

DR. ARCHIE CARR:

THE VOICE OF THE
TURTLE

Once legion in the Caribbean, the ancient host of sea turtles has now been depleted to the brink of extinction. Hunted for soup and shell, incidentally decimated by shrimp trawlers, or displaced by "development" of their habitats, they may vanish before we have unraveled many of their mysteries.

A man who knows more about those mysteries than most is Dr. Archie Carr, who presides over a highly successful turtle program at Tortuguero, Costa Rica, the last major green turtle rookery in the Caribbean. Tens of thousands of turtles have been tagged there for study of their enigmatic habits—migration, navigation, reproduction, survival. Since 1955 Tortuguero has been Mecca for students of these intriguing creatures of the sea.

Colorful and enthusiastic, Dr. Carr relaxed amid the comfortable disarray of his laboratory and talked with associate editor Tim Knipe about old discoveries and new riddles, and about the future of sea turtles. He is currently Graduate Research Professor in the Department of Zoology at the University of Florida in Gainesville. In addition to many technical papers and articles, Dr. Carr has written several books, including *The Handbook of Turtles*, *The Windward Road*, which won an O. Henry prize, and *So Excellent a Fish*, an authoritative and eloquent appeal for the survival of these species.

J.A.

Calypso Log: When and how did you become interested in sea turtles?

Archie Carr: I got interested in them back in the 1940s, when Cornell University Press invited me to write *The Handbook of Turtles*. I searched the literature of the world and went to a lot of museums. I wound up realizing that the most colorful and interesting turtles, biologically and every other way, were the ones that live in the seas. They were also the ones about which the least was known. So, way back in 1946-47, I decided that I would work on them as my specialty. Prior to that I had worked with freshwater turtles.

I was especially interested in the idea that the green turtle might be migratory. It wasn't thought to be. But everything I read indicated to me that we didn't know how these things could possibly get to where they are fished, on their feeding ground, from where we find them breeding, 800 to 1,000 miles away. They must migrate, and thus be capable of navigation. And being a practical-minded character, I said heck, this could get the attention of

the navy and NASA and people who could furnish some research money and transportation. So I combined a general natural history approach to sea turtles with a study of their navigation processes, which incidentally I never did solve. But at least I took a good look at it. That's a story in itself, animal navigation.

No one prior to that point had really taken an overview?

Well, the study of sea turtles was pretty medieval then. Back in those days there were three of us in the world, maybe four, who were dedicated to

studying sea turtles. Occasionally some museum curator would examine some specimens that somebody had found washed up on the beach and write a little paper about them. But interest in marine turtles has burgeoned to its considerable magnitude just in the last 20 years.

Could you tell me how the nesting ground of Kemp's ridley was discovered in Mexico?

Well, the ridley wasn't even completely recognized as a separate species when I was writing my turtle book. Some of the other turtle books grouped it in with the loggerhead, as just a variant. But from my observation it was very, very different. The ridley doesn't weigh but 90 pounds when it breeds; the loggerhead weighs about 160. Their feeding habits are different, their scalation and skulls are completely different. I called attention to the ridley as a perfectly distinct species.

I got interested because ridleys were

FRONT COVER**The Silent World Survives**

In 1950 Jacques Cousteau began writing in English about his experiences in an alien element, "the clear blue infinity" of the sea. Within 25 years that exhilarating new environment had been ruinously degraded in many parts of the world, but a few pristine pockets remain. Among the most luxuriant is the Virgin Island coral reef setting of the Project Ocean Search expeditions, where the divers on the cover are exploring their own relationship with the sea. Photo by Richard Murphy.

VIEW FROM THE BRIDGE 1**Bloody Beginnings for the Law of the Sea**

Before the international law that created 200-mile limits has even been ratified, contends Captain Cousteau, it has begun to provoke inevitable conflicts.

INTERVIEW: DR. ARCHIE CARR 2**The Voice of the Turtle**

Who cares about sea turtles? Until recently, very few people other than poachers, aphrodisiac vendors, tortoiseshell artisans, and Archie Carr. Now the survival of several species is in jeopardy, and at last this world expert in marine turtle ecology is beginning to make his voice heard.



Anne Meylan

MATTERS OF FACT 6**Testing the Antarctic Treaty**

By Tim Knipe

Some 600 million years ago, Antarctica was part of the tropical supercontinent called Gondwanaland, which included present-day South America, Africa, Arabia, India, and Australia. Does it then share their mineral makeup? As technological advances reduce the difficulty of Antarctic exploitation, the common sense and goodwill of the existing Antarctic Treaty are about to be tested to the limit.

THE NEWS NO ONE TELLS YOU . . . 10**Debt and Development: The Amazon Obsession**

By Paula DiPerna

Fighting hard to balance foreign business interests in the Amazon, Brazil and the other nations are undertaking



massive development schemes in mining, timber, agribusiness, cattle-ranching. Bankrolled by international lending agencies, the projects' stupendous debts are secured by the only valuable asset around—Amazonia itself.

Ayrton Camargo

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Final curtain: Rave reviews continue as the final segment of COUSTEAU/AMAZON airs. First rewards: For the first time on record, the Northeastern Regional Stranding Network successfully rehabilitates and releases a whitesided dolphin.

EXPEDITIONS 16**Man and the Rivers:****The Mississippi Expedition Moves West**

By Paula DiPerna

As the findings from *Calypso's* exploration of the "vertical" Mississippi begin to form a profile of a river much used by man, Land Teams are branching out along the "horizontal" Mississippi, beginning with Big Muddy.

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Jean-Paul Cornu and Paul Martin

BACK COVER**Gold Fever**

The Serra Pelada open pit gold mine in Brazil has yielded 26 tons of gold in four years, in nuggets weighing up to 76 pounds. But for most of the 45,000 men who work cube-like claims less than eight feet on a side, gold fever is finitely measured: 40 to 60 round trips up and down the ladders each day, carrying up 45-pound bags of ore and dirt at 40 cents apiece, nets an average of \$20 per day. Concerns about profit or loss are for owners only. Photo by Ayrton Camargo.

Calypso Log is available through membership in The Cousteau Society. *Calypso Log* is published quarterly. The *Calypso Log Dispatch* is published seven times a year. Editorial Offices: The Cousteau Society, Inc., 777 Third Avenue, New York, New York 10017.

Membership contribution to the Society is \$20.00 a year for an individual membership, which includes the *Calypso Log* and *Dispatch*, and \$28.00 a year for a family membership, which includes in addition the children's *Dolphin Log*. Mail memberships, address changes, and adjustments to The Cousteau Society Membership Center, 930 West 21st Street, Norfolk, Virginia 23517.

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quite common in Florida during the '40s and '50s, and yet nobody knew where they bred. So I began visiting museums and talking to people all over the world. I traveled the entire Gulf Coast and much of the Caribbean and never could find where they were nesting. After 18 years of looking, a friend of mine summoned me out to the University of Texas at Austin. He said, "We got the damndest film you've ever seen, and I believe it's ridleys."

I walked into this lab and there exploded on the screen a solid mile of ridley turtles nesting so close together that you could've jumped across from one back to the next for that mile. We calculated 40,000 in a day later on in that aggregation. So, the reason I'd never been able to find them was that they were doing all of their nesting on a one-mile strip on the Gulf Coast of Mexico in just two or three days, then they got the hell out of there.

Do other turtles follow the same breeding patterns as the ridleys?

Pretty much. Most of them breed two to four times during their season at the beach, and most of them come to the beach not every year but every two, three, or four years. At our project with the green turtles, we've monitored the beach every year since 1951. We never had but two turtles that came back in successive years, out of the thousands that we have recorded. It is not an annual affair.

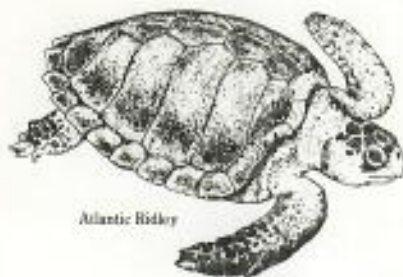
But the ridleys have not been as lucky as our greens. That ridley film had been made 12 years before I saw it, and the nesting colony was already on the skids. When people started going out there it had gone down from 40,000 to 6,000 breeders. Now it's down to 400. That's the most endangered turtle on earth—if you want to put your finger on an animal there seems to be no hope for, it's the little Kemp's ridley.

In *The Cousteau Almanac* Wavemakers series, we wrote an article [page 235] on Ila Loetscher's work on Padre Island. Are her turtles all ridleys? That's right. The ridley gets more attention than any other marine turtle. I don't know any marine animals except the cetaceans that have had such an enormous amount of public attention. There has been a collaborative effort that you just wouldn't believe between the U.S. government—the Fish and Wildlife Service and the Department of Commerce—and PESCA in Mexico. You know, we can't get

together with Mexico on many things, but they've all come in and worked like the devil on this fantastic endeavor. But the story is really very sad: By the time all this heroic effort and international attention came, the situation had gone down so far that the incidental catch by shrimp trawlers is enough, it seems to me, to give the ridleys the coup de grace. I think it's coming.

Without any further hunting?

Yes. There is almost no hunting of ridleys



Atlantic Ridley

What nearly killed ridleys off was egg poaching. A lot of people think the eggs are an aphrodisiac—they just go crazy over turtle eggs.

anymore. There is some stealing of eggs—what nearly killed them off to start with was egg poaching. The poachers were selling the eggs in bars all over the Vera Cruz coast of Mexico and clear up to Mexico City, where a lot of people think they're an aphrodisiac. They just go crazy over turtle eggs.

The poachers weren't actually killing the turtles when they nested?

No, there was not so much of that. Now down at our camp in Costa Rica it was just the reverse; hardly any eggs were bothered, but when I got there the turtles were being chopped up. It looked as if I wouldn't have a place to do research even after I had located that breeding ground.

Did the government cooperate then? Did they keep the people away from the turtles?

Yes. With a little arm-twisting. It was the coastal folks who were doing the killing.

They had discovered a way to preserve just the calipee, which is the cartilaginous part of the lower shell. There was a big market for that in England, Germany, and Switzerland, to make the clear green turtle soup that Churchill made famous.

There was no interest in the turtle meat?

Well, they want turtle meat. But to get the meat from Costa Rica to London or Zurich is a hell of a job. But take off the belly shell, cut out the cartilaginous parts, dry them, and then package them tightly—you've got an imperishable product and something that is not very heavy and has a very high price on it. That's why they were killing practically every turtle that came out on a given night. And nothing is used but the calipee. I've flown that beach and seen hundreds, maybe thousands of dead turtles lying up and down there. Some of them not even dead. Just a ghastly sight.

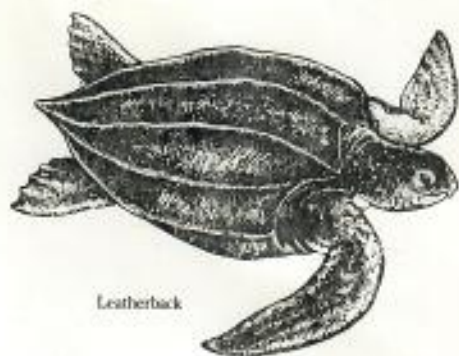
On a more positive note, what is the "lost year" mystery?

Well. When you look at a baby turtle you think he's so little and tender and simple-minded that he must live in very shallow, protected places; that when he leaves the ocean beach where he's born, he must go into the water and along the shore to some estuary, then find a cozy nook where he's out of sight and away from that awful ocean. Not so.

When I went around looking for ridleys, I was also looking for any kind of baby turtles. Because there weren't any in collections. There were plenty of brand new hatchlings that had just come out of nests, and plenty of plate-sized adults a year old or more. But nothing in between. No saucer-sized or teacup-sized turtles at all. Maybe a whole museum like the British Museum would have one turtle of saucer size. Well, I began calling that growing time the "lost year" way back in the '40s. And we've been wondering what happens ever since. And ever so slowly the information has been coming in. Now we know where at least a whole lot of them go: into the sargassum mats, the sargassum weed that drifts past off most of the good nesting beaches, in the Atlantic system anyway.

Is that where most of your results came from?

Yes. Along the coast of Florida, from Cape Canaveral to Palm Beach, and the coast of Panama, and Costa Rica where our camp is. You go out about 50 miles and you'll find sargassum sometimes in an endless chain



Leatherback



Loggerhead



Pacific Ridley

clear up to the Nicaraguan Cape and down to Colón, Panama. That's where the South Equatorial current hits the shore water, which flows southerly, causing a shear. This downwelling draws any floating object over and holds it. It can't sink because it is a floating object, but it can't go any farther either. In addition to natural material this current also corrals all the old junk—used contraceptives, mangrove seeds, and above all, Styrofoam plastic and Pliofilm plastic... just an atrocious-looking mess of trash in some places. But off our place it is mostly sargassum. And that's a 50-mile offshore swim.

It seems like they must know where they're going.

Well, you can sure say that if you put quotes around "know." How are they able to find the sea to start with? They come up out of the nest and there may be a little dune in front of them. They can't see the ocean at all. But if 100 come out, except for a few deformed ones, within an hour you find 100 going in down at the water. And there's very little spread between them. That means they go straight toward the breaker line. Then they swim, swim, swim, and if you follow them as we've done over and over, you see that they're not just swimming up or down or back in to shore. If they did there wouldn't be any turtles. They'd starve or be eaten by predators. They all swim straight away, using the same course, just as if they had projected the land course, nest-to-water course, into the open ocean.

They come out of the nest with a big blob of yolk in their bellies so they don't need to eat for the first four or five days. They come out also with an intense craving to swim. In captivity, they spend their whole time just swimming, swimming, in this anxious way, pushing against the walls of the aquarium. Well, that's the drive that gets them away from shore, and they've got the yolk to finance that endeavor. It

There was a big market in England, Germany, and Switzerland for the clear green turtle soup that Churchill made famous.

takes them unerringly seaward, and there's a good chance, off the two shores I mentioned, that they'll barge into sargassum rafts. When they're there, they've got asylum, they've got a refuge and a source of food, the little molluscs and crustaceans that also live in sargassum.

But I didn't discover the sargassum raft answer to the "lost year" mystery. The answer came slowly, in bits of evidence from a lot of different people. What I did was pose the question back there when nobody else had even talked about where little turtles go. I wrote *The Windward Road*. It was widely read by people who had a native interest in that kind of stuff. So everybody began wondering where little turtles go. And sure enough, all over the world they couldn't find where they went.

I got a few grants to get vessels and go out and look for them. Well, that's not practical. Even after we found that they go into the sargassum, we realized you can't go out and find them on any given day. If you turned *Calypso* over to that job and spent a year at it, you'd probably find them in several places. But you'd travel hundreds, maybe thousands of miles before you did, because there must be hundreds of thousands of miles of convergence lines in the world. These baby turtles aren't just in the bosom of the ocean. They're in convergences between big global currents or at the edges of gyres that spin off these currents. When I discovered that, I just

traveled around where people fished along weed lines. Sword fishermen were my best source.

Do all different species of sea turtles experience this "year of living dangerously," or is it only the green turtles who head for sargassum rafts?

We never have found leatherbacks or ridleys in the rafts. But the Atlantic ridley is just about gone so we wouldn't really expect to find them. And leatherbacks, Lord knows what happens to them.

See, the baby turtles are plankton, drifters. That's the thing you've got to remember. They can swim up and down, or from raft to raft. But as far as swimming from here to the Azores, they can't do that. But they do travel that far. They travel just like plankton, they ride the currents.

Do you feel that the turtle mortality rate is decreasing or increasing? Are more surviving?

No, I think they are in foul shape. The worst problem today is international commerce. That's had two climactic peaks. One was the Mexican leather trade, which wiped out several big *arribadas*—arrivals of tens of thousands of turtles to nest on their short strips of beach. The Kemp's ridley I was talking about before had only one aggregation there on that bit of the Gulf Coast of Mexico. But on the Pacific coast there is the olive ridley, which used to breed in seven different *arribadas*. Now every one of those but one is gone. This is in my book *So Excellent a Fish*. It is a very dramatic story.

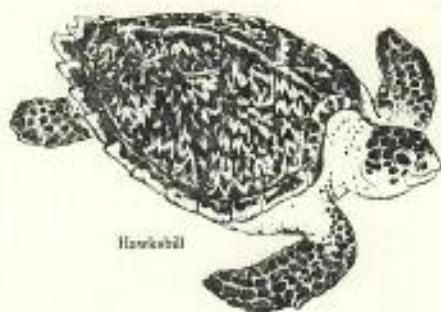
The Mexican ones were overexploited—six of the *arribadas* were just obliterated for leather. The skin of the front flippers and neck make very handsome leather for shoes. France and Italy especially have had a great demand for it. The money was such that the Mexican fishermen just got out of control and little could



Green Turtle



Ancestral Sea Turtle



Hawksbill

be done about it. It was just so easy.

That was a terrific crisis, but the one that's breaking a lot of people's hearts now is the plight of the hawksbill.

Why is that?

The Japanese signed a Convention on International Trade in Endangered Species (CITES). But they took a reservation with respect to the hawksbill, because working shell is a traditional, ceremonial, almost religious activity in some guilds that they have over there. This is a thousand-year-old business with them. All over the Orient tortoiseshell has been held in great esteem. Cleopatra's bathtub was lined with it; some predynastic tombs contained ornaments made from it. And it is all from the hawksbill.

They do superb work, elegant stuff. But they pay such high prices that the hunters over here are wiping the hawksbill out. They pay up to \$60 a pound. When I started working on turtles, it was 10 cents or 12 cents a pound. Now, \$60 a pound puts shell in the realm of a semi-precious material. The temptation for the hunters is just too great.

Is the green turtle declining as rapidly as the ridley and hawksbill?

In some places. In the Bahamas, just pitifully. There used to be lots of them. The Bahamians ate them up in the 1700s. Then they started coming over to Florida to hunt them. They ate up the green turtles on our east coast. Now we're just working on the remains of a once massive population. There must have been a dozen separate colonies as big as ours in America. The green turtles that are left today are really just the remnant.

There's a lot of meat in a turtle and it lives a long time just turned over on its back. It takes them a long time to die. You could carry green turtles clear to London from the Caribbean just lying on their backs.

Now, \$60 a pound puts tortoiseshell in the realm of a semi-precious material. The temptation for hunters is just too great.

Do you feel that the effects of commerce are more damaging than the effects of ocean pollution?

In the long run maybe pollution will outweigh everything else unless something can be done about it. But at the moment, the worst thing in the lives of ridleys is the leather trade, and for the hawksbill it's definitely the Japanese paying prices as high as \$300 a turtle. Fishermen simply can't resist that. No laws can make them.

Is there any mention of turtles in the Law of the Sea Treaty?

Unfortunately not. They didn't get into migratory animals.

That seems like a shortcoming.

It sure does!

What do you see as their future? Is extinction inevitable?

I can't answer that question. I don't think the ridley is going to make it. I really don't see any way. I don't think the hawksbill in the Caribbean Sea is going to make it unless Japan shapes up. So those two are in foul condition. The loggerhead in the Atlantic doesn't seem to be as bad. It's really very exciting to see how many nest on the good beach section on the Florida coast, from Melbourne down to Palm Beach. But then you realize that those are the loggerheads that populate the feeding grounds all over the warm parts of the Americas, practically.

Our camp in Costa Rica is far and away the best green turtle colony in the Americas. When a female turtle leaves our beach she can go all the way out to Trinidad, clear up to Cuba, Hispaniola, even Florida or out into the Gulf of Mexico. Most of them don't. Most of them go to Nicaragua. But Tortuguera has helped populate the entire Western Caribbean and some of the Eastern Caribbean with green turtles from its 20 miles of beach in Costa Rica.

What else is being done to restore sea turtle populations?

There has been some interesting management research going on lately. One group of visiting scientists spent an entire summer at our camp and took thousands of temperature readings of nests in a transect from the water line up to where the vegetation begins at the top of the beach. They came away with positive statistical proof that warm nests produce females and cold nests males. And it's so damn specific that if you go up the transect from warm (because it is in full sun) to cool (because the trees are there), and find a nest located at the pivotal temperature, the turtles that hatch out of the warm middle of that nest are females and the ones that hatch out of the cooler outsides of it are males. It's that delicately balanced.

Now all over the world thousands of baby turtles are being incubated in Styrofoam boxes as part of management policy. One of the few things we can do for turtles is take the eggs out of dangerous places and hatch them in safe places. At least this way we can raise them up until they are too big to fit in the mouths of their predators.

But now we realize that nobody has the vaguest idea what that practice has done to the sex ratio of hundreds of thousands of little hatchlings that have been raised in this expensive way over the last ten years.