Nat. Hist., N.Y. 1967
76: 40-43, 52-54, 56,
58, 59, 1 fig.

by ARCHIE CARR
Part II: 100 Turtle Eggs

NO ONE KNOWS WHERE THE TURTLES GO

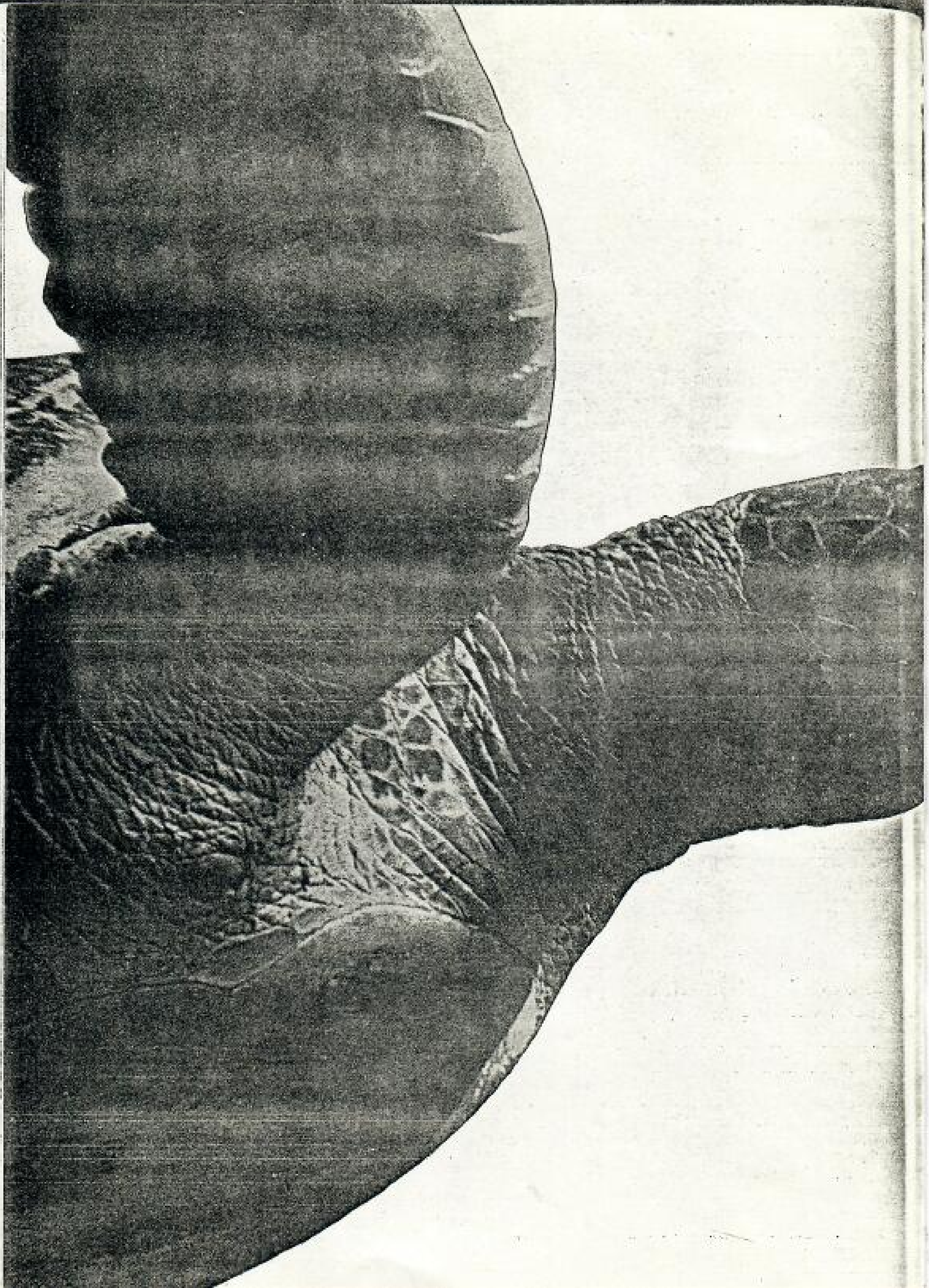
Two of the stubborn problems of green turtle biology are how the baby turtles find the sea, and where they go during the months after they enter the surf.

To worry about the former of these may seem at first glance like nit picking. Why not suppose that the little turtles just look around and see the ocean out there and walk out to where it is? But the answer is not that easy. The question has had a great deal of attention. The water-finding process seems to be essentially the same in marine and fresh-water species, and zoologists have made extensive observations of the behavior of hatchlings of various species in an effort to decide what the cues are that lead them to the water. All these studies seem to agree that the main sense involved is sight, and that some quality or quantity of the light out toward the sea is what leads the hatchlings in the right direction. Beyond that, little has been learned, and saying the guidepost is some aspect of the illumination over the sea is not really saying much.

Sea turtles are among the most confirmedly aquatic of all reptiles. In body form, musculature, and behavior they are drastically modified for successful life in the water. But they have retained one old reptilian feature that ties them to the land. That is the shelled egg that has to be lodged on shore. The inconvenient, hazardous nesting venture on land complicates life for both the female turtle and her young and is surely influential in determining how many eggs must be laid to insure survival.

When a female turtle returns to the water after nesting, she never follows her incoming trail, so she cannot be guided back by the sign she laid coming in. When the return must be made from a place where the water is hidden by vegetation, topography, or debris, you have to conclude that a fairly fancy guidance process is being used. It also seems likely that the sea-finding ability of the female going back after nesting and that of hatchlings newly emerged from the nest must be the same, and both probably differ fundamentally from the orientation of the adult in its long-range migratory travel. A light-compass sense and probably, in some cases, a true navigation process are among the mechanisms that guide the migrating turtle. In the trip from the nest back to the water, however, orientation seems to be basically a tendency to move toward a special kind of illumination or away from the lack of it. The sea-finding feat and the long-range navigation are probably composite sensory processes in which a fundamental signal is repeatedly supplemented or reinforced by local signs. Of the two, the return to the sea is more easily studied experimentally, and it can serve as a helpful model for understanding high-seas navigation.

The trip of little turtles to the water begins when they break out of the nest. This may be located on unobstructed beach sloping evenly toward a sea that lies in full view. More likely, however, the location of the nest gives the hatchlings a first view of nothing but sand and sky. In either case the little turtles have to find the water, and unless they are eaten they nearly always do. After a



few short false starts they begin to crawl and, almost at once, swing in the general direction of the sea. They move around, through, or over obstacles, and go up or down slopes with unswerving "confidence" in whatever sign it is that marks the ocean for them. They can find it by daylight or at night, in all weather except heavy rain, with the sun or moon hidden or shining brightly in any part of the sky. The main guiding cue is not yet understood. Later I'll try to show how thoroughly it is not understood and to tell of the things being done to learn something about it. Although sea finding quite evidently involves light, it is certainly not a simple tendency to move toward light. Otherwise the hatchlings would be expected to go directly toward the sun or moon, which they only rarely do. On the other hand, they sometimes do get distracted by an artificial light source, or even by some especially intense patch of natural light such as is provided by a hole in cloud cover. Most often, however, they move confidently toward the water, no matter what the condition of the sky may be.

After the soft dune sand is left behind and the turtles reach the hard tidal flat, the main guidepost can be supplemented by local signs. Besides the fundamental light-response, a chain of other signs and responses may affect the course or speed of the progress to water. White breakers in strong moonlight and fiery surf on phosphorescent nights both bring accelerated effort. At night a lantern beside the direct path to water often, but not always, distracts a train of hatchlings, and by day a shiny or white object may do the same. The hardness and smoothness of the ground may appear to cause them to move momentarily faster. When they come to a strong seaward slope the turtles may accelerate their pace somewhat, and if a reverse change occurs they slow down. If a log obstructs the way they move along it to the end, and then at once turn seaward again. No normal feature of beach topography either disrupts or replaces the response to the basic signal, whatever it may be.

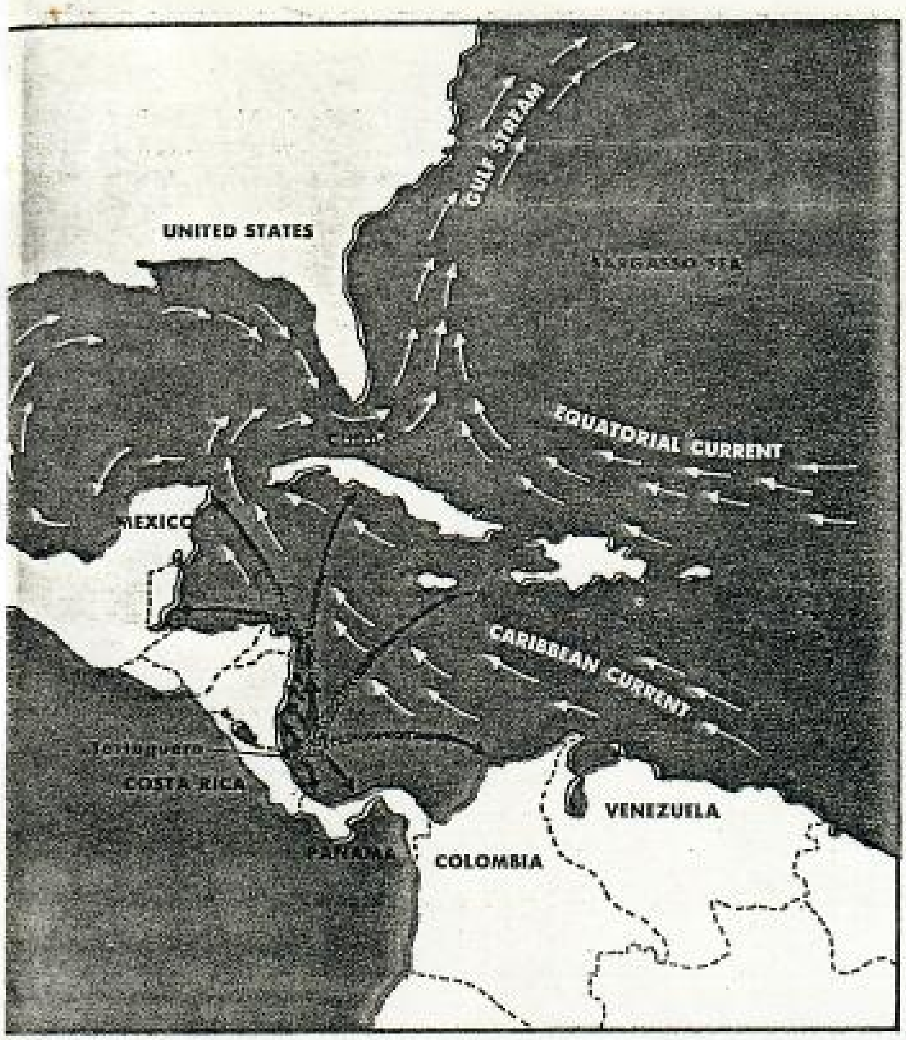
When sand wet by the highest waves is reached, another surge of speed and confidence is often shown, and some of the turtles may even break prematurely into short bursts of swimming strokes. The touch of the wet sand is evidently the cue that brings on this premature change of gait. When a wave slides up the flat and lifts the turtles, the flying swimstroke is instantly taken up by all the hatchlings; during the time that they are alternately lifted and stranded by the coming and going of the sheet flow, some confusion is evident among them. As each wave wash comes back, however, the hatchlings begin swimming forward toward the surf.

As the turtles reach deeper water they keep swimming seaward, dashing forward under water for a few feet, emerging to breathe and look around, then going down and moving ahead again. When they reach the breakers their heads go down as each crest grows white. Presumably they dive for the bottom and go under the plunge of the surf. This stage of the journey has not been observed closely, but a complex innate behavior is bound to be involved. In waves approaching shore, the relation between translation, plunge, and backwash, and between these and the position of the step in the bottom is complicated and variable. It is not really known how a turtle hatchling gets through a breaking wave. It is a normal obligation for them, however, and the fact that they do get through even the powerful surf of Pacific beaches suggests that they have strong adaptive adjustments to wave dynamics.

Various field experiments and observations show that the orientation process in the sea-finding ability of sea turtles is not based on compass sense. That is, the little turtles are not hatched out with an instinctive urge to go north to get to the sea, or south, if that should be the way the water is. After blindfold tests had virtually proved that the hatchlings needed their eyes for finding water, we carried out some crude experiments with females that had just nested and were therefore ready to return to the water. These were moved to various places between the sea and a lagoon that lay three hundred yards away through a coconut grove. In all the situations in which the ocean sky was clearly in view, the turtle went toward it when released. Nearer the lagoon shore, however, where trees hid the sky over the sea, the direction choice shifted, and all the turtles tested went into the lagoon. Likewise, hatchlings taken just before emerging from a nest at Tortuguero on the Caribbean, flown across Costa Rica to the Pacific shore, and there released and allowed to emerge from an artificial nest back in the dunes, went directly to the strange ocean, even though it was completely hidden from their sight.

The ability of the female to find the water after nesting appears to be the same as the juvenile sea-finding sense, and not a new capacity acquired later in life. This seems indicated by tests with year-old turtles. Tortuguero hatchlings, reared to ages of nine and fourteen months without seeing the ocean, found the water readily when released on the beach. Some of these had been kept under natural light at Tortuguero, and others under artificial light in the laboratory at the University of Florida, where the period was spent in two-gallon tanks in which swimming was limited. In some twenty-two trials with such turtles all found the sea without major setback, even when a variety of obstacles blocked the course to the water and hid it from view.

It finally became obvious that little more was going to be learned about the sea-finding sense by simply watching turtles of different backgrounds go back to the ocean under different conditions of weather, time and topography. More searching tests would have to be arranged, to show what features turtles see in the beach landscape, and what kinds of light they find most attractive and most useful as signs for sea finding. Accordingly, Dr. David Ehrenfeld, of the University of Florida, began a series of experiments in which he equipped turtles with changeable-lens spectacles. The lenses were filters that let in light of controlled wavelength or modified the light in other ways—diffusing it, depolarizing it, or simply cutting down its intensity. In this way he was able to begin analyzing the natural light on the seashore in a systematic way, using the turtles



Dark arrows indicate the distribution of tag recoveries from green turtles marked at Tortuguero, Costa Rica (1955-1959), and show only the spread from tagging locality, not routes. Major currents are marked with white arrows.

themselves as indicators to show what features of the light may point the way to the ocean.

Most of Ehrenfeld's early work was done with adult females returning to the sea after nesting. When the turtles were blindfolded—by putting cardboard squares into the spectacles—they traveled in hesitant circles or blundered off on a course that got them hopelessly tangled in the sea grapes and coco plums far up the beach away from the sea. So the experiments clearly reinforced the conclusion we had arrived at some time ago: that green turtles rely mainly on vision to find the water. It is, of course, possible that they also can hear the surf or feel the vibrations caused by the pounding breakers, or that they can smell or taste water vapor or particles in the air; but all non-visual senses together, if used at all, are not adequate to guide the turtles to the water when they are blindfolded.

When the cardboard squares in Ehrenfeld's turtle spectacles were replaced by special filters that only allowed some of the colors that make up ordinary white light to pass through, the turtles performed differently, depending upon the color they were allowed to see. A filter that let in light of green wavelengths seemed to make no difference to them. They crawled to the water as quickly and directly as if there were no filters at all. Blue filters caused a little trouble, but the difference in performance was so small that it probably was insignificant. When the blue or green filters were replaced with red, however, the sea-finding ability dropped markedly; the turtle took a long time to reach the water and often followed a devious route in getting there.

At that point it could be concluded that either there is something about green and blue light that tells the direction of the sea, or turtles see better in green and blue light and are simply using it in their inspection of the contours of the beach or of other features not yet identified.

Another possible source of seaward guidance is polarized light. The effect of this has also been studied by David Ehrenfeld. When light is reflected from any smooth, flat surface, such as the ocean or a highway, or when it is passed through certain transparent substances, a part of it is changed physically. It has been proved that this changed, or "polarized," light can be detected by honeybees and some other animals and is used by them as a celestial landmark in finding direction. To see whether turtles also use polarized light, depolarizing filters were placed in the spectacles. The filters made no difference at all in the ability of the turtles to find the water. It seems pretty clear that turtles do not rely on sea-polarized light in sea finding.

In October, 1965, Dr. Nicholas Mrosovsky, a British experimental psychologist who has done a lot of work with fresh-water turtles, came to the research station at Tortuguero to study the sea-finding problem in a different way. Instead of altering the natural light coming from the environment, Dr. Mrosovsky chose to supply the turtles with his own light of brightness and colors determined by filters at the source.

Working on the beach with portable battery-operated equipment, Mrosovsky gave baby turtles a choice between heading in the direction of the sea or turning at right angles to it in order to go toward a colored light placed at beach level. He found that blue and green lights could compete with the light from the sea in attracting the baby turtles. Red light was considerably less attractive. In another experiment Mrosovsky allowed the hatchlings to move toward either of two colored lights. In these tests the turtles showed a consistent preference for blue or green light over red, even when the red light was the brighter.

Continued on page 52

In more recent experiments Ehrenfeld tried to see whether he could find any grounds for choosing between two sea-finding hypotheses suggested by his work with the mature turtles. Were they using some quality of light from the sky to find the sea, or were they relying upon the silhouette of the land to supply the information necessary to guide their movements? This time he took along a homemade, but very sensitive, portable spectrophotometer capable of measuring the brightness of the light of any visible color, and coming from any particular portion of the sky.

A testing arena was set up several yards from the sea, on the site that had been used by Mrosovsky for his experiments. This was a circular arena 42 feet in diameter surrounded by a wall 18 inches high. Twelve young palm trees were planted at regular intervals around the arena. The wall and palm trees were intended to hide the tree line and beach contours without blocking the light from the sky. At various times throughout the day and night, Ehrenfeld moved his spectrophotometer out to the center of the testing arena and measured amounts of red, blue, green, and polarized light coming from the sky over the sea and over the land. Immediately after taking these measurements he released batches of hatchlings in the center of the arena and recorded the directions they chose.

The results seemed to answer the questions being tested. The spectrophotometer showed no consistent differences between the light in the sky over the sea and that over the land, and the turtles in the walled arena were surprisingly disoriented. Some of them headed directly inland, even when the ocean was lapping against the far side of the arena wall. Many did not bother to move at all. When the wall and trees were removed, and other batches of young turtles were put into the arena, virtually all of them headed for the sea, even though it was still not visible.

From these experiments it seems that whatever the guidepost may be, it is not located high in the sky, but low over the horizon. The hatchlings do not raise their eyes to the sky for guidance toward the sea. A brief glance, or series of glances, about the landscape is apparently sufficient. Just what feature of the exposure or illumination provides the guidepost has still not been clearly determined. The tests gave some preliminary information on the color vision of green turtles, however. Although apparently not blind to any of the colors visible to man, they seem, at least while on land, to be most sensitive to green light. All of the conclusions reached so far are based on preliminary experiments and need further confirmation. Even this seemingly trivial aspect of sea turtle life will have to have a great deal more study.

Another puzzle in the natural history of little sea turtles, and one that surely hides factors of great importance in determining the size of the egg complement, is the disappearance of the young for their first year of life. At most of the known nesting grounds the water in front of the beach is wholly unfit habitat for the hatchlings. The extreme exposure to predation by traveling bands of surface fishes, the lack of any conceivable source of food on the wave-washed bottom, and the constant sweep of alongshore currents all make the home waters an unlikely place for little turtles to stay in; exhaustive searching has failed to find them there at any time after the hatching season.

It is, in fact, hard to see how enough hatchlings escape predators to keep the race going. They obviously do, however, and this anomaly may one day help the effort to trace them during their first year of life.

The negative results of a great deal of searching of the shores of the Caribbean, the Gulf of Mexico, and the Atlantic coast of the United States have made me unwilling to believe that little sea turtles merely follow shorelines when they move away from the nesting beach after hatching. Throughout this area I have systematically canvassed net fishermen for clues. Along those coasts, hundreds of miles of small-meshed nets are regularly set or dragged during the months of the turtle-hatching season. Only when nets are used adjacent to the nesting beach are little turtles caught. That they are caught there proves that they do not simply avoid nets elsewhere. That they are not caught on other sections of the shore suggests that they must move farther out to sea.

Other facts support that assumption. The coloration of the young green turtle is unlike that of the loggerhead, hawksbill, and ridley. It suggests that of free-swimming pelagic fishes: dark above and white below. This arrangement supposedly constitutes obliterative coloration for a creature that swims in the upper waters of the open sea. The white underparts make it less visible to a predator viewing it from below against the sky, while the dark back merges with the dark depths of the water to hide the turtle from water birds overhead. The green turtle shares this coloration with the leatherback, which is the most aquatic of all turtles and, indeed, the most completely pelagic of modern reptiles except the sea snakes or, perhaps, the Loch Ness "monster."

The feeding habits of little turtles kept in tanks may help one to visualize their habits during their early life in the sea. The smallness and weakness of their jaws must keep them in places where bite-sized or bitable food is available. In captivity they show a preference for animal food over plants—at least over the plants we furnish them. In tanks no more than two or three feet deep, they feed equally well at the bottom or at the surface. In deeper water, however, they have trouble finding and manipulating food on the bottom. In water four feet deep, baby sea turtles of all kinds would probably starve if fed only food that sinks. The natural habitat of young sea turtles, therefore, must be either very close to shore—which appears to be almost surely not the case—or at the surface in some part of the sea where there is a reliable supply of floating food.

Theories to account for the disappearance of little sea turtles are in one way like those that seek to explain how green turtles navigate: they are all preposterous. The most likely idea at present seems to be that the hatchlings for a time become plankton, that they drift more or less passively in the open sea. If this is the case, then it would seem reasonable to look for them downstream in the current that washes their natal shore. If on entering the water the hatchlings just swim out to sea for a certain distance and then relax, they must be picked up by any alongshore currents that are there and carried wherever the currents go.

The trouble with this theory is that nobody knows where the currents go. The little longshore drifts and eddies inside the major swirls like the Gulf Stream are very sketchily known, at least in the Caribbean. If you look at a chart that shows ocean currents, you see, off our turtle beach in Costa Rica, arrows that point to the northwestward. These show how the equatorial current, having just squeezed itself through passages among the easternmost Antilles, flows on up between the Yucatán Peninsula and Cuba, and into the Gulf of Mexico. It does some circling there, and then funnels out between Florida and Cuba and emerges in the Atlantic Ocean again, this time as the Gulf Stream. Looking at such a chart, and figuring from the trend of the major surface currents of the region, it might seem logical to search for the baby turtles in the place where the current comes close to shore in Yucatán or Cuba. A great deal of searching has been done there but no baby turtles have been found. Most of our tag returns, however, have come from localities in, or not far out of, this main northwesterly current. This may have some bearing on the problem of the disappearance of the hatchlings. But what? A lot of returns come from the other way too, from Panama and Colombia, and even from Venezuela. But all of these tags are from mature turtles. Both the northern and the southern tag-recovery sites are the grazing grounds of the grown-up, herbivorous animals. I have never seen a baby green turtle on these flats anywhere, and nobody I have talked with has seen one there. So the lead that the current at first appears to offer peters out, and you have to go on back to Tortuguero and take up the trail of the lost hatchlings once again.

I told of some of the signs that suggest that young green turtles are pelagic—that is, that their habitat is for a time the open ocean. There are some objections to this notion. The spry awareness little turtles have of the untrustworthy character of seabirds, and the obliterative effect of their white bellies and black backs could help explain how the hatchlings avoid being eaten at sea. But there would remain the puzzle of knowing how they are able to find anything to eat out there. There is only one place I can think of where, at the surface of the open ocean, there might be a concentration of small, soft-bodied, simple-minded animals that baby turtles could find with no more active finding power than they appear to have. That place is among the floating rafts of sargasso weed, which drift in tropical currents and accumulate in vast volume in the Sargasso Sea.

Sargasso weed, or gulfweed, as it is also called, is the common name given to a number of species of brown algae that grow on rocky tropical shores. The plant has a long, stemlike portion with flat, leaflike blades branching from it, and spherical floats as big as peas, which help keep it up at the surface where the sunlight is. The plants break loose in rough weather and drift about with surface currents. Unless wrecked or thrown ashore by wave action they live on indefinitely. A lot of plants get caught in the Gulf Stream and are swirled into the central North Atlantic, where they accumulate in the quiet center of the current system that circles that part of the globe. This is the place known as the Sargasso Sea. It is a region of little rain and wind, a high evaporation rate, and clear, salty water, which stands at a higher level than that of the surrounding ocean.

It is estimated that some ten million tons of sargasso float in that tranquil sea. The weed accumulates there, partly because more of it drifts in on the Gulf Stream than drifts out the other side on the equatorial current, and partly by vegetative reproduction. Algae were pioneers in the art of sexual reproduction. The sargasso algae, however, are for some reason unable to procreate sexually. They simply grow and reproduce by breaking off branches of themselves. The individual plants probably never die, unless they are smashed by waves. Rachel Carson suggested that some of the sargasso weeds in the Sargasso Sea today might have been seen by Columbus. In his time the place was feared by mariners as a trap for ships. It was fancied to be a solid field of clinging plants that hindered the progress of ships. This was, of course, an error of the times. The weed is not that dense. There is quite a lot of it out there, however, and together with the peculiar conditions of climate and hydrography that prevail in the area, it makes the

Sargasso Sea one of the distinctive regions of the earth.

The Sargasso Sea is often referred to as a biological desert. What the people who call it that have in mind is the generally skimpy plankton and fish faunas in its water, which is warm, clear, and poor in nutrients. The sargasso weeds themselves, however, are by no means sterile. They have a diverse fauna of small creatures, most of which are strongly adapted by evolution to life in a gulfweed raft. In fact, a sargasso raft is an organized biological community integrated by a variety of ecological bonds. One only has to look at the sargassum fish, for example, to see the reality of the sargasso raft organization. The little fish is a classic case of concealing form and coloration. Sprigs of weed seem to sprout from it, sargasso berries are painted on its sides, and it even appears to be encrusted with the same tracery of small, limy worm tubes that decorate real sargasso weed.

The raft fauna ranges in body size from that of a multitude of tiny larval creatures that live there to the big, rambunctious dolphin, which seems strangely drawn to lurk about in the drifting weeds. There are pipefishes there and sea horses, filefishes too, and various kinds of crabs, octopuses, and sea slugs, all molded by natural selection in ways that let them find enhanced survival in rafts of sargasso weed.

A big gulfweed, therefore, wherever it may be found, is not just a drifting plant. It is an integrated company of different kinds of animals, vertebrate and invertebrate—grazers, scavengers, and savage predators—to all of which the weed is a source food, an asylum from attack, or a buoyant craft on which to cruise the warm currents of the world. And because these are precisely the requirements of a baby green turtle fresh through the surf, and off to wherever it is they go, why not suppose that they join up with the sargasso fauna for a while?

Bob and Gene Schroeder of Islamorada, on the Florida Keys, have kept hundreds of young green turtles in live cars. When they throw sargasso weed into the cars, the turtles scramble busily about the weed, eat some of it, forage through it for hidden bits of the ground fish the Schroeders feed them, and at night sleep supported by the rafts. Only a few sea turtle hatchlings have ever been found in sargasso weed. One man found nine baby loggerheads in one raft in the Gulf Stream off Florida, and one or two loggerheads have been reported in weeds on a few other occasions. No green turtle hatchlings have as yet been found in sargasso, at least not by anybody able to identify them, or excited enough to tell about the discovery.

I ought to make it clear that I have never been able to locate a place, or anybody who knew of a place, where little sea turtles of *any* kind could be caught. Not even one little sea turtle. I never even heard rumors of the existence of such a place, and this is very significant, because all about the world fishermen are mostly zoologists at heart. Hardly any other aspect of the lives of sea turtles is left unmentioned in their folklore.

While we are waiting for somebody to find the habitat of young sea turtles it would be helpful to be able to mark hatchlings in a way that would make them recognizable when they reach maturity. It is, as I said, not even known whether the big female turtles that go ashore on a given beach hatched out on that beach a decade or more before. The strong site tenacity the females show in going back to a place for repeated nestings makes it reasonable to believe that they must have been born where they themselves nest. But this can be proved only by recoveries of mature turtles that were marked as hatchlings. And though it sounds like a simple thing, a permanent tag for a baby turtle is frustratingly hard to devise.

The trouble is finding a mark that will resist the changes a turtle undergoes when it grows from a three-ounce hatchling to a three-hundred-pound adult. Holes punched in the edge of the shell or flippers fill in or erode through to the margin. Notches sawed in the shell-edge open into wide emarginations as the shell grows, and then disappear completely. Branding the upper or lower shell makes a mark that might last if the size of the turtles stayed the same, but they grow so fast it soon becomes impossible to tell the brand from a barnacle scar or a coral scratch or, later on, from the marks made by the courting male. It is the same with tatooing. You put on a fine, clear, pigmented mark, and in three months the particles of ink have all spread apart or are hidden under thickening upper layers of shell or skin. And the fastening on of mechanical devices is completely impracticable. Any external tag is soon either overgrown or popped off by the increasing thickness of the tissues it perforates. A radioactive tag of some sort came to mind early in the sea turtle study. This was quickly ruled out, however, because of the risk of ill-feeling among people of the Caribbean, when they should learn of the plan to install radioactive slugs in animals so esteemed as human victuals. It could be done in a harmless way, but it would make for prohibitively bad public relations in a project that depends on pan-Caribbean goodwill.

When plans for radioactive marking of hatchlings dissolved, the idea of a magnetic tag came up. Why not get a lot of tiny magnets made of some of the new alloys that make stronger magnets than iron does, and somehow install these inside thousands of baby turtles? Of course, nobody without a magnetometer would be able to tell a tagged turtle from an untagged one; but with the right detection apparatus, it ought to be possible to walk about among turtles in a crawl, or belly up in a fish house or turtle cannery, or on the deck of a Cayman schooner, and pass the instrument over the outside of the turtle and detect the presence of any field of magnetism that a magnet inside might be throwing out. The idea seemed promising. It was hard to figure a way to code the magnets so that an individual turtle could be recognized, but at least it seemed a way to identify a Tortuguero hatchling, for instance, if you found it as a twenty-five-pound Florida yearling, or if it should come ashore still later to nest on Tortuguero Beach.

I looked around and had no trouble locating an engineering company willing to furnish the magnets. They designed and made 20,000 beautiful little magnets of a fancy alloy. They put them up like tiny sausages, in chains of ten, in tight-fitting tubes of Teflon. Each magnet was a thin, shiny section of wire, only eight millimeters long. It could easily be injected into a baby turtle by inserting an ordinary hypodermic needle and then pushing the magnet in through the needle with a sterile plunger. They were lovely little magnets, and we stuck a lot of them into baby loggerheads, green turtles, and hawksbills, and the turtles seemed not to mind at all.

But this scheme went to pieces, too, when the contractor called one day to say that the magnetometer he had designed for the work had turned out to be able to detect the magnets at a distance of only five centimeters. An instrument sufficiently sensitive to detect the feeble field of our tags would cost nine times the original estimate, and even with that, the turtle being inspected would have to be given a very close going-over. The body of a sea turtle changes its form and dimensions drastically, and the little magnets seemed likely to shift about inside. Finding one of them in a turtle the size of a calf, which might be the only marked turtle among twenty other untagged ones, seemed just too shaky a prospect to work hopefully toward. Especially when you pondered that the detection was a blind search for a grown-up hatchling that had been one of a handful tagged, among millions of its year-group that got no recognition mark at all.

I don't know what to make of the fact that, as different as the habits of the five kinds of sea turtles are when they mature, the young of all of them remain equally hidden from view. I have talked mostly about *Chelonia* in this article, but only because more is known about it than about the others. The habitat of all hatchling sea turtles is unknown. It is a dilemma, therefore, whether to theorize about five kinds of lost hatchlings, or to try to trace them down one by one. I suppose both have to be done at once.

Wherever it is that hatchlings seem to lose themselves, they cannot be really lost. They must be in some pretty good place which, although not thought of by zoologists, is nevertheless altogether reasonable and proper for little turtles to be in. Until that place is found, there will be a big gap in the natural history of sea turtles. There will be unknown enemies of turtle hatchlings out in unknown places, and unknown ways to foil them. Famine and storms will be out there where the hatchlings are, and good things to eat, too, and calm seas for foraging. So long as this vital, vulnerable stage in the lives of sea turtles remains hidden from view, nobody can hope to know why a sea turtle lays a hundred eggs.