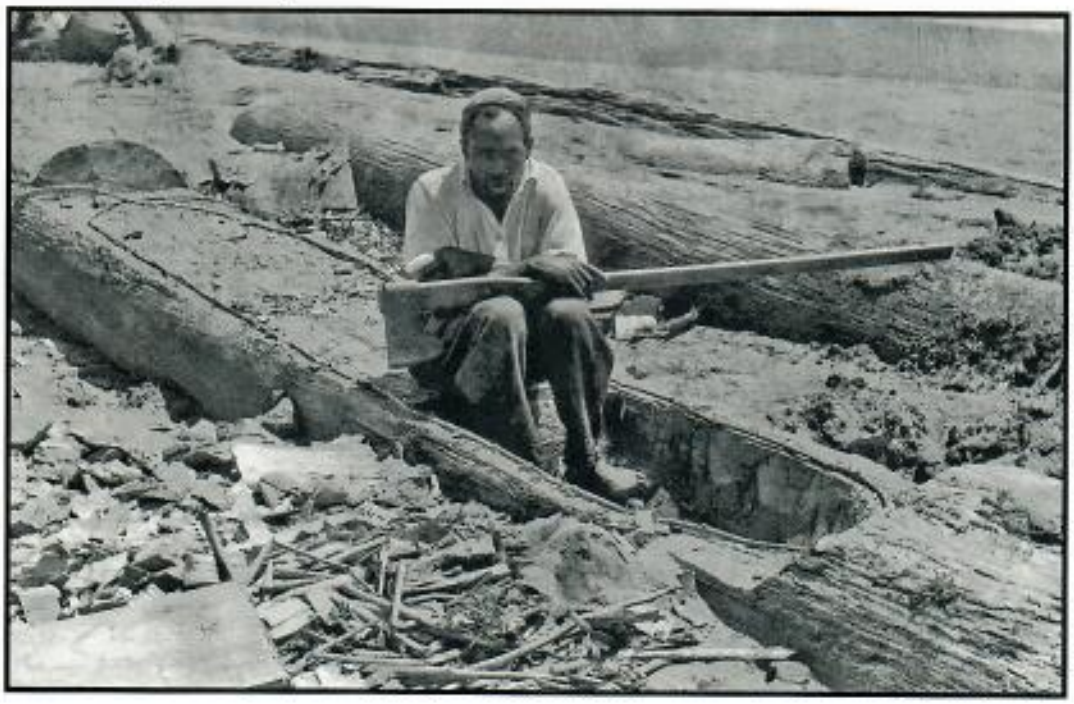
Night after night Larry walked the beach. It was usually hot, raining, or both. His eyes probed the darkness, searching for turtle tracks in the black sand. He knew that the tracks, if they appeared, would resemble those left by a vehicle or by heavy construction equipment. But there were no vehicles on this beach. In fact, there were no roads leading to Tortuguero on the Caribbean coast of Costa Rica.

Larry scanned the sand for tracks, then swept his eyes along the incoming tide—hoping for enough moonlight to glimpse a huge turtle riding the rhythms of the sea onto the beach. When he spotted a turtle that had not completed her nesting, he noted her position and hurried down the beach to turn the next one. The nesting process generally is completed in a couple of hours, so timing the return to any turtles left behind was a judgment call, but Larry would flip as many as he could before the night's nesting ended. He would come back in daylight to tag and measure the turtles he had turned the night before and watch for stragglers still coming ashore.

One day he spotted unusual movement in the waves. He

could make out something large and dark, larger even than a leatherback, the biggest of all sea turtles. Upon approaching, Larry could see the outline of a man struggling to beach a huge log that was the perfect size to make a cayuca. The man fought to bring his prize in, but the sea fought back—reclaiming the floating log again and again. Larry waded in and grabbed one end of the log. Working together, the two were able to drag the prize to the beach, though getting it safely out of reach of the tide took the better part of a day. Larry hired Leo Martinez on the spot to help with the turtle-tagging program. Their friendship and working relationship endured until Leo's death many years later. Leo built a cayuca for Larry from the log they'd salvaged together.

In the year 2000, Edna Gail Dases, a Canadian woman married to a local man, interviewed Leo about his memories of life in Tortuguero. The elder of Turtle Bogue spoke of his friendship with Larry and told Ms. Dases a story of their explorations:



Leo at work on the cayuca he is building for Larry from the log they pulled from the sea. While hacking out the center he gashed his finger with the adze and Larry bandaged it.

Let me tell you, lady, this Mr. Larry had an interest in everything in the jungle. I would paddle him around in the canals day or night. He wanted to touch and see anything that moved. One night I remember silently paddling down the dark canals, when he signaled me with his hands to get closer to the edge of the jungle. He saw two eyes peering out from a lower branch. Well, Mistress, when I saw the two spots next to these eyes, I quickly backed up the canoe, as Mr. Larry's hand was extended out to grab this thing. Mr. Larry asked why I pulled away. Well, Mr. Larry, that thing was the most deadly snake here in our jungle. It is called the fer-de-lance. One strike from that snake and you're dead. So you see, Mistress, in one way, I saved his life. This is why visitors, no matter how much they have studied outside, they still need help from the residents.[4]

Green turtles can weigh as much as 400 pounds, but Larry learned that he could flip one over alone if he went about it right. On his knees between the front and back flippers, he fended off the sharp claws that arm the heavy flippers, which were making broad swings as the turtle tried to proceed across the beach. Grabbing the edge of the shell, he gave a mighty upward push to flip the turtle onto her back. The technique worked pretty well on the smaller turtles; the larger ones, however, sometimes dragged him around. One morning Leo looked at the tracks on the beach where Larry had struggled to turn a particularly difficult turtle and laughed, "You did a fine dance with that lady—all around the ballroom."

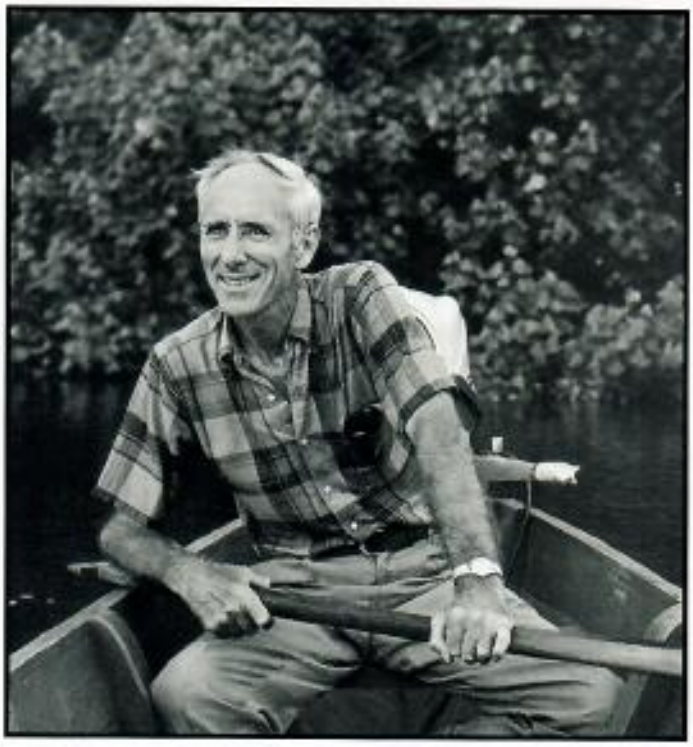
Larry drew this sketch of himself and Leo on the bottom of a letter to his mom.

2

Archie Carr and Shefton Martinez use a wooden caliper to measure the shell of a turtle. The turtle was turned the night before and had been flailing about with its flippers digging a trench around its body. Turning was the traditional way to handle turtles, but as research progressed they found methods less stressful to the turtle to get the data they needed.

In the Beginning There was Archie Carr

ARCHIE CARR DID not go to Tortuguero to save the sea turtles. That would come later. He went because he wanted to know. He wanted to know where baby turtles go, how female turtles find their way to nesting beaches, and how these massive lumbering reptiles make their living. Newly hatched turtles make a beeline for the sea and swim hard—and remain concealed from human eyes and instruments until they are dinner plate size. By then they'd be yearlings, Carr guessed. Where do they go? The question nagged at him. At a diameter of about 10 or 12 inches, which was Carr's idea of "dinner plate size," they occasionally washed up on beaches or got entangled in fishing nets. Where did they spend their saucer-size days, and what was their final destination when



Archie relaxes in a boat belonging to the station. Motors were a welcome addition but were used sparingly as gasoline was always in short supply. Today, motorized boats are commonplace, and gas is shipped in from Limón in 50-gallon drums.

they finally began to show up? Were they world travelers, or did they spend their lives within a few miles of the beach on which they hatched and to which they would return to mate and lay their eggs?

As a zoologist, ecologist, and popular writer, Archie traveled the world studying many animal species. In Africa he wrote of lions, giant pythons, and tiny gnats. But he always came back to turtles. In the early 1940s, he was researching his first technical book, *The Handbook of Turtles*. He wanted to include both the freshwater turtles, which had first piqued his interest, and their giant cousins, the sea turtles. He found that no one knew much about these monsters of the sea. Dr. Carr was a naturalist driven by curiosity. He would have to find out for himself.

He went to Honduras to interview prominent educator Wilson Popenoe about sea turtles. As it turned out, Popenoe knew little about turtles, but Archie fell in love with the people, jungles, and tropical climate of Honduras. In 1945 he took a leave of absence from the University of Florida and accepted a position teaching at the Escuela Agricola Panamericana (Panamerican Agricultural School). The school, recently opened by Popenoe for the United Fruit Company, accepted students from all over Central America. Archie moved his family there and became part of the community. He talked about sea turtles to everyone—students, other teachers, and local residents.

Finding a Home

One exceptional student, known to his friends as Billy, was Don Guillermo Cruz. Billy Cruz shared with Archie his knowledge of sea turtles and his enthusiasm for his home country of Costa Rica. As Central America stretches southward to connect North and South America, the land narrows, drawing the oceans close together. Costa Rica, a wild land of jungles and volcanoes, is part of that narrow band

of land. This small country separates two great seas and could provide an opportunity to study the turtles of both the Pacific and the Atlantic/Caribbean.

Costa Rica was known for the huge "arribadas" of olive ridleys, and for smaller numbers of leatherbacks and other turtle species that arrive regularly on the Pacific coast. *Arribada*, the Spanish word for 'arrival,' is used to describe the mass influx of thousands upon thousands of ridley sea turtles, all coming to the same beach to lay their eggs. To the east across the mountains, little was known about the muggy rainforests and isolated beaches of the northern Caribbean coast. But Carr heard tantalizing rumors of great fleets of green turtles and, incredibly, there were hints of a turtle that fit the description of the Kemp's ridley, one of Carr's pet subjects. He had studied the turtle in Florida, but no one knew of even one nesting location for the species. In fact, many turtle fishermen doubted that Kemp's ridley nested at all. They called it the bastard turtle and thought that it, like the mule, was the sexless product of interbreeding between two species. Archie didn't buy the bastard theory and was excited by the idea that the miles of isolated beaches of the Central American coast might be hiding the secret of the Kemp's ridley.

BILLY CRUZ

"Indispensible" is the word that is most often attached to the name of Guillermo Cruz, an executive with the Republic Tobacco Company. Known as Billy, the businessman lived in San José, where he was always available to extend a helping hand to the turtle project. Larry Ogren says "He did anything we needed, from a ride to or from the airport, to using his political connections to obtain the permissions and permits we needed." As the first vice president of the newly formed CCC, he took the message of sea turtle conservation to the top levels of the Costa Rican government. He used his influence to bring high-ranking officials to the beaches of Tortuguero. In addition to arranging for the visit of Don Pepe Figueres, the president of Costa Rica, Billy introduced Mario Boza and Alvaro Ugalde to Tortuguero and to the plight of the sea turtles. Boza and Ugalde were later responsible for launching the Costa Rican national park system. In 2004 Guillermo Cruz was awarded the Archie Carr Lifetime Achievement Award. He died in June 2013, leaving friends worldwide to cherish memories of his accomplishments and friendship.

Carr's position as a UF graduate research professor gave him freedom to focus on research rather than classroom teaching. He could travel as needed, as long as funding could

be found, and through UF he was awarded a long running National Science Foundation grant. He traveled around the Caribbean searching for the ideal place to base his research and finally followed local turtle lore to the coastal village of Tortuguero, Costa Rica. Turtle Bogue, in the northern part of Limón province, was in a largely unexplored region of Costa Rica's Caribbean coast near the Nicaraguan border. After an exploratory trip along the coast, Carr settled on the tiny village as a base for his turtle studies and a tagging program. He had identified this beach as the only remaining major nesting site for green turtles in the western Caribbean. A smaller number of leatherbacks and hawksbills also nested there.

Calipee drying in the sun. The dried product is light and easy to transport.

From this research camp he hoped to learn not only where the hatchling turtles went, but where the big turtles came from. Surely the incredible number of turtles that showed up here to lay their eggs didn't live and feed right off the coast of Tortuguero. Fishermen of the Bogue were sure that turtles traveled great distances to reach the breeding beach, but there was no scientific evidence to back up this belief. Carr hoped that by putting some kind of identifying mark on the turtles, he could learn not only where they went after nesting but whether they returned to the same beach to nest again. He began his

RIDDLE OF THE RIDLEY

The Kemp's ridley was such a worrisome item for Archie Carr that he titled the first chapter of *The Windward Road* "The Riddle of the Ridley." As the years went by, he gleaned some insight into the life of the smallest of the sea turtles, but no hint about where they went to reproduce. He did learn that they were known for their belligerence when captured: "The ridleys is always mad," one turtle man told him.

In 1957 Carr and his family drove from San José to their home in Gainesville, Florida with a stop-over on the eastern coast of Mexico to investigate rumors about nesting ridleys. They found a man in Veracruz who said that on rare occasions, a single ridley would be seen nesting. There was no reason to doubt the veracity of this claim, but these few sightings could not account for the number of ridleys observed by coastal people and marine biologists. Mass nestings must be happening somewhere, but where? In 1961 that question was answered. Carr tells the story at length in *The Sea Turtle: So Excellent a Fishe*. It seems that the location of a huge ridley nesting beach had been known not long ago, perhaps by many. The proof was in a film made in 1947—and then lost. In 1961 a marine scientist based in Texas, Dr. Henry Hildebrand, came into possession of the footage shot by a Colombian, Andres Herrera. Hildebrand, who was scheduled to present the material at a meeting of the American Society of Ichthyologists and Herpetologists, invited Carr to come to Austin for a preview.

The informal documentary shows an estimated 40,000 Kemp's ridleys on the beach at Rancho Nuevo, Tamaulipas on Mexico's Gulf coast, going about the business of laying their eggs and doing it in broad daylight! No other marine turtle nests during the day. Though Kemp's ridleys sometimes nest singly on Mexican and Texas beaches, validating the information Carr had received in 1957, Rancho Nuevo is the only significant nesting beach for the species.

turtle tagging operation there in 1955—the summer before he brought Larry Ogren to the village to run the program.

Harvest Time

Turtles were a mainstay of Tortuguero's economy. The meat was popular with locals, but most of the turtles were shipped live to restaurants in the United States, or canned in Nicaragua for shipment to England and Germany. Green turtle soup, favored by Winston Churchill, was considered even more of a delicacy than the meat. The calipee, or cartilage from the turtle's bottom shell, formally known as the plastron, produced a thick, gelatinous broth that was the key ingredient of green turtle soup. Turtle shells were also valuable in some markets, especially hawksbill shells. The hawksbill has a beautiful translucent shell that was used to make tortoiseshell jewelry and combs prized by women all over the world. Turtle eggs were also harvested. They were good for eating and baking and were believed to have aphrodisiac properties.

During the green turtle season there was a frenzy of activity. Veladors turned the females and attached the buoys for later pickup by the boats. Both adults and children raced to dig up the eggs before dogs, peccaries, sand crabs, and other predators beat them to the nests; and the boat crews gathered the buoy-marked females. To increase their catch, the boat crews harpooned male turtles—it was their only opportunity to capture adult males, which never return to land after leaving the nest as hatchlings. But, like the females, male green sea turtles are drawn irresistibly to the waters off of Tortuguero, where mating occurs at intervals over several months. For a short time, males, females, and eggs are all together in one place. For thousands of years this gathering provided a rich but sustainable harvest for both humans and wild predators.

Female sea turtles usually nest every second or third year; each individual produces several clutches of approximately 100 eggs in a nesting season. After a couple of

months of unattended incubation, the hatchlings make their way out of the sand. Somehow timing their eruption from the nest for after dark, they avoid many of the diurnal predators such as birds and sand crabs. But even at night, predators lurk on the beach, hoping for a feast of baby turtle. The hatchlings that successfully enter the sea find marine predators waiting with open jaws. For millennia, the large number of eggs laid by each female turtle provided food for many other creatures,

Harry Hirth measures a turtle's head as Archie takes notes and Larry looks on. An unidentified man watches in the background

while assuring that enough of the newborns survived to maintain the turtle population. There were enough eggs to sustain a stable turtle population and to provide a protein feast for many predators, including humans.

Archie Carr enjoyed a good turtle stew or turtle fin soup as much as the next man. And in the early 1950s, there was still an abundance of turtles. He saw turtle products

as a sustainable resource if they were harvested responsibly. Every year, the turtles arrived right on schedule. After the nesting season, they disappeared. But the next year turtles again appeared by the thousands to nest on the beaches of Tortuguero and other beaches around the world. It had always been so.

These men likely came down from Barra del Colorado or possibly Nicaragua to hunt the hawksbills that hung out on the rocky bottom around Tortuguero. Hawksbills were not eaten, but were taken for their valuable shells.

Changing Viewpoint

Carr's initial goal had been to unravel the secrets of the life of the sea turtle. But, after seeing the slaughter and talking to old-timers about the declining numbers of turtles, his focus changed. He wanted to teach people to harvest responsibly, so that turtles could continue to be a source of food and income for those who lived near nesting beaches. In *The Windward Road* and *The Sea Turtle, So Excellent a Fishe*, Carr talks about the historical importance of turtle meat to sailors and to the development of the Caribbean. Not only are sea turtles a major source of protein, but they play an important role in the culture, religion, and mystical beliefs of Caribbean people. He respected these traditions and wanted to find ways to sustain them.

However, as the population numbers continued to drop, his focus turned to simply saving sea turtles from extinction. These massive reptiles, which had roamed the seas since before the time of the dinosaurs, were rapidly disappearing.

The native people of Tortuguero and other nesting places could not grasp the idea that the turtles could disappear. They had always been there. Villagers such as Sibella Martinez, who cooked for the biologists in the camp, were incredulous when Archie told them that the turtles might not always be there. He wrote in the preface to the 1979 reprint of *The Windward Road*:

> In one important way the wisdom of the Caribbean people seems to go unaccountably awry. That is in the wide spread belief that the green turtle is an inexhaustible resource. My first season at Tortuguero, when I asked Sibella how long the turtles could stand the slaughter then going on at the nesting beach, she said, "Dey never finish Don Archie. The tel-tel never finish. . . . Dey *can't* finish."[5]

Carr knew that the turtles could finish, because human predation had upset the age-old natural balance. When feeding the village people was no longer the only reason for hunting them and the turtles had become a commodity to be traded internationally, their populations began to decline. The same was happening on turtle nesting beaches around the world. Carr witnessed the magnitude of the slaughter and the egg harvesting during one nesting season after another and knew that at these rates, the turtle was doomed. In his research Archie Carr relied on a resource that many scientists disdained—he talked to the local people, especially the old-timers. In fluent Spanish, he prodded them to tell him about their culture, to share their history and their turtle stories. He learned that although the number of turtles nesting on the beach seemed large to him, it was much lower than it had been in the past. Year by year the numbers had dwindled. After establishing the research station, Carr and his students saw the numbers continue to decline. It was clear to them that sea turtles were in serious trouble.

Carr's quest for understanding the sea turtles became a mission to save them, so that future generations could know them. Through his writing, his research, his position as a visiting professor at the University of Costa Rica, and his contacts within Costa Rica's political system, he would strongly

influence the country's growing environmental awareness and conservation efforts. By 1970 some wildlife protection laws had been passed, but poachers were ignoring them with impunity.

A slaughtered turtle awash in the waves of Tortuguero Beach. After the turtle harvest became illegal, poachers took only the precious calipee, leaving the rest to spoil.

In 1975, to make a case for preserving the green turtle and protecting the lush Tortuguero jungle, Carr and Billy Cruz invited a small group of people to visit Tortuguero. The group included José (Don Pepe) Figueres Ferrer, president of Costa Rica, and his wife. One of Carr's graduate students, David Ehrenfeld, later wrote about the visit:

> It was Don Pepe's first visit to the legendary Tortuguero—we had been watching a green turtle nest, also a first for him. El Presidente, a short, Napoleonic man with boundless energy, was enjoying himself enormously. Both he and Archie were truly charismatic people, and they liked and respected one another.

As they continued their walk down the beach the two men chatted, and Don Pepe questioned Carr about the status of the green turtle and the importance of protecting the species. Then, near the waterline, they spotted a disturbing sight. A turtle was pulling herself along the beach, trailing something behind her. The group hurried to investigate. They were horrified to see that the struggling turtle was dragging her own intestines

and marking her path with a scattering of eggs. Poachers had cut away her plastron to get the precious calipee and flipped her back over to suffer a slow death. Ehrenfeld remembers the moment:

> Dr. Carr, who knew sea turtles better than any human being on earth and who had devoted much of his life to their protection, said nothing. He looked at Don Pepe, and so did I. It was a moment of revelation. Don Pepe was very, very angry, trembling with rage. This was his country, his place. He had risked his life for it fighting in the Cerro de la Muerte. The turtles were part of this place, even part of its name: Tortuguero; . . . She was home, laying her eggs for the last time.[6]

Later the same year, President Figures established Tortuguero National Park. The biologists who were with him on the beach that night believe that the sight of the dying turtle, trailing eggs and intestines, was a turning point in Don Pepe's dedication to preserving the environment and wildlife of his homeland.

Traveling the Windward Road

There is no doubt that Dr. Carr had a profound effect on conservation in Costa Rica and on the preservation of sea turtles globally. In the preface to *The Windward Road*, his humorous and perceptive story of his travels around the Caribbean, he describes how the book came to be written:

> The appeal of marine turtles for me thus had several facets, and I decided to learn everything I could about them. *The Windward Road* was just a compulsive recounting of things I saw and pondered, including the fascinating Caribbean people I consorted with during the first exciting years of that quest after Chelonia [the taxonomic name of the order containing all turtles].[7]

The book began to build a following before it was published. The last chapter, "The Passing of the Fleet", was presented at the

annual meeting of the American Society of Ichthyologists and Herpetologists in 1954. Another chapter, "The Black Beach," was published in *Mademoiselle* magazine and won the O. Henry short story award. An even more momentous event would come from the book. Carr tells the story in the preface to the 1979 reissue of the book:

> But before that a portentous thing had happened to *The Windward Road*. Joshua B. Powers, a New York publishers' representative, happened to read it. . . . He sent copies of the book to twenty influential friends who he hoped would share his interest. They did and the Brotherhood of the Green Turtle was promptly formed with the aim of "restoring green turtles to their native waters, and insuring to Winston Churchill his nightly cup of turtle soup."[4]

The original members of the Brotherhood included Tallahassee, Florida, resident John H. Phipps (known to his friends as Ben) and Jim Oliver, then director of the American Museum of Natural History, in New York City. The group was organized in a spirit of good fun, but with a serious purpose. Archie Carr was named Grand Admiral of the Fleet. Ben provided financial stability, and Jim later helped bring in the participation of the U.S. Navy in a major research and conservation effort called Operation Green Turtle. The group also helped secure grants from the American Philosophical Society for staffing the seasonal turtle tagging camp—the John H. Phipps Biological Research Station—at the Tortuguero nesting ground.

The Brotherhood incorporated in 1959 as the Caribbean Conservation Corporation (CCC) with Ben Phipps as its president. On June 16, 2010—Archie Carr's birthday and World Sea Turtle Day, the Caribbean Conservation Corporation changed its name to Sea Turtle Conservancy (STC). Though the organization had been long respected as the CCC, the name gave no hint of its focus on sea turtles. In this age of electronic communication, it is important for an organization to be easily identified by online search engines.

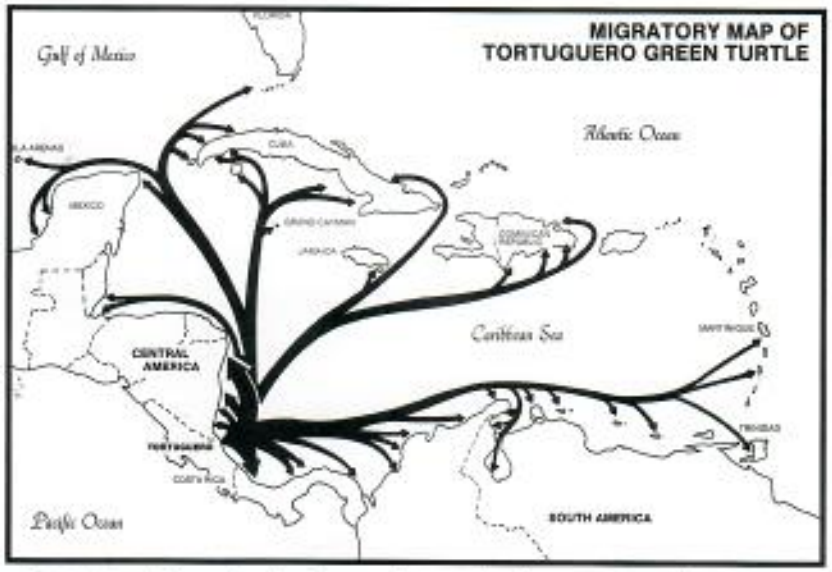
In addition to the research station in Tortuguero, the STC has headquarters in Gainesville, Florida, an office in San José, Costa Rica, and a research base in Panama. The tagging program established in Tortuguero in 1956 is still operating and still presenting us with new knowledge about sea turtles.

Carr, always a naturalist, took biology out of the laboratory and into the fields and streams and onto the beaches. He wanted to know not just how many scutes made up a turtle shell, but how the animal lived, what it ate, how it bred, and how it spent its day. And he wanted to assure its continued existence. He was practicing conservation biology long before it was the vogue, and he was an important influence in Costa Rica's developing conservation policies. Carr and the STC encouraged the establishment of the national park in Tortuguero. In 1975 President Figueres set aside more than 77,000 acres of Tortuguero's wilderness land as a national park. Costa Rica's conservation efforts have set an international example, and today over 27 percent of the country's land has protected status in categories including national park, wildlife refuge, and forest preserve.

Global Recognition

The future of sea turtles began to look a little brighter in 1966 when Peter Scott of the International Union for the Conservation of Nature and Natural Resources (IUCN) invited Dr. Carr to join the organization's Survival Services Commission, now called the Species Survival Commission. Scott asked Carr to establish a group to study marine turtles, to serve as its chair, and to appoint its members. Over the 18 years that Carr chaired the new Marine Turtle Specialist Group, it consisted of 15 to 30 members from around the world, including his friend and associate Larry Ogren. Participation in this group provided a tool for drawing attention to the plight of sea turtles internationally. Over the years the group has expanded to approximately 200 members from more than 50 countries in a dozen geographic regions.

As the turtle station grew, it acquired a name, The John H. Phipps Biological Research Station, and gained structures including a large display board to tell visitors about its mission.



The migration chart shows where Tortuguero turtles have traveled. Initially, turtles could be tracked only by their tags. Today the travels of some turtles can be continously monitored by satelite transmitters.

In 1983 biologists came from around the globe for the first Atlantic Sea Turtle Symposium in Tortuguero. (Pictured roughly L-R) Mario Hurtado, Edward Standora, Colin Limpus, George Balazs, Chuck Carr, Harry Hirth, Njoman Nuitja, Leo Brogersma, Ada Fowler, Merry Camhi, Robert Brundner, Larry Ogren, David Ehrenfeld, Charles Webster, Nicholas Mrosovsky, Jacques Fretey, Willem Roosenberg, Perran Ross, Georges Hughes. Also attending: Archie Carr, Karen Bjorndal, Anne Meylan, Rene Marquez, Peter Pritchard.

A Legacy Left

Dr. Archie Fairly Carr Jr. died in 1987. His curiosity, humor, compassion, and thirst for knowledge touched many lives and lit flames that illuminated the world of conservation biology. His wife, Marjorie Harris Carr, also a biologist, was well known in Florida as an environmental advocate. Carr felt comfortable bringing his children to the village or sending one or more of his sons along with Larry Ogren or Harry Hirth, a graduate student biologist, for extended stays. Tom Carr says he started going to the village when he was seven. Sometimes he came alone and sometimes with one of his brothers. On one of his first visits he stayed with Larry in Leo's house. He remembers Larry as "everyone's favorite" among the biologists.

Carr's sons and many of his students have gone on to build international reputations in sea turtle research and in other fields

Fishing was good in Tortuguero. With the help of an unidentified man, Steve (left) and Tom Carr (center) display a Goliath grouper they just caught.

of biology. James Spotila, a noted turtle biologist and popular author, wrote:

> Archie provided a model for others to follow and a legacy of followers to carry on his work. Most sea turtle biologists trace their roots, either directly or indirectly, to Archie Carr. The older ones were his students or worked with him during their careers. The younger ones studied or worked with Archie's academic offspring. Now the world is filled with Archie's academic grandchildren and great-grandchildren.[9]

The station and the village have changed with passing years, but Larry, Harry, Carr's sons, and others from the first years at Tortuguero still cherish the memories of those early days. Archie Carr's example taught them to be tough and adaptable and to respect not only the natural world but, especially, the wisdom and integrity of the local culture in which they carried out their work. They lived the life of the village and formed friendships and memories they would carry for a lifetime.

Archie and an assistant weigh a green turtle. Methods in Tortuguero were makeshift but they produced a massive amount of data on the life history of sea turtles. More importantly, dissemination of the data awakened global concern for the sea turtles and other declining species. Conservation biology was born here.

With Larry Ogren at the helm, Archie and Marjorie Carr motor down the Tortuguero lagoon.

3

After a successful hunting trip, Albert Taylor, Miss Junie's husband, dresses two peccaries. The wild pigs that roamed the jungles were an important food source for the people of Turtle Bogue—the local name for the village.

3

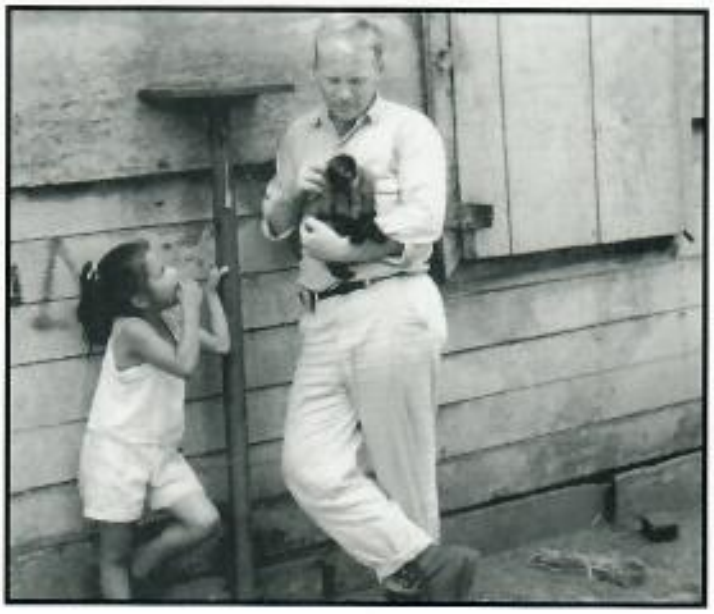
After a successful hunting trip, Albert Taylor, Miss Junie's husband, dresses two peccaries. The wild pigs that roamed the jungles were an important food source for the people of Turtle Bogue—the local name for the village.

Pura Vida
Life in Turtle Bogue

As the Cessna taking Archie back to Limón disappeared from view on that day in 1956, Larry felt a thrill of anticipation. He knew he was the only gringo within miles. He would have to quickly learn the way of the village and live it. There were no restaurants or hotels where he could hang out with other students; in fact, Tortuguero had no electricity, no running water, no sewer system, no telephones; of course there were no radios or TVs. There were no automobiles—or roads to run them on. There was no postal service; but occasionally Paco, Vanoli's pilot, or the captain of the Bessie, would bring a message or letter.

The tropical weather required some attitude adjustment. Most of Costa Rica has two seasons—rainy and dry. Tortuguero, tucked between the mountains and the sea, has but one season—hot and wet. There is some variation in the intensity of the rain, but Tortuguero is never really dry: average annual rainfall is 250 inches. On August 9, 1956, after more than a month in Tortuguero, Larry wrote to his mother.

Pura Vida translates roughly to "life is good," although it is a contemporary expression it seems appropriate to the ambiance of the village of the 1950's and to Larry's relationship with the people and village.



"Well, the weather is still slightly damp, but it's starting to clear up some now in the afternoon—long enough to dry out some socks and pants and my shoes. . ."

Larry says you get used to having everything "slightly damp"—it is welcome relief from being soaking wet. Chuck Carr remembers the sour, unpleasant odor and dingy gray look of clothing that had been under continual attack by mildew. He agrees with Larry, though, that heat, rain, rot, mold, rats, and bugs are all part of the adventure. Friendly people, abundant wildlife, "lots of herps" (reptiles and amphibians), lush tropical jungle, a fascinating job, and cooling breezes, make it all worthwhile. Even so, it was hard to get used to the mold creeping over everything. Larry especially hated finding his film ruined and his lenses etched with mold. Not to be beaten, he protected his camera and film with a dehumidifier fashioned from a metal can and a candle. Film was expensive and delicate, and of course, the exposed film had to be stored and protected from the damp until he returned to the States, as there was nowhere to have it processed locally. Thanks to his ingenuity, he was able to build a small collection of village photos.

A Day in the Village

As the sun flushed the sky with rose-colored light, the cocks began to crow and the people of Tortuguero stretched and rose from their floor mats or cots. Most villagers lived in sturdy thatched-roof houses built from odd-sized lengths and bits of leftover lumber from the sawmill. The sparse furnishings were built on site or laboriously hauled in from Limón. The people thatched their roofs with palm fronds. A good thatch roof with a fresh layer added occasionally can last five or six years in the jungle. The thatching provided a snug home for a variety of squatters. Rats, bats, snakes, spiders, scorpions, and a large assortment of insects industriously built nests and tunnels all through the thatch. Their construction projects shortened the life of the roof, and interesting things sometimes plopped

out of the ceiling in the night. Larry says, "A lot of poop, but sometimes live critters as well."

For most people, the day starts with a trip to the toilet. In Tortuguero in the 1950s, this meant a short stroll to the beach left bare by the morning's receding tide, where people relieved themselves on the sand. The incoming tide provided the flush and left the beach clean again. The villagers bathed in the river, despite the threat of crocodiles. The sawmill crew preferred to gather on a half-sunken tugboat on the riverside for their morning ritual. Though Larry fit easily into most of the rhythms of the village, he was not really comfortable with the toilet facilities.

Breakfast varied depending on the food that was available. After breakfast, the men who worked for the sawmill went to cut lumber in the forest or feed it through the big saws at the mill. The others gathered their tools and left to fish or tend their plots of cassava, banana, coconut, and plantain. Larry recalls that roasted corn sometimes provided a welcome break from the more traditional fare. The corn was

Shefton Martinez, a brother of Sibella and Leo, arranges strips of turtle meat on a rack and hangs a bag of eggs inside a structure of planks in order for the smoke to preserve them for a few extra days in the moist tropical heat.

COCONUTS

Although dangerous when plummeting out of trees, coconuts were a prized crop in Turtle Bogue. Young coconuts, still encased in a thick fibrous shell, contain large amounts of coconut water, a refreshing drink. Coconut milk is a very different substance, produced from more mature coconuts; it was long a mainstay in traditional Caribbean cooking. The meat of the coconut is removed from the shell and finely grated, yielding a rich semi-liquid. Two popular dishes, Tortuguero-style rice and beans and rundown—a stew that could contain either meat or fish and vegetables—were cooked in coconut milk. Pipas, young coconuts filled with coconut water, are still popular in Tortuguero, but the coconut milk dishes are somewhat out of vogue, perhaps because shelling and grating the meat is such a time-consuming chore.

In the early days, coconuts were also valued as a money crop. They could be taken by boat to Limón and sold, or the meat could be dried to produce copra. Coconut oil is extracted from copra, which is lighter and easier to ship than whole coconuts; what is left is sold as feed for livestock. Chuck Carr says he can still smell the sweet-acrid aroma of drying copra that often permeated the village.

supplied by the village carpenter, Chico Montalbán, who also built cayucas and farmed the Bogue's only cornfield. The women cared for the children, prepared food for the evening, and filled a big wooden tub with river water to wash clothes without benefit of soap. They spread the clean clothes on a grassy area to dry in the sun. The children did what children everywhere do—played pretend games, squabbled among themselves, annoyed their mothers, and began to learn the skills they would need as adults.

Dining at Sibella's

Appetite born of long days and hard work made it easy for Larry to adapt to the village diet. Mealtime found him with his feet under Sibella Martinez's table. When Archie Carr first arrived in Tortuguero, he inquired about a place to eat. He was told to go into the village and ask for "the woman who feeds people." He found both Sibella's food and her personality pleasing, and that first meal led to a lasting relationship between the Martinez family and the turtle research station.

Larry took his meals at Sibella's, sometimes alone and sometimes in the company of some of the sawmill workers. As her popularity grew, Sibella added a dining room with four tables and benches to her house, and cooked in an attached kitchen. Since most villagers cooked on a box of dirt that sat on a stand over an open fire, Sibella's cast iron wood-burning stove

was the envy of the Bogue. In the beginning, Larry was the only gringo at the table, but as the years passed, Sibella would serve many biologists and visitors to the turtle station. Always dignified and unflappable, she calmly stretched her meal to feed any number of unexpected guests.

Larry remembers meals as being either quite good or very boring. Sibella was an excellent cook, but the quality of the meals depended on the availability of foods. Cultivated vegetables were rare. In a village surrounded by jungle

Sibella Martinez, known for her dignity and strength of character, cooked for the turtle biologists for many years before passing the job on to her daughter, Junie.

and bounded by the sea and a lagoon, there was very little land suitable for growing crops. Cassava, a major source of carbohydrates for many people of the tropics, grew well on small plots in the jungle and sometimes it was the only food available. For Larry though, cassava porridge was high on the list of really boring meals. Breadfruit, the product of a tree that grew in the jungle, was, however, "Wonderful! Boiled, fried, baked—it didn't matter, it was always delicious." Other than that, it was beans and rice, beans and rice: the heartbeat

of Costa Rican cuisine. But if the launch wasn't running, even these basics were not always available in Turtle Bogue. Larry started bringing some rice and dried beans for Sibella to cook when he arrived for a new turtle season. "A feast!" he recalls. "But it didn't last long."

In 1957 one of the two launches that occasionally brought supplies to Tortuguero sank in a squall. Larry wrote:

> Now with nothing here in Tortuguero to beckon the remaining launch to come in, it by passes this place like we had the plague. [*Lumber orders were down , so the launch did not have to stop to pick up a load of lumber.*] Consequently, the only way my cook [Sibella] can get any groceries (flour, sugar, coffee) is to walk 30 miles to the south or 17 miles to the north—the two closest settlements. Needless to say I am short of mail, cigarettes, kerosene, etc. But I think I can survive the summer. Outside of the staples, there's some good enough victuals right here—wild pig, wild turkey, fish, bananas, bread-fruit, etc. Oh—turtle steaks natcherly!

Even when the launch was running, if there was meat, it was most likely fish or game or occasionally one of the scrawny chickens that pecked out a living in Sibella's yard. Favorite menu items included peccary, a wild pig, and a large rodent called lowland paca in English; in most of Mexico and Central America it is called tepezcuintle. In August 1956 Larry rendered the unfamiliar name phonetically:

> Leo's still working with me & we have taken a few hunting trips up the river on the side. Got some snakes, crocodiles, [*not for the table, but for research*] and shot some animal they call Tippysquinty. It resembles a rat, only with light stripes fore and aft & a pig's hide. Gets up around 25–30 lbs. Man, it sure eats good as Leo would say. Sibella cooks them

> for me—much better than beans, rice, & eggs! They don't butcher meat too often around here, so one has to go out in the bush and shoot game, mostly the white lipped peccary, ...and Tippysquinty."

Sibella's tepezcuintle was one of my favorite meals." Larry remembers, "A thick layer of fat underneath the skin gave the meat an excellent flavor." The tepezcuintles are nocturnal, so Larry wore a headlamp to hunt them at night. The animal's large eyes caught and reflected the light, pinpointing its location. It was dangerous hunting, as jaguars were stalking the same prey.

There will be meat on the table tonight! Larry shot the tepezcuintle that Leo is holding.

The best meal at Sibella's was green turtle, the turtle was named for the greenish color of the delicious but sticky belly fat that seasoned the meat and was eaten along with it. The calipee and the fat comprised the most valuable part of the turtle to the outside market. It was used to produce the thick broth that gave green turtle soup its distinctive flavor and texture. Sibella prepared delicious soups and stews from the meat, fat, and broth. Nothing was wasted. When a turtle was killed for food, the villagers gathered around with an assortment of containers to collect some of the bounty. The meat had to be shared, for it would quickly go bad in the humid heat.

Manatee was also a treat favored by the villagers. Larry sheepishly admits, "I am embarrassed today to tell people I ate turtle and manatee, but at that time they were plentiful and delicious! They were the food of the village and were

CAYUCA BUILDING

Boats are a necessity in Tortuguero, but with the advent of fiberglass-and aluminum-hulled boats, cayuca building is all but a lost art. Bill Sambola and Albert Taylor were known for their cayuca-building skills. Eighty-five-year-old Bill still spends much of his day in a boat, but he too now uses a manufactured canoe. Not only is building a cayuca a long, difficult process, but the national park frowns on cutting down trees of the rainforest. Cayucas ranged in size from 8 feet to as much as 35 feet. Building a dugout began with the selection and cutting of a tree, with construction getting under way in the forest where the tree was felled. The log was cut to size and the center hacked out with an axe creating enough of an indentation for a man to sit and paddle the emerging cayuca to the village. The only measurement taken established the center line down the length of the log. A cord coated with carbon from an old battery was used to mark the line and the builder was careful to maintain an equal distance on either side of it. An adze, a cutting tool with a curved blade used for shaping wood, was used to finish cutting and smoothing the inside surface. Toward the bow, the sides are gradually curved in to form a pointed prow. Final smoothing was done with a plane. Methods were pretty standard, but whereas some builders liked a rounded bottom, Bill Sambola points out that a flat bottom provides stability.

Chico Montalbán (left) puts the finishing touches on a cayuca (circa 1950s). Alhough some of the work was done with chain saws in later years, hand tools were traditionally used for the cutting and hollowing. To assist in the exhausting work, skilled craftsmen always employed a second, or helper, usually a family member.

considered a necessary part of the diet. And I lived the life of the village—a subsistence culture." After the seriousness of the decline of turtles was recognized, Archie Carr and his student biologists stopped eating them. But when Carr visited the camp, he would occasionally slip down to Sibella's for a guilty taste of his favorite dish—turtle flipper stew.

Top: Children look on as a turtle's meat and partially developed eggs are divided up.

Bottom: A fetus found in a manatee killed the night before was a boon the villagers would not allow to go to waste. They found a use for everything and shared with one another.

In the 1950s manatees were not endangered and were an important food source for the people of Tortuguero. The huge mammals are often called "sea cows," because they are large herbivores and because their meat is dark and rich—much like beef in flavor and texture.

At night the "sea cows" would come into the rivers and sloughs to feed on aquatic grasses growing along the water's edge. Hunters from Tortuguero would go out in a cayuca and listen for the sound of manatees munching water plants. Preparation for the hunt included shaving the blades of the paddles down to smooth sharp edges so they would

cut silently through the surface of the water, allowing the men to sneak up on their prey. When they located a manatee they heaved a long harpoon silently and accurately into its flesh. They used the rope attached to the harpoon to pull the manatee near to the boat, where they killed it before attempting to bring it aboard. Experience had shown that a living animal the size of a manatee would flop around, possibly injuring the hunters or breaking the sturdy cayuca. Even dead, however, a manatee posed a logistical challenge: how to get 500 pounds or more of dead weight into the vessel.

Leo poses with his manatee harpoon; the blade is both broader and longer than the type used to harpoon turtles. The wooden spool fitted to the end of the shaft is a float that contains coiled line. The line uncoils when the harpoon is thrown and allows easy retrieval of the implement.

The hunters' solution was to tip the cayuca to one side, letting it fill with water. When the top edge was almost at water level, they rolled the heavy carcass into the boat and quickly bailed out the excess water. This tricky process required a lot of skill, for if the cayuca were to capsize, the hunters would be plunged into the dark, crocodile-infested waters. Back in the village the manatee was butchered and the villagers lined up with pots and bowls to collect their share.

Moving into luxury

When Larry arrived for his second summer, Leo said, "You will not live at the sawmill. You will live at my ranch." Leo's wife had taken the couple's four children to Limón to go to school, so the arrangement worked well. Larry had Xavier Nuñez, a local carpenter, build a wooden cot frame to support a sheet of canvas he brought with him [Xavier would later build the biologists' first set of calipers for measuring turtle shells.] Larry says, "A canvas cot is the best way to sleep in the tropics. It

is sturdy, but allows air circulation, and doesn't get as damp as sheets." He adds, "I had my own room at Leo's and kept it neat and clean—that was not always the case with the rest of the house." A new cot and no more sawmill noise—life was good. On July 29, 1957 Larry wrote to his mother:

> I sure do like Leo's camp, real convenient. Just a few steps and I'm on the beach. No more stumbling through a village with all its barking dogs. The well is just outside the door—nice and clean water—just a few mosquito larvae & bits of leaves—no dead rats! [*On the narrow peninsula, saltwater flowed in and out of the well with the tide. Fresh water is lighter than saltwater and floated on top. The higher the tide, the easier it was to scoop up a bucket of fresh water.*] There is a nice long overhanging eve of thatch—enough for me to hang clothes under it and all. Leo helped me build a privy the second day I was here, so no more hunting around for privacy like last year (which usually ended up somewhere on the beach). Out back is the boat shed with two dugouts . . . a big 18 footer & a small 8 footer. Plenty of ocean breeze, direct through the house. The open beach, well anywhere in the open, is hot as hell, but inside the house is real cool and nice, cooler than Gainesville. . . . Only one trouble & that isn't too bad—<u>rats.</u> They live in the thatch roof and tunnel around & when it rains you don't know where the next leak will be. They also come out at night and nibble at anything you happen to leave out—mostly chow—bananas, etc. But sometimes they'll chew into your gear, clothes etc. I brought a rattrap this time & and have chalked up 5 kills. Also when I sit at the table at night writing, I keep a loaded pistol handy. Then I spot bits [of bananas] around on the rafters. When I hear one come out, I snap on a flashlight & blingo!

When word of Larry's marksmanship with a pistol got out, neighbors began asking him to come shoot the rats that lived in their houses. He used his own ammunition, a precious

commodity in the village, further earning popular gratitude. Santiago Conu, however, would come to Larry and ask to borrow a bullet. In the beginning Larry was surprised and would ask, "Just ONE?" The man assured him that was all he needed to hunt wari. And it was. Santiago never failed to come back with meat for the table.

Habla Inglés?

Larry didn't speak Spanish, but most of the villagers spoke a patois English that fell sweetly on the ear, like drops of honey. The villagers were a mix of Miskito Indians, African-Caribbean immigrants from Jamaica and San Andreas, Colombia, and native Costa Ricans known as Ticos. They were mostly bilingual or even trilingual and would slip into Spanish when they didn't want to share their thoughts with Larry.

In his second summer in Tortuguero, a letter written in Spanish came from the Costa Rican government. One of Larry's former roommates, Jim Wing, a language major, told him that it didn't matter how much vocabulary you learned because if you couldn't pronounce words correctly, no one would understand you anyway. So he had taught Larry, not

The hammock on Leo's porch was a great place for Larry to relax after a day's work. There was usually a stalk of bananas hanging nearby for a quick snack.

For Larry, Leo's house was a haven after the open room and noise of the sawmill.

Spanish vocabulary and grammar, but pronunciation. With this preparation, Larry read the letter to Leo in almost flawless Spanish but with no idea what he was saying. Leo couldn't read but, being bilingual, was able to translate. As Larry read, Leo responded with the English equivalent. Leo was sure that because Larry's Spanish sounded so good, his friend had secretly acquired an understanding of the language. Thereafter, Leo was always highly amused when other villagers switched to Spanish with the intent of preventing Larry from knowing what they were saying.

The letter from the government informed the villagers that two miles of beach had been set aside for the research project and that hunting and egg gathering were no longer permitted there. The beach dedicated to the research project would begin at the inlet north of the village and would extend southward past the village. Most of the villagers cooperated, but there was not enough funding available to hire guards to effectively protect the beach from poachers. Some of the poachers were taking turtles and eggs for their own use, not for sale. Meshach Moses, for example, was struggling to feed a large family and turned a turtle every few days during the

season. Larry tried to keep Meshach and others like him to the south and off the protected beach, but they didn't always cooperate. In those cases, he says, "I didn't push it."

Leo and some of his children with a clutch of turtle eggs. Eggs provided needed protein, and as a bonus many Caribbean men believed them to be aphrodisiacal.

Pigs and Paths

Wild peccaries were a welcome menu item, but domesticated pigs had higher status as currency among the villagers. Sometimes a single pig would make its way through the entire village as it was traded for a fine fishing net here, a used cayuca there, until someone felt rich enough to butcher the pig and eat it.

Walking through the village with Leo, Larry puzzled over the paths that twisted and snaked their way through the village. He asked Leo, "Why don't the paths run straight? The land is flat with no hills to avoid or waterways to cross." Leo said, "Look around you. What do you see?" Larry said, "Coconut trees." "And where are the coconuts?" Larry's gaze climbed a tree, then dropped back to the ground, and he laughed with understanding. The paths wound their way through the village just far enough from the coconut trees to avoid the trajectory of falling coconuts. Coconuts are filled with liquid, and a thick fibrous outer shell covers the inner shell making the fruit large,

heavy, and hard. A falling coconut can kill a person. Suddenly the meandering system of paths made perfect sense.

The Doctor Is In

In the mid-1950s no modern medical care was available in the village. People relied heavily on the herbal medicines prescribed and prepared by a village healer or midwife. The talented Sibella Martinez, in addition to being a fine cook, was well respected in the village as a healer. When Larry and the other biologists were injured, she treated them with "bush medicine." Larry in turn would bring a supply of antibiotics and syringes to the village for Sibella to use on those who needed prescription drugs.

Larry was fortunate enough to stay healthy most of the time, but the possibility of serious injury or infection was always a nagging worry. In September of 1957, he sustained what in other circumstances would have been a minor injury. In the humid rainforest environment, however, the wound site quickly festered into a major problem. Once the emergency had passed, Larry wrote to his mother about it in an understated tone:

> Well Mom, as soon as my hand got better I went right back to Tortuguero to continue tagging. The finger is stiff, but possibly with some therapy—exercise—I can get it loosened up eventually. Oh I had a cut on my finger (little, left) from a turtle's flipper (the back edge is horny & somewhat sharp) and possibly I got it infected when I cleaned a partially decomposed crested guan (a tropical turkey-like bird) that I had shot earlier in the day. It got quite painful & started to spread into my hand & by the time I finally managed to flag down a plane three or four days later it had gotten pretty bad. The Carrs were very nice—they boarded me, footed the hospital bills & everything! They're certainly a swell bunch—I'd like you to meet them next year when they come back from Costa Rica!" [This was during the time that Carr was teaching in Costa Rica.]

Attack on Two Fronts

While in San José for treatment of his infected hand, Larry picked up a newspaper with a headline proclaiming that Tortuguero had been attacked! Even 50 years later he seems disappointed that he missed the excitement. He wrote his mother about the incident.

> While I was gone, that is up in San José, Tortuguero was raided by some Nicaraguan rebels after guns & ammunition. No one was hurt though & the fellas were captured back in the woods behind the landing field the day before I came back. You know that small commissary where I stayed last year, well there was a cache of machine guns, rifles, & thousands of rounds of ammo right below my room! These rebels got wind of it & wanted that stuff to carry out a raid on their president, Samosa [Somoza]. What all that armament was doing in Tortuguero is a mystery! There was only one soldier stationed there to watch about 25 miles of beach!

The invasion of armed militiamen caused excitement that was talked about for years. But there were other smaller, more dangerous enemies. Mosquitoes are a fact of life in the jungle. Sometimes they carry malaria, yellow fever, dengue fever—diseases that can wipe out whole villages. And then there was DDT. The Costa Rican government sent antimosquito teams armed with huge amounts of the pesticide into the villages. As happened elsewhere in the developing world, the teams sprayed the air, they sprayed bushes, they sprayed the houses—inside and out. Mosquitoes died by the thousands. Roaches, ants, scorpions, spiders, rats, and snakes died along with them. Sibella's chickens feasted on the glut of dead vermin and also died. Furious, and determined not to let good meat go to waste, she gathered the dead birds, plucked them, and prepared a chicken feast for her diners.

After the biologists moved into their own house Harry Hirth wrote in a letter to Dr. Carr, "Some malarial crew came and sprayed all the houses with DDT. We now are an official member of the village with our yellow sticker on the door."[9] It was only a few years later that research about the danger DDT poses to humans and other animals became widely known.[10]

After several seasons, Carr began sending other students to participate in the program. The first to come was Harry Hirth. He moved in with Larry and Leo and settled into the routine.

Lost in the Jungle

When Archie Carr first showed up in Tortuguero, gringos were a rare sight and not a particularly welcome one. Turtles were essential to village life, and interest in them by outsiders was worrisome. But Carr's easy acceptance of the village way of life and his enthusiasm for the old-timers' stories and the village food—including turtle—soothed their uneasiness. When Larry Ogren arrived in the second year of the tagging program, his good-natured kindness and wry sense of humor served to further acceptance and pleasant working relationships among the biologists and the local people.

Carr's sons were frequent visitors to Tortuguero and blended easily into the life of the village. From early childhood Tom was an avid fisherman and hunter; in his teens he helped provide meat for the village. In Tortuguero, he kept a .38 derringer for shooting rats. He recalls taking the little revolver along on a hunting trip with a rather unsavory

character that he remembers only as "Boom Boom." Peccaries were the designated prey that day. The cunning pigs can be mean and dangerous, and they will work together to separate two hunters. This happened on the trip with Boom Boom, who made matters worse by shooting and wounding a big boar. The injured wild boar spotted Tom and charged. As the angry pig approached, Archie's son drew the derringer and fired—killing the boar with a direct hit between the eyes. To this day, Tom says, he can't believe that he not only hit but killed the boar with a derringer. Boom Boom gutted and butchered the pig and secured it to Tom's back. It was a heavy load to carry back to the cayuca, but the pride of accomplishment lightened the task.

Leo Martinez, silhouetted against sky and lagoon, uses a machete to hack away the outer shell of a coconut. A skill practiced in Tortuguero today.

Tom's brother Chuck went along on his dad's second visit to Tortuguero, before the tagging program was begun. Chuck liked the village people and the jungles and visited as often as possible. At 14 he spent some time at the research station under the supervision of Harry Hirth, the biologist on duty at the time. Chuck, who stayed with Harry in a thatched shack on stilts, remembers him as a gentle man who walked around the camp singing hymns on Sundays. Every night, the pair patrolled the beach, looking for sea turtles. Chuck later wrote,

> Sibella Martinez, at whose house we ate three meals a day, was a master of preserving food by heat and smoke. This led to more and more potent flavors as the jack fish or turtle roast was reheated two or three days in a row."

Eventually there would be no meat but canned Vienna sausage: "nasty things . . . like eating human thumbs, . . . tasted terrible."

Vienna sausage on the menu always sparked plans for a hunting trip. Sunday, the only day the turtle team didn't walk the beach, was hunting day. As this particular Sunday approached, Chuck worried that something would go wrong: it might storm, the outboard might not be working, or there wouldn't be enough gasoline. It did rain, but nevertheless, Harry, Chuck, and Leo set out before sunrise in search of peccaries.

> We stashed the guns—cheap but accurate .22-caliber, single-shot, bolt-action rifles—and machetes in the dugout with a basket of food wrapped in oilcloth that Sibella had sent along. Leo took the bow, Harry the motor. I sat amidships and scrunched down in my poncho, trying to be small and dry. The motor buzzed, and with Leo to watch for drifting tree trunks, we slid through the rainy darkness, up stream, toward the Agua Fria, the creek that would take us to the hunting trails. We cruised for an hour. The dawn light came just in time, because the creek became narrow and curvy. With the currents boosted by the rainfall, getting anywhere, even with the engine, meant everybody thrashing around with paddles, fending off snags, pushing away from the bank, fighting a mean little eddy in a hairpin turn. Exciting stuff, and strenuous. Leo waved us over to a place on the bank where a hint of a trail could be seen, an old machete cut, some scuffing on the mud, and we stopped.

The hunters ate the boiled eggs and bread that Sibella had provided. Then, leaving the ponchos in the dugout, they set out with Leo in the lead, moving fast, and chopping limbs to clear a path. After about two hours they gave it up, returned to the dugout, and maneuvered farther up the Agua Fria. They saw large tapir and jaguar prints, but no game. By their third stop it was time to start the long paddle home, but Leo

proposed one final attempt to bag some game. They spread out about 25 yards apart and pushed on through the jungle in hopes of flushing something edible.

> I was pretty excited with this deployment and held my gun at the ready with two hands, using the gunstock, instead of the machete, to force my way through any restraining palm fronds or lianas. I was tensely alert, certain that any moment a big game bird would explode from concealment ahead. Through the buttressed tree trunks and understory brush, I could glimpse Harry from time to time, also moving ahead in a stealthy way.

Eventually Chuck and Harry moved closer together and realized they had lost track of Leo. "*Harry Hirth and I were lost in the jungle.*" They shouted and fired their guns, but the dense jungle absorbed the sound. As dark fell, Harry said they should prepare for the night.

> I looked around, trying to define "prepare." There were gleaming wet tree trunks; reddish mud where the leaf litter had been carried off; puddles of water, rivulets of water, and shiny dark-green palm leaves. Far off, a tree branch fell noisily and heavily from some great height, crushing things as it came down. "Cut some palm frond," Harry instructed. "Make a bed. Make a lean-to." That would be the extent of our preparations. I cut big palm leaves and laid them down on a piece of ground that looked slightly elevated. I lay back to test it, and could feel each central beam of each big leaf along my back. . . . The rain let down steadily and copiously. I sat on my harsh-ribbed bed, and inventoried my misery. I was exhausted, . . . a burning of bodily stores not replenished by food since the last hardboiled egg at dawn. I was getting cold too. . . . As I lay there, using my hat to keep rain out of my eyes and nose, my body compressed the palm fronds. They sank into the mud. The water rose up to my buttocks and shoulder blades and rib cage [1]

Chuck spent the rest of the night on his feet with his chin and arms wedged into the branches and notches of a small tree. When morning finally came, the pair renewed their search for a way out and soon found Leo's trail. Leo had cut a broad path lined with gleaming, freshly cut foliage. The path led back to the Agua Fria. After cutting the path, Leo had made his way in pitch dark down the winding log-filled river all the way to the village. The two weary campers knew that Leo would be back and sat down to wait. Shortly Leo's cayuca appeared, followed by five cayucas filled with village men. Chuck remembers seeing Bill Sambola in the lead cayuca. They had left the village before sun up to come to the rescue of two of their own—Mistah Harry and Mistah Archie's boy.

Life in Tortuguero was Pura Vida, both for the gringo biologists, accustomed to a very different way of life, and for the villagers, who had never lived another way. But Tortuguero was destined to change. It would be change wrought not by the gringos who had shared their life but by changing times, the closing of the sawmill, and the decline of the turtles. Yet the village would adapt and survive. Because it was always Pura Vida in Tortuguero.

4

While working at Tortuguero, David Ehrenfeld designed goggles to gain insight into the vision of sea turtles. Dr. Ehrenfeld, currently a professor at Rutgers University was the founding editor of the periodical *Conservation Biology*. The photo was taken by Dr. Robert Schroeder, a turtle and coral reef biologist.

Finding Facts:
Frustrating, Fulfilling, and Funny

Archie Carr loved a puzzle and would worry it around in his mind until he found an answer; but finding answers about sea turtles was a daunting problem. As tiny hatchlings they bubble up out of the sand and disappear into the sea, not to be seen until they are dinner plate size and begin showing up in fishing nets, or foraging for food in the grass flats. Male sea turtles never set flipper on dry land again. Mature females by the thousand, however, appear on certain beaches, where they dig holes in the sand, drop their eggs, and start the life process over again. After laying, and roughly two months before the eggs have hatched, the females, too, disappear into the world's seas.

Eager to find answers about an animal that starts its life buried in the sand, and then vanishes into the seas that cover almost three fourths of the earth, Carr pondered the problem. He had a special interest in greens because of their importance as a food source to the subsistence cultures of the Caribbean. He chose Tortuguero for his green turtle research station because it had the largest green turtle nesting population remaining in the Caribbean.

Carr had learned that some turtles nest singly scattered across many miles of beach, but others nest by the thousands on certain beaches. He saw this mass nesting as the only window of opportunity for marine biologists to have personal contact with mature turtles and, approximately two months later, with their hatchlings. The huge Olive ridley arribadas of the Pacific were hectic frenzied events that were quickly over, whereas on Caribbean nesting beaches, green sea turtles nest in great

numbers, spreading their nesting activity over several months. The longer nesting season allows a single biologist or a small team time to accomplish more. The overlap of nesting and hatching makes it possible to carry on adult tagging and data collection while observing nests and, finally, hatchlings.

Biologists had their work cut out for them when it came to accessing all those nesting turtles. Tortuguero is hot and muggy year round. It rains–a lot–year round, and the rains that fall in turtle nesting season are torrential. Moreover, turtles nest at night, and the light of a single match can send a big hen lumbering back into the sea, still carrying her eggs. This means that biologists must walk the beach in the dark, guided only by the sounds of the sea. The gray volcanic sand hides logs, glass, and other beach debris that can rip painfully into a toe. Closed-toed shoes provide some protection, but walking for miles in the yielding sand becomes even more difficult. Sometimes washouts leave behind treacherous slopes or sudden drop-offs into the water.

Two children watch as Larry and Leo tag and measure a turtle turned the night before.

Larry wrote his mother:

> Really get the walking in around here, Mom. At night patrolling the beach I get in around 8 miles or more, and during the day when I tag them I hike 6 or more miles. And when we go out in the canoe, "cayuca," it's strictly arm work—no mechanized vehicles around here! What an appetite I've got now—I hope it will

> disappear when I get back. . . . lots of things to nibble on between meals over on the beach too—coco plums (sweet fruits size of crab apples) sea grapes, coconuts, water coconuts with lime juice [water coconuts are young coconuts that contain a large amount of liquid that will later mature into coconut meat], pears (we call them avocados), a stick of sugar cane to suck on—but not all of them are wild. The limes, sugar cane, & pears Obid (Leo's brother) gives me. And Xavier Nuñas & Leo keep me supplied with bananas.

On another occasion he wrote again about his ravenous appetite and the hard work of turning turtles:

> Golly what an appetite—walking that beach wrestling turtles sure makes me hungry. Sometimes the "old hens" put up quite a struggle—guess they don't like to be rolled over, . . . When they get frantic, they flap those flippers violently & woe to anyone who gets into their range. I haven't been hit hard yet, but I've gotten some "terrific" sand baths. One night I caught sight of a big one as it was retreating back to the sea. I ran out in the surf after her & tried to haul her back. We fought back & forth for a while but finally she caught me with her flipper. Away went my flashlight & just then a wave broke over me, & she took off. They're not all this stubborn, but these are the old girls you remember!

Off the beach, the biologists faced other challenges. In the beginning they had no electricity, no running water, no toilet facilities, and limited communication with the outside world. After several years, they had a thatched roof cabin on stilts built on Leo Martinez's property. They also began to acquire mechanical equipment designed to make life easier, but often it just added new headaches. Over the years, as the turtle team accumulated equipment, letters to Dr. Carr would often begin with an assessment of which items—outboard motor,

generator, and electric water pump—were actually working at the moment. The unreliable electric water pumps operated only during the few evening hours that the generator was running. Chuck Carr remembers a big green single-piston, British-made Lister generator that powered a pump that pulled water

Larry's spare time could always be filled with working on the pump, the generator, or the boat motor.

from a well into barrels, which were connected by pipes to the washbasin and shower. Larry says, "The showers were after my time. We didn't have anything nearly that fancy. We thought having a little pump to pull salt water into our turtle tanks was real luxury." Chuck recalls another problematic power source, as well.

> One other little item of interest was flashlight batteries. Jesus. Back in those days, before alkaline, we used carbon-core batteries, and they didn't last long. We'd bring in a big box of them. They weren't cheap. Our lives on the beach depended on the flashlights. . . . Larry taught us that you could pass a dying D-cell battery over a candle flame and restore its power for a little bit."[12]

Flashlights were used to get around the camp and village in the dark. Before the researchers fully understood the effect of light on the turtles, they sometimes used flashlights on the beach.

The scarcity of gasoline was, of course, another big problem. Larry's excitement over getting a 3-horsepower outboard motor was soon tempered by the realization that the engine wouldn't get much use because gasoline was always in short supply. Soon after acquiring the motor, however, he and Harry spotted a big metal drum floating in the surf. They decided it might come in handy and struggled to get it ashore. Like a gift from the gods, it contained 50 gallons of gasoline!

Despite the hardships, many of the world's leading turtle biologists have spent time in Tortuguero—and those who have not, have benefited from the knowledge painstakingly gathered there.

Turning and Tagging

Local fishermen believed that the green turtles nesting on Tortuguero beach came from far away. This belief was supported by two facts: green turtles eat sea grass, and there were no grass beds near Tortuguero. But where had the turtles come from, and how had they known where to go? Archie's plan to put an identifying mark on the turtles in order to track their movements presented its own problems. How do you mark a turtle? You can't just slap a mailing label on its back. The researchers knew that any marking they might apply to a turtle shell would wear off or corrode after years in saltwater. The markers would have to show identifying numbers and a return address, and, of course, they could not harm the turtle or interfere with its movements.

In the first year, 1955, Archie and Leonard Giovannoli used oval tags made of a salt-tolerant metal alloy. They'd flip a turtle over, drill holes in the rear scutes of its shell, thread stainless steel wire through the holes, and attach the tags firmly to the shell. Chuck Carr tells about Leonard Giovannoli's heroic contribution to the turtle tagging:

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> But, with all the steps involved in the original technique used by Leonard Giovanolli, the manipulating of the turtle in the dark,

> often hampered by rain; the drilling of the shell; the threading of springy wire through sand-clogged holes; the measuring of the carapace in the light of a dim flashlight; and of course the careful taking of notes— all of that is made almost improbable when you realize that Giovanolli had only one leg! Yes, it's true. He walked for miles with crutches that plunged into the soft, yielding volcanic sand of Tortuguero. And then he confronted the big green turtles and flipped them over. And then he proceeded to drill the shell and secure the metal oval tags.[13]

That first year, there was money available to hire veladors who helped turn the turtles in the dark; then Giovannoli tagged, measured, and flipped them back over so they could return to the water. The number of turtles Giovanolli tagged in a day in 1955 set a record and became the standard for all Tortuguero biologists. If Giovannoli could do so much, there was no excuse for a two-legged researcher to fail to do as well.

By the second year, when Larry Ogren came to tag the turtles, Archie had learned that Dr. Tom Harrison in Sarawak, Borneo was using Monel metal tags. Ranchers identified their cattle with tags made of this proprietary alloy of nickel and copper, which is very resistant to corrosion and acids. Since a cow's ear and a turtle's flipper are both flat and contain few nerves, Harrison had decided the same method could work for turtles. Archie ordered similar tags made of the durable Monel metal, and an implement designed for attaching the tags to a cow ear, which turned out to work on turtle flippers, too. Though much more sophisticated means of tagging and tracking turtles have come with advances in technology, Monel tags for turtles are still in use today.

Birth on the Beach

Although scientists and local observers had long known that when sea turtles finish laying, they abandon their eggs buried in the sand, but what happened between the initial nesting and the departure from the site was a mystery. Gradually,

Today a turtle's route can be precisely, but expensively, tracked by satellite. Nevertheless, metal tags remain the primary tool for learning about the travels of sea turtles.

through observation and experimentation, the researchers learned that when female turtles reach sexual maturity at between 15 and 35 years of age, they are drawn irresistibly over hundreds or even thousands of miles back to the beach where they were hatched. They don't travel together in great fleets or schools, but over several weeks thousands arrive, alone or in small groups.

The females will mate several times, with different males, and they will produce several clutches (about a hundred eggs) about two weeks apart. This obstetrical schedule succeeds because the female turtle can store sperm in her body for later use. She can also secrete a gooey substance in her reproductive tract that cuts off oxygen flow to the eggs. By "pausing" both the fertilization of the first sperm deposits and the development of fertilized eggs, one female is able to produce several clutches in one nesting season. When the first clutch is ready to be laid, she goes ashore and selects a spot in the sand beyond the high tide line. It is a laborious trek through soft

sand for an animal weighing hundreds of pounds and having only flippers for propulsion. She is very skittish during this journey across the beach—light or movement can cause her to make a U-turn back to the sea. When she has selected a place, she uses her front flippers to clear away sticks and other beach wrack. After tidying the area, she digs a shallow body cavity with her front flippers and settles into it.

Oblivious to the presence of bystanders, a green turtle deposits her eggs in the sand.

Now the real work begins. Using only her rear flippers, the turtle begins digging the nest cavity, which extends deeper into the sand beneath the rear part of her body. At this point she is no longer disturbed by activity around her, and researchers can use small red-filtered lights as they measure, tag, and take notes. The turtle, now in a trancelike state goes on with the job at hand, unable to see what she is doing as she neatly removes flipper-full after flipper-full of sand, alternating rear flippers with each scoop. As she digs, shedding copious amounts of salty tears, she carefully shapes and molds the cavity into a bulb shape with the big end on the bottom. Scientists believe that the tears remove excess salt and also help keep the sand out of the turtle's eyes.

The soft, leathery eggs look like ping-pong balls but are intricately complex. The inside is composed of several substances, including the developing embryo and yolk sac. The various fluids and membranes inside the egg allow the performance of such essential functions as providing food,

WHY 100?

Most sea turtles lay approximately 100 eggs in a clutch, hawksbills sometimes more and flatbacks less. The females nest every two or three years and lay as many as five clutches a season. That's a lot of eggs. How can an animal that reproduces at this rate be endangered? The Sea Turtle Conservancy estimates that each egg has less than one chance in 1000 maybe even as little as one in 10,000 to survive to full adulthood.

Predators of sea turtle eggs and hatchlings include insects, crabs, raccoons, boars, birds, coyotes, jaguars, coatis, wild dogs, domesticated dogs—and, of course, humans. And these are creatures that prey on eggs and hatchlings while they are still on the beach. When hatchlings hit the water, there are sharks, fish, frigate birds, and other sea birds waiting. On crowded beaches nests are often inadvertently destroyed by other turtles seeking a nesting spot—this is most common with the ridleys, which nest in huge arribadas with many thousands of turtles on the beach simultaneously.

Thus some of the hundred eggs in any given clutch fail to hatch, and many do not survive the juvenile stage. The excess of eggs provides a glut of high-protein food to coastal dwellers, both human and animals. Even the shells and eggs that are dug up and left rotting on the beach are not wasted—in the low-nutrient sand they nourish dune vegetation and tiny sand-dwelling creatures. For millennia the balance had held. One hundred per clutch was the right number to maintain the turtle population and contribute to the food web. But when humans made the harvesting of egg and turtle meat a commercial enterprise, and began gobbling up sea turtle habitat for construction, they threw the system out of kilter. One hundred was no longer enough, and sea turtle numbers began rapidly dropping.

oxygen, water, shock absorbency, and the sequestering of waste. Once the eggs have been deposited, the turtle refills the hole with her back flippers and tamps it down with her body. Then, instinctively, she conceals the nest by tossing sand around the surrounding area. When all is done, she returns to the sea to rest. In about two weeks she will make another nesting trip to the beach. She may nest from two to five times, occasionally more, in one season. In about two months, the time varies according to the temperature in the nest, little turtles come boiling out of the sand and head for the sea.

Larry had pieced together information about the structure of turtle nests in the course of moving certain nests to protect them from rising water or predators or to enable him and Harry Hirth to monitor the process more closely. But just what went on down there and how the little creatures managed to make their way to the surface simultaneously was a puzzle. To solve it, the researchers came up with a way to spy on the little guys. They dug out one side of a nest, put in a piece of glass, put a tarp over the hole to keep out light, and took turns crawling into the hole to watch the eggs.

Larry and Harry learned that a turtle that's ready to hatch has an egg tooth sticking up from the nose and uses

This view of hatchling abdomens highlights the differences between the green turtle (left) and a leatherback (right).

it to tear an exit hole in the leathery shell. They observed that when one little turtle cut his way out of the shell and straightened its curled-over body, the movement seemed to stimulate the turtles in nearby eggs to follow suit and tear open their eggs. Soon there were many little turtles stretching their legs, straightening their shells, and generally squirming around and getting in each other's way. As the upper-level hatchlings squirmed and clawed, they disturbed the layer of sand over them, causing the grains to come loose and fall away. As more and more turtles wiggled around, the sand slid around them, migrating toward the bottom of the nest and gradually raising the level of the nest cavity. As more and more sand slipped from overhead to underneath, it lifted the hatchlings toward the surface. Of course the minutes-old hatchlings are not making a conscious effort to get out of the nest. They are just squirming. But when their activity has raised the "floor" beneath them to surface level, almost everyone scrambles out and heads for the sea. Occasionally one or two healthy turtles in a clutch hatch late, only to die in the sand because they missed the chain reaction triggered by the squirming bodies of their siblings.

The Pull of the Sea

Archie Carr had wondered from the outset how the hatchlings know where the sea is. In the dark of night, the tiny creatures always hurried off in the right direction, detouring around beach debris and scrambling over piled-up sand in their race to the water. Instinct told them where they were meant to go, and the ones that didn't get scooped up by predators on shore plunged into the waves to try to outmaneuver the waiting marine predators.

We now know that hatchlings are attracted to the brighter glow of the night sky over the sea, and that the sound and vibration of the surf also help guide them. Today we also know that brightly lit beachfront homes, businesses, and parking lots can override these subtle natural cues and draw

hatchlings to their death in swimming pools, parking lots, or under the wheels of traffic. But arriving at that understanding was not a simple process.

Larry Ogren's mission at the Tortuguero station included making behavioral observations and conducting a number of experiments in an effort to find the answers to any number of puzzles. In one early experiment he and Dr. Carr took a batch of hatchling turtles from Tortuguero to San José. From there they caught a ride to Parrita, on the Pacific coast, on a cargo plane loaded with tubular fish traps. Larry and Archie traveled cowboy style astride the fish traps. They wanted to try to determine whether the little turtles were programmed to respond to the magnetic pull of the earth.

Tortuguero's hatchlings always went east, into the sea. If they were guided by the earth's magnetic pull, then they should always travel east. To test this hypothesis, Larry and Archie released the hatchlings on the beach at Parrita: Would they go east toward the mountains, rather than to the sea, in the opposite direction? They soon had their answer, as the little turtles marched westward across the beach and into the Pacific. Apparently the earth's magnetic field wasn't pulling them east. Their instructions had to be coming from another source.

These just hatched turtles wandered aimlessly when their eyes were covered with tape—proving that vision was important in finding their way to the sea.

TURTLES IN SPECTACLES

Imagine if you can, giant turtles strolling the beach wearing eyeglasses. In the 1960s, in a further attempt to unravel the mystery of how turtles find the sea and how they perceive their environment, one of Dr. Carr's former students fashioned eyeglasses with changeable lenses for use on adult turtles. The lenses Dr. David Ehrenfeld used were designed to let in light of certain wavelengths only. To determine how turtles respond to various light waves of various lengths, Ehrenfeld put the glasses on females that were returning to the sea after laying their eggs. He learned that unlike humans, turtles can see ultraviolet light. He also found that they see best in the ultraviolet-to-green region of the spectrum; very little at the red end is visible to them.

In the1940s a German scientist determined that honeybees can detect polarized light and use the pattern of polarization in the sky to navigate. Ehrenfeld studied sea turtle vision and light characteristics near the sea to test the theory that the turtles used polarized light to not only find the water, but to navigate thousands of miles of open seas. His experiments showed that turtles cannot see polarized light nor do they use celestial navigation. When their eyes are out of the water sea turtles are near-sighted and cannot see well enough to be guided by the stars.

Ehrenfeld examined various other hypotheses, as well; but the only conclusion validated by all the data was that hatchlings looking for the sea, or females returning to the sea after nesting, head for the brightest light that's low on the horizon. Pieces of the puzzle were not exactly dropping seamlessly into place, but through the process of elimination and an occasional "Aha!" a body of knowledge was built.

Turtle hatchlings head for the water, even when they can't see it. That had been demonstrated. So Larry wondered if vision was crucial to their mission of reaching the sea. Would they still manage if they could not see at all? To find out whether the hatchlings were using obvious visual cues, Larry blindfolded a few with strips of adhesive tape and turned them loose on the beach. He smiles now at his primitive methods, but he learned that turtles that couldn't see, couldn't find the sea. They wandered in circles or stood still. He knew then that even though newly hatched turtles couldn't see the

ocean, they were seeing something that led them in the right direction. In Tortuguero Larry dug up nests and reburied the clutches of eggs farther from the water's edge to see whether distance was a factor in the turtles' ability to find the sea. He learned that little turtles born closer to the river than to the sea would head for the river, while turtles born farther inland would become disoriented. In addition, he'd noted that on dark, cloudy nights, hatchlings would wander around in confusion. "Light!" Larry thought. It was well known that the sky is usually brighter over both the sea and the river than over land. Could the slight increase in light intensity be the cue that drew the turtles seaward?

The Missing Year(s)

Even more intriguing—and more difficult to solve—than the mystery of how the hatchlings found the sea was the matter of where they went after their plunge into the waves off Tortuguero beach. All scientists knew was humans didn't see green sea turtles again until they were dinner plate size. Archie initially theorized that when the turtles reappeared, they were about a year old. In the 1950s, we had not yet put a man on the moon, much less developed satellite tracking systems. So how do you follow turtles not much bigger than a fifty cent piece as they travel through the ocean?

Carr suspected that the young turtles spent a period of early growth in the open sea. Like some fish, the turtle's bottom side is light colored and the top is dark. To predators looking up from below, the light-colored plastron blends with the light surface of the water. Looking down from the sky, birds see a dark-colored field, the sea; they are unlikely to notice the dark carapace of the turtles. But even with some camouflage, open water is a dangerous place for a bite-sized turtle. And food for small creatures is not concentrated enough in open water to sustain large populations of growing reptiles. The question loomed: Where do they go, and how do they make their living en route?

One biologist, Jane Frick, proposed a radical approach to finding the answer. In Bermuda, Jane, a strong swimmer, had taken to the water to escort the little turtles as far as possible; she was followed by an assistant in a skiff who took periodic bearings from the shore. The two researchers determined that the turtles swam in a straight line away from the shore. This was useful information because the ability to maintain a straight course suggested the presence of some kind of internal navigation system. Jane, therefore, wanted to use in Tortuguero the technique that had succeeded in Bermuda. Chuck Carr, who worked with her at the research station, remembers that his first challenge was persuading Jane that swimming with the turtles in the treacherous currents and bull-shark-infested waters of Tortuguero was out of the question. They finally agreed to try to track the turtles from a rickety observation tower attached to a small aluminum boat. The night before, they collected about 20 just-emerging hatchlings.

Carr wrote, "To get to sea, Jane and I had to negotiate the nearby river mouth, a dangerous, tormented place during the stormy rainy season, just passed. But, we glided through without mishap. . . ." Once in the open sea they rowed a half-mile along the beach to the research station where Shefton Martinez waited with the bucket of turtles. At a signal from the boat, he released the turtles, which immediately headed for the water.

> But we were not the only observers on that beautiful morning. Somewhere, very, very high in the sky there were frigate birds. . . . The frigates came from nowhere. From the ionosphere, perhaps. They tumbled out of the sky like black and broken kites, and they descended upon the phalanx of swimming turtles.
>
> There were about six of the long-winged, elegant birds, some with handsome white bibs. Avidly, they plucked the little turtles out of the sea.

> Shocked as I was, I was nonetheless able to perceive that the actual kill was an incongruously delicate act. The bird careens down from the heights, zigging and zagging in a vertical plane, and then, just as it reaches the surface, the plunge is arrested, the head dips, the long beak, with its terminal hook, probes downward like a surgeon with a pair of forceps, and the baby turtle is snatched up, flapping wildly of course. [14]

When the attack was over, only a single hatchling remained, possibly saved because it was very close to the boat. Saddened, the two scientists continued their mission with only one hatchling to track. They followed along as the little turtle continued to swim in a straight line out to sea. The turtle would surface, stick its head up and look around, then dive to a depth of about a meter, swim for about a minute, and resurface. Chuck and Jane had followed the tiny creature for approximately four miles when a frigate bird struck again. Swimming at the surface, the turtle spotted the predator and instinctively made a dive. The bird missed a snack, but it did not give up. The turtle dived deeper and stayed down longer than previously, continuing that pattern for several dives. The bird in the meantime revised its strategy. It dropped to sea level and came streaking up from behind as the turtle surfaced. The two scientists, screaming and waving arms and paddles, were able to make the bird abort the attack.

The hour was late, and with the top of Turtle Mountain—the only navigational connection with the shore—about to drop out of sight, the researchers headed back toward the beach. Despite the horror of watching the frigate birds gobble up their turtles, the day had not been lost. Chuck and Jane had watched in fascination as the little turtle navigated a course straight out into the sea long after it had lost any potential navigational clues from shore. They'd also learned that the turtle instinctively knew to watch the sky

for predators and to take evasive action. The frigate bird, on the other hand, had proved itself smarter than the turtle by changing its tactics and approaching low and from the rear.

The tracking venture, though disappointing, was a step toward learning about the missing years. Later, another of Dr. Carr's students, Karen Bjorndal and her husband, Alan Bolten, would discover that little loggerheads spend those gap years—between 7 and 12—in the eastern Atlantic, spending much of their time in convergence zones floating in masses of brown algae. This seaweed, called sargassum, floats in large drifts in the temperate and tropical oceans of the world. The mass of seaweed provides the hatchlings with camouflage, resting places, and an abundance of food. Many tiny animals and larval animals also make their home in the sargassum. The young loggerheads dine on these tidbits, not changing their diet to sea grass until they leave the shelter of the sargassum. We still don't know what tells them it is time to move on.

In the 1950s and 1960s methods were not high tech. Moreover, exhausting, frustrating efforts often produced only disappointment. But even experiments that did not appear to have been productive were building blocks to support the next attempt. Bit by bit, understanding of sea turtles was building.

Turtles breeding on the beach is a rare sight. They prefer the privacy and comfort of the water. Perhaps they didn't notice that the waves were pushing them shoreward.