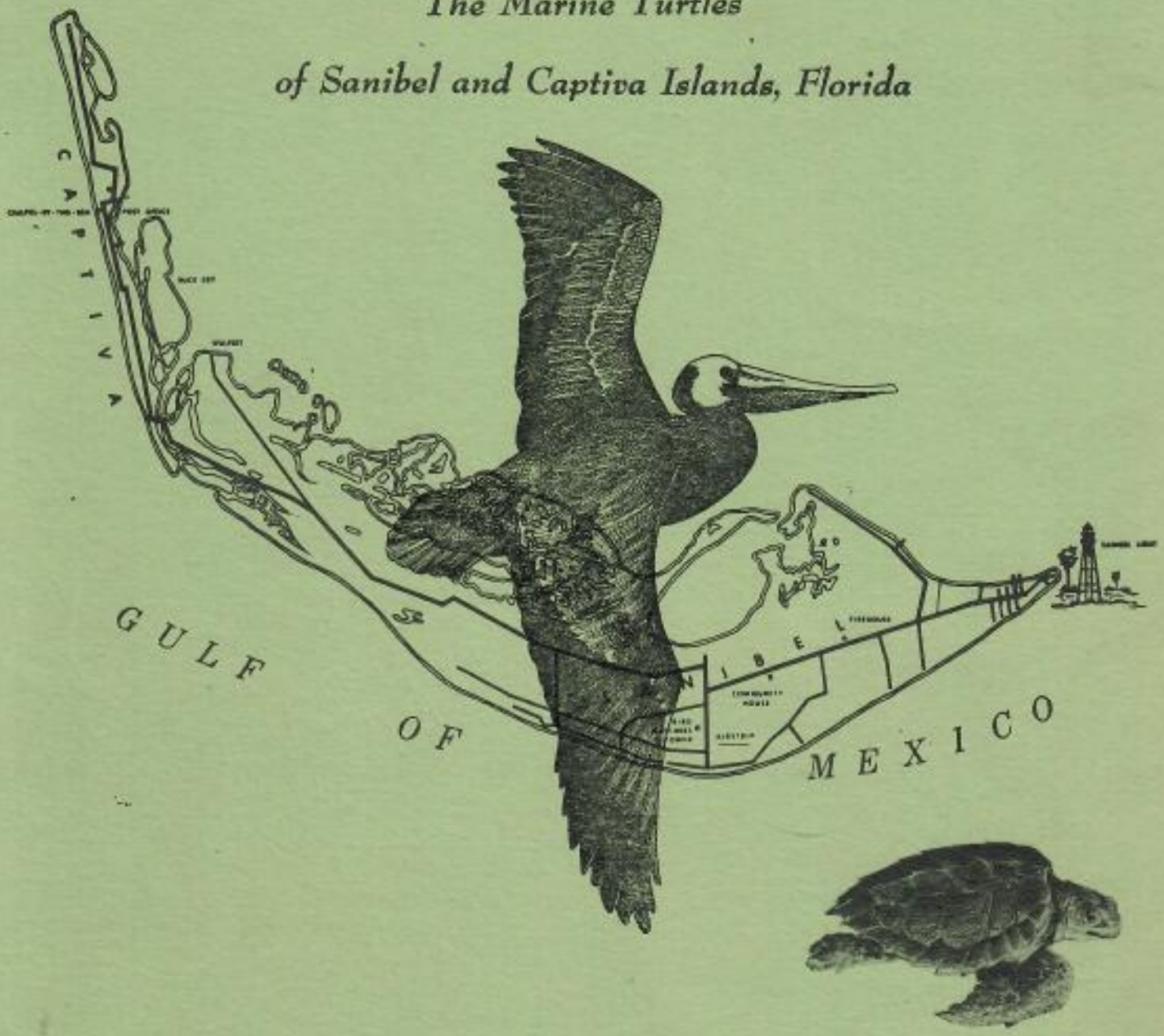
The Marine Turtles of Sanibel and Captiva Islands, Florida



Charles R. LeBuff, Jr.

Special Publication No. 1

Sanibel-Captiva Conservation Foundation, Inc.

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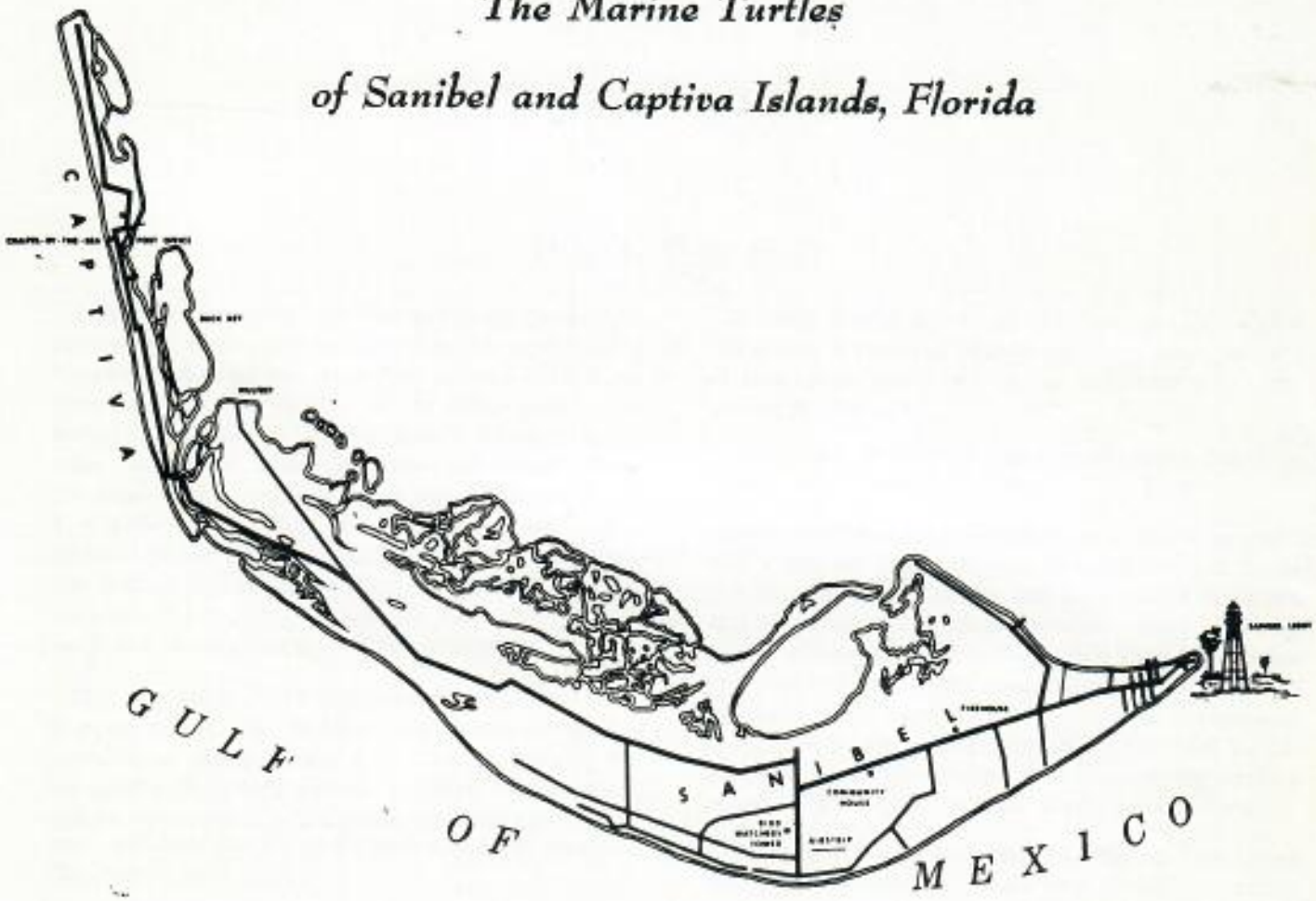

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PREFACE

I have not intended this manuscript to become an impressive, technically written research report but a broad coverage of the work and related studies accomplished on the marine turtles indigenous to the waters of Sanibel and Captiva Islands, Florida, during a ten year period. Scientific results will remain above the scope of this progress report and will be published in a professional journal at a later date, while this is directed to the novice zoologist and conservationists. The author thanks the following individuals and organizations for their interest and assistance in field work and in preparation of this publication.

The Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior, whose objectives are represented locally in the J. N. "Ding" Darling National Wildlife Refuge, and the employer of the author, is directly involved in the preservation of the ecology and wildlife of Sanibel and Captiva Islands, including the marine turtles.

The Sanibel-Captiva Conservation Foundation, Inc., interested in the future of the island's wildlife and continued wise use of their natural and wildlife resources, has graciously published this work as a special service to their membership.

Richard Beatty and other "special" people receive the author's personal thanks for their help, interest or inspiration which led to the beginning and completion of the task.

Carol Lee of Captiva contributed many hours in typing and editorial assistance.

Clifford Grimard, of all things, an ex-turtle poacher, and a marine turtle expert, directed his sea turtle interests to the protection and propagation of island marine turtles. Cliff spent countless hours and long nights without sleep with the author, and without his help and encouragement many facets of the sea turtle program would have been impossible to accomplish. He agrees that a definite plan of action must be followed to insure that the Atlantic loggerhead remains a part of the islands' wildlife heritage and charm.

This report would be incomplete without this father thanking his children, Leslie and Chuck, for riding with him often and keeping him awake during long nights of many turtle seasons. To my lovely wife, Jean, my thanks for her tolerance in spending so many nights alone.

Charles R. LeBuff, Jr.

The Marine Turtles of Sanibel and Captiva Islands, Florida

Charles R. LeBuff, Jr.

Sanibel and Captiva Islands, portions of a chain of islands in Lee County, on Florida's Southwest Gulf Coast, are world renowned for the variety of exquisite seashells that abound in their surrounding waters. The islands also receive national recognition for their climatic location, the abundance of unexcelled sports fishing, and a large and diverse bird population. The Gulf waters of these islands also contain a mysterious, interesting, and endangered marine animal — the Atlantic loggerhead sea turtle, *Caretta caretta caretta (L.)*.

Loggerhead turtles, immense marine counterparts of our common fresh water turtles, have utilized the white sand and shell beaches of Sanibel and Captiva Islands since the first red mangrove rooted on a forgotten shoal and the development of an island formation began. Perhaps 20,000 years have passed since that first loggerhead ventured forth on prehistoric Sanibel or Captiva to deposit her eggs, and to begin a cycle whereby future generations of her kind would themselves return for the same ancestral ritual. Through the years the islands grew, hurricanes deposited great quantities of soil to the sandbar that produced primitive Sanibel and Captiva, ocean currents delivered their deposits of silt, vegetation flourished and this evolution of land development continues to the present. Today we term this process erosion, accretion, or destructive storms, yet loggerhead turtles who can trace their pedigree to that first brave turtle still make Sanibel and Captiva Islands an important stop in their oceanic wanderings.

Marine turtles roam the temparate seas of the earth and species inhabit both the Atlantic and Pacific regions. The five major groups of marine turtles have been divided into ten forms, five for each great ocean. The five groups, all of separate genera, are: Loggerheads *(Caretta)*, Ridleys *(Lepidochelys)*, Greens *(Chelonia)*, Hawksbills *(Eretmochelys)*, and Trunkbacks *(Dermochelys)*. All five species are known to occur in waters adjacent to Sanibel and Captiva Islands. Of the five, only the loggerhead utilizes island beaches for reproductive requirements in modern times. The presence of green and trunkbacks on the island beaches has been reported. However, this, if accurate, was well before the turn of the century, and although others remain as transients in the Gulf, it is the ponderous loggerhead that visits local waters and uses the beach for egg laying on nights during May, June, July and August.

Sanibel or Captiva Island cannot be termed, at present, a marine turtle rookery, as can islands on Florida's east coast or certain islands off the Georgia or South Carolina coasts. In years past it was! It has been accurately reported that fifty years ago one could stand near the Sanibel Lighthouse on Point Ybel, look west along the Gulf beach and easily see fifty or more sea turtle nests. Perhaps 2,000 turtle nests were located on Sanibel and Captiva Island beaches during any turtle season. What happened? What went wrong?

The Loggerhead Turtle

The Atlantic loggerhead turtle is limited in its nesting range to the coastal area of North America from extreme southern North Carolina to Mexico. There are rare exceptions to this general distribution, for stray nesting individuals have been observed as far south as the Caribbean coast of Cost Rica. The normal range for the species includes bays, sounds and open seas, with the reptile having been recorded as far north as New England and in rare instances as far away as the British Isles. The exact origin of such far ranging turtles remains unknown. However, scientific speculation accepts that such individuals are wanderers from American populations.

As far as sea turtles go, the loggerhead is large, perhaps one of the larger species, only outranked in proportions by the trunkback. Weight records of outstanding loggerheads are numerous. A maximum size of some 900 pounds is given to these sea turtles, but today such loggerheads are probably non-existent, with most adults seldom reaching 400 pounds.

During the summer months from May to August, mature loggerheads intent on and driven by reproductive requirements, congregate along suitable beaches that are most assuredly selected through ancestral drives. Both sexes travel to the predetermined site, although hundreds of miles may separate them from their destination when the biological clock directs them that it is time to undertake the breeding journey. It is known that green turtles do not reproduce every year but every second or third year, and there is the distinct possibility that other marine turtles, including the loggerhead, may have similar reproductive cycles. That such is true will not be determined until tagging of loggerheads reaches the proportions of tagged green turtles, and nesting beaches are examined year after year. How they arrive at the proper land mass on schedule remains one of Nature's strangest puzzles. The mechanism that guides all sea turtles on their migration from feeding areas to nesting grounds is unknown, but it is certainly a gift of remarkable navigation.

By May the turtles have arrived in the vicinity of the nesting beach, having paralleled the coastline for perhaps hundreds of miles. Seldom does the loggerhead travel the open ocean directly to its destination, and certainly the reproductive population is composed of many individuals that inhabit the Gulf, bays and sound close to Sanibel and Captiva Islands. Copulation takes place in the water, often some distance from shore. Occasional battles are fought as several males rival each other for a female. The copulatory act is often of several hours duration, and turtles are often observed during this activity in waters adjacent to the nesting beach. Following fertilization, the female loggerhead directs her intentions on selection of the location to deposit her eggs.

Stranding the surf at the water's edge, after dark, the female "smells" the sand by pressing her head into the wave-washed water, raises her head and begins the slow, clumsy, peculiar locomotion up the beach. Now and then her travel is paused, and she halts to scan the beach-scape, then continues on. After having crossed to the high dry sand above

high tide, the turtles again scans here and there and often probes the sand again. Suddenly she may turn and withdraw to the surf without beginning the nesting excavation. This is one of the unexplained exploratory emergences or false crawls — the turtle crawls from the water and returns without completing the laying cycle. Returning to the water, the female parallels the beach until another location for venturing forth from the water is selected. This second emergence may occur the same night or take place several nights later. If the site then selected is the "proper" location, she will begin the fascinating process of nest excavation and egg deposition.

Providing the site selected is suitable and passes all the unknown standards required by loggerhead turtles, actual nest excavation commences. With side to side movement of the shell and sand removal by the front flippers, the turtle develops a slight depression in which her shell becomes slightly lower than the surrounding grade of the beach. Generally a pause is made and then the rear flippers deftly feel the soil at the rear of the shell. Like a spade, each rear flipper alternates as the turtle digs into the sand several times and gently removes a cupful of soil, placing it beside the developing nest cavity. As the alternate flipper moves into play, the previous digging flipper, with a quick motion, throws aside the last-moved sand. Turn after turn the flippers dig until the cavity is too deep, and the flippers stretching into the hole cannot bring forth soil. By this time the cavity is some eight inches in diameter and some eighteen to twenty-two inches in depth and the diameter slightly larger near the bottom of the cavity.

Upon completion of the nest cavity, the female again pauses and then moves her rear flippers to each side of the nest opening. The tail is then positioned over the cavity and the ovipositor is extended from the cloacal opening. Noticeable contractions and expansions precede the actual egg laying, and as the ovipositor too is dilated, a mucous substance begins to flow. Shortly thereafter, actual egg laying begins, as individual eggs begin to drop into the nest, each coated with the mucous substance. Eggs drop rapidly following the exit of the first dozen and are dropped in threes and even fours. This continues until all eggs to be deposited are in the nest. These number from 75 to 150. Normally well over 100 make up a nesting complement. Each egg is white, covered with a flexible egg shell, and approximately the size of the ordinary ping pong ball.

During the nesting period the female's eyes are lubricated by a tear-like fluid produced by glands near the eye. This lubricating fluid protects the eyes of the turtle during the next stage of nesting.

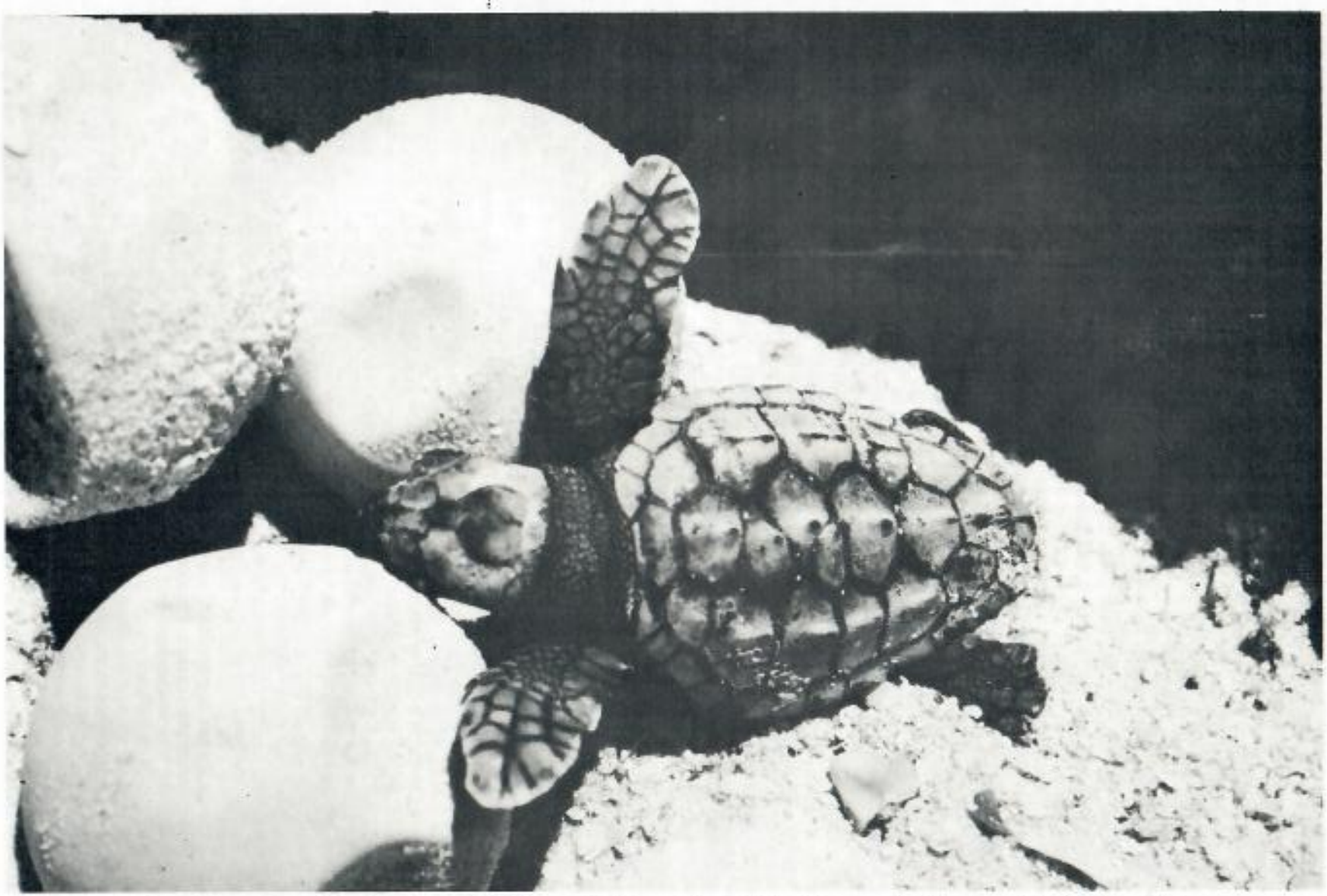
Shortly after the final eggs are deposited, the turtle, using her rear flippers, slowly covers the egg clutch, and gently kneads the soil to compact it. Then with the front flippers she throws sand wide around the nest and simultaneously moves her shell from side to side as a camouflaging technique. The loggerhead then turns to the sea and slowly returns to the water. Upon reaching the water, she again pauses, dips her head into the surf for a few moments, and then enters the dark sea.

If the nest site is fortunate and safe from all natural obstacles that confront developing turtles, the young turtles will emerge from the nest in 55 to 60 days.

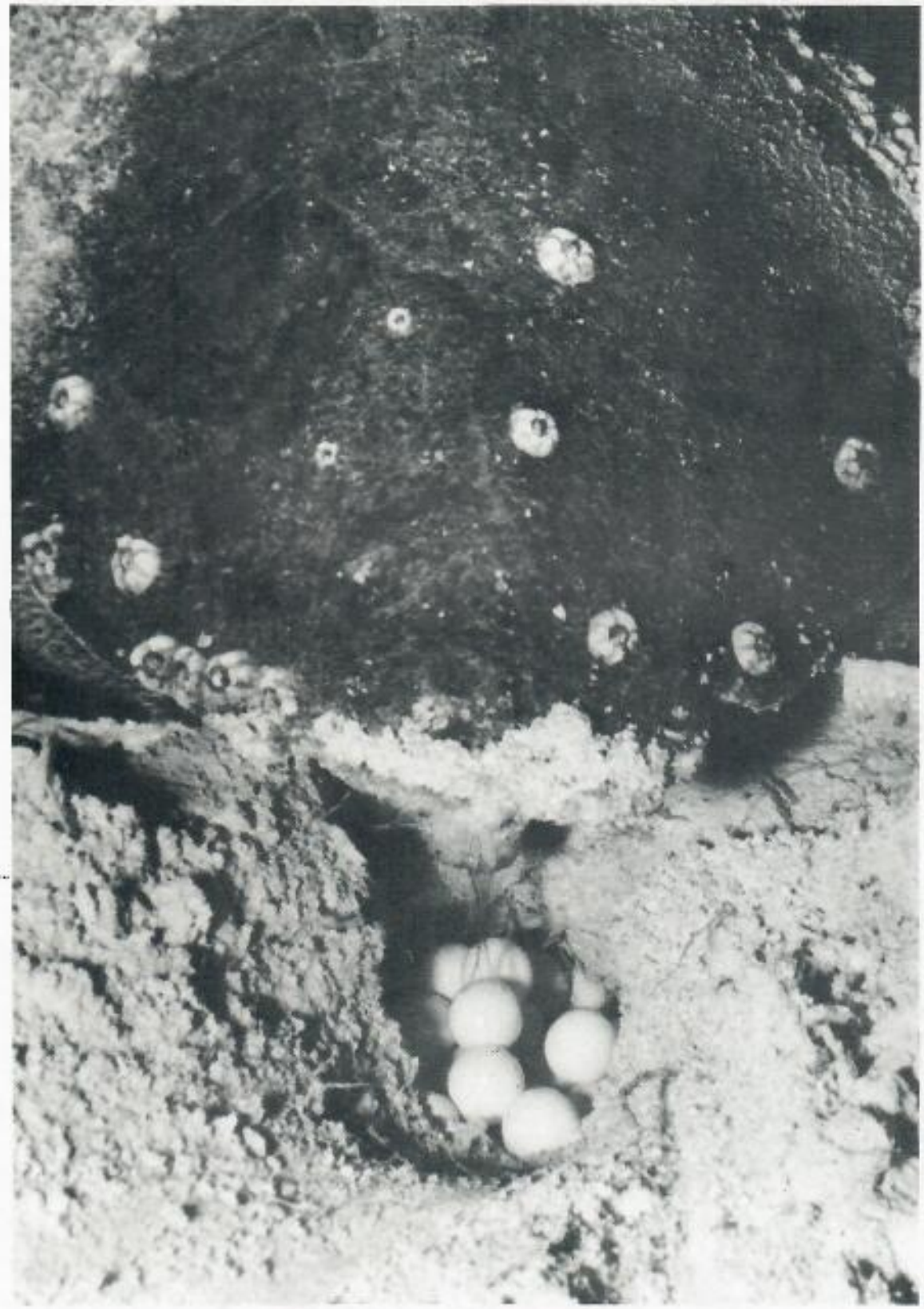
The enemies of developing eggs and hatchlings are numerous and can be generally grouped into three categories: ancestral predators, human predation, and weather-induced damage. The first of the above includes destruction by predatory terrestrial forms of life and marine organisms. The second involves man in two attitudes, driven by either curiosity or dietary desire to direct removal of egg complements. The third is the uncontrollable weather, with its high storm tides or daily erosion. Sanibel and Captiva Islands are no different from other beaches in the loggerheads' range with reference to the damage caused upon eggs by the above factors. Each year great numbers of nests are destroyed by these means, thus having a great influence upon the dwindling loggerhead population, not only on Sanibel and Captiva beaches but on every loggerhead beach in the United States. Attempts at control or alleviation of these problems have been made everywhere these turtles occur. Some have been successful, others have failed. It has been determined that an annual loss of mature female loggerheads has been in process since at least 1959. Each year from then until the present, records have been maintained in turtle use, and the progressive loss is clearly defined. Again, this is taking place not only on Sanibel and Captiva, but throughout the range of the loggerhead. It was first believed in the early years of this study that a periodic cycle was taking place, similar to that previously mentioned in the case of the green turtle, yet numbers that would give this supposition some basis never increased at a later turtle season, as was hoped. That this reduction in the entire loggerhead population is a natural process and something beyond human control should not be argued. The loss can be directly contributed to man and not the gauntlet of natural problems that confront the loggerhead turtle as an extant life form. Man also has the ability to conserve and restore the marine turtles and manage them properly for the benefit of the future of man and the turtle.

Enemies that are included in the first category are: raccoons, dogs, and sand crabs, fish crows, gulls, and predacious fish such as sharks and snook. Man as an enemy includes curious children excavating nests for hatching or "turtle egg fights" and those people who favor the use of turtle eggs in their diet, either eaten as they come from the nest or in various pastries. The third element or means of egg destruction is the hurricane or tropical-storm-created high tide that inundates and washes out entire egg complements. Normal erosion on portions of Sanibel and Captiva also destroys nests.

Actual hatching of eggs takes place several days before the young turtles reach the surface of the beach. During development of the embryo, an egg tooth is formed on the front of the turtle's head. The young loggerhead uses the egg tooth to break open its eggshell. As an egg hatches, the soil surrounding the egg loosens and soon, as many eggs are pipped by turtles, the soil becomes very loose, enabling the young to begin their mass tunneling to the surface. Temperatures play an important role in the exodus from the nest. If the hatchlings reach within four inches from the beach surface during daylight hours,



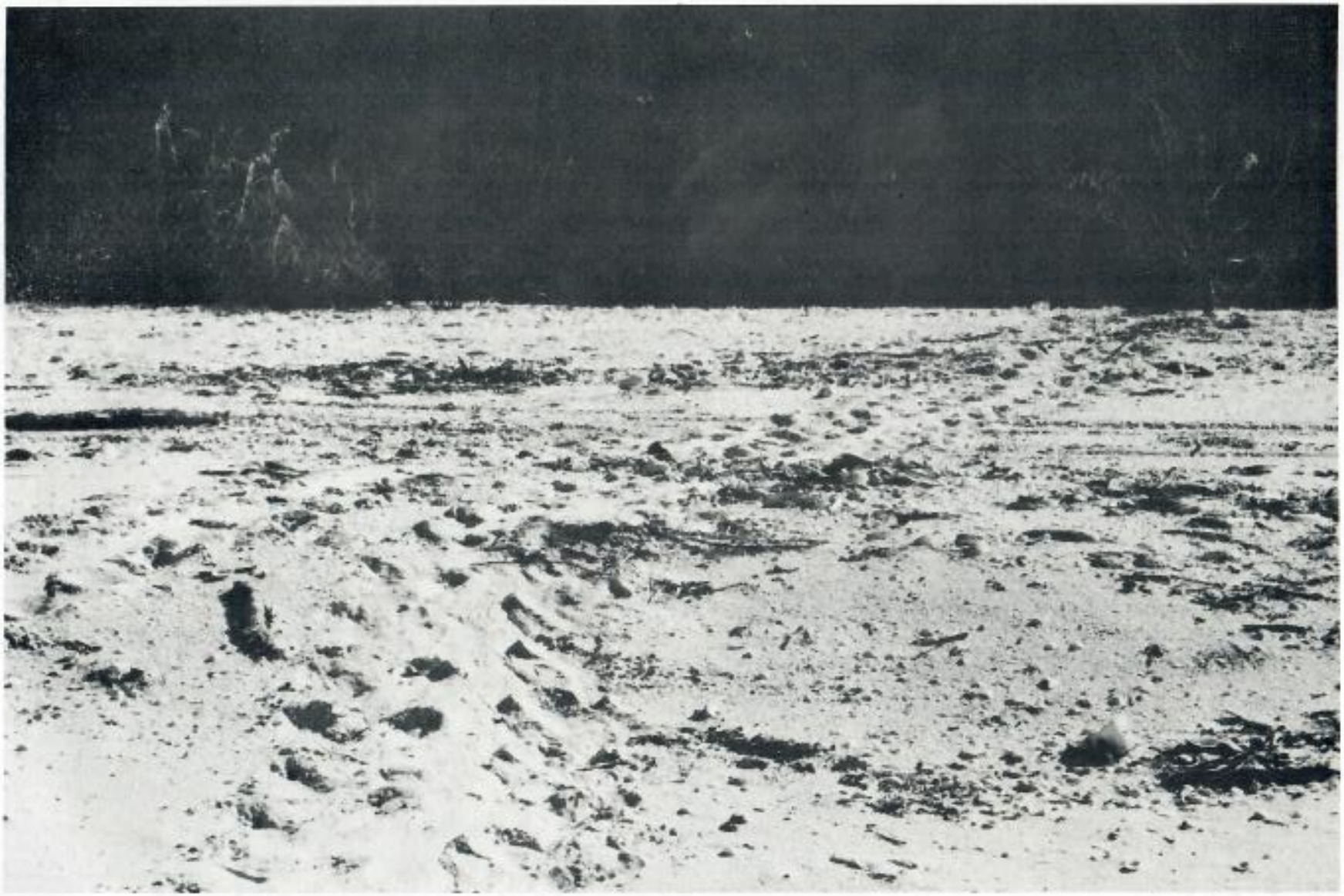
If conditions are favorable and enemies overlook the egg site the eggs hatch in 55 - 60 days. This photographs shows the comparative size of eggs and hatchlings. Eggs pictured were infertile and if the nest had not been examined for success the hatchlings would have succumbed, for it was hopelessly entangled in sea oat roots.



Following excavation of the main depression the nest cavity is dug with rear flippers. Here the ovipositor is extended and egg laying underway. The lubricating and cushioning fluid can also be seen. 146 eggs were deposited in this particular nest from which 62 hatchlings successfully emerged.

Egg laying completed the turtle covers the cavity and kneads the sand to compact it with the rear flippers. During this stage the front flipperes eratically throw sand in the site vicinity to obscure the precise location of the egg clutch. The nesting is now completed and she will turn and slowly return to the sea.

Showering herself in sand the loggerhead begins the task of egg laying by digging a slight depression with the aid of both front and rear flippers. During this phase of nesting glands near the eye secrete a fluid that washes sand particles from the eyes. These "tears" have washed sand from the eye and has resulted in the clean area just below the eye.



Leaving the water the female loggerhead leaves obvious her task. The crawl is a laborious journey and the turtle is easily frightened during ascent up the beach. The actual nest site is located at the right side of the illustration beside the sea oat clump.

the surface temperatures are normally too high to allow safe exit and the young await cooler evening temperatures. Under normal conditions when the young on the top are ready to leave, it is a mass movement, and all young move en masse to the water. If turtles remain in the nest and are not entrapped by various in-nest problems and cannot leave during darkness, they wait until the following night. The actual vacating of the nest by all developed hatchlings may take from five to seven days.

At the time of hatching, juvenile loggerheads measure approximately two inches in shell length — far from the giants they will one day become.

Following emergence from the nest, the young head directly to the water, bravely enter it, and swim headlong straight out to sea. As they do, another mysterious problem of sea turtle biology begins, for no one has discovered the life history of sea turtles from the time they reach the sea as hatchlings until they return as adults to the ancestral nesting grounds.

An Endangered Species

Marine turtle studies on Sanibel and Captiva Islands, encompassed by this publication, began in May of 1959 and terminated in August of 1968. Initially, general observations were made and a preliminary outline based on the anticipated study was compiled. This, it was hoped, when put into operation as a project would furnish additional information to other turtle investigators engaged in similar life history studies through other portions of the loggerhead's range. Such studies were in progress for the green turtle, now the best known of the marine turtles, both popularly and scientifically, but further data was and is needed on the loggerhead itself. Such pertinent information as an annual population census, annual nesting success, possible correlation between nesting and weather, tidal or lunar influences, annual changes in beach contours and their relationship to turtle use, depredation upon and mortality of adults, eggs and young were all necessary to accumulate an understanding of problems confronting a then supposed stable population.

As mentioned earlier, sea turtles are constantly battered by three major foes: man, wild predators—mammalian, bird and marine—and weather. All stages of the life span of these turtles are menaced by one or more of these threats to their individual survival, and all three of these destructive forces endanger continuance of the species. Adult turtles face few natural enemies. Fungus infections, internal parasites, sharks and dangerous jelly fish contribute to mortality of adults while in the ecosystem of the estuary or sea. Man's inroads into the population of adults result during the nesting season when egg-laden females are upon the beaches, or by shrimping operations in the vicinity of the nesting grounds. Occasional adult loggerheads are taken by hook and line fishermen and/or harpoon.

The flesh of the loggerhead is by no means as palatable as that of the green turtle, although there may be some disagreement with this opinion. The loggerhead has been chiefly utilized for food by the outdated few who originally sought the meat as a source of protein and a supplement to a diet of fish. Today use of loggerhead meat is a holdover from hard times and something most modern people have little use for except as a novelty. Yet each season great numbers of loggerheads are turned and brutally butchered throughout the turtle's geographical range despite State laws enforcing closed season as a measure to reduce mortality and loss within local sea turtle communities.

Shrimping operations close to the shores of Sanibel and Captiva Islands during the study period influenced the decline of the local sea turtle. The turtles often become entangled in shrimp trawls, are drowned, and usually cast adrift by busy shrimpers. Statistics show the following loss in this manner during the duration of the study: 1959—12, 1960—9, 1962—3, 1965—4, and 1967—1. All of these were washed ashore on Sanibel or Captiva by current or tidal action, all were destroyed as a result or indirect predation, and are certainly a fraction of actual cases of turtle drownings by shrimping operations. The number of turtles removed from island beaches during the nesting process and destroyed by man cannot be estimated. For all practical purposes it is safe to assume that the numbers far exceed those unintentionally destroyed by shrimp boats.

Before a fatal virus infection drastically reduced the over-abundant raccoon population of Sanibel and Captiva in 1964, these mammals were so numerous that survival of a clutch of loggerhead eggs was nearly impossible. So common were these intelligent predators that entire egg complements were often devoured by family groups of raccoons literally while the nesting turtle was in the process of egg laying. If eggs were not discovered and consumed during the night of their deposition, they usually were within two or three nights thereafter. To deter this destruction, fresh nest sites were sprayed or dusted with various experimental chemicals, which were applied above the nest cavity and vicinity to destroy revealing odors and eliminate excavation by raccoons. This method worked well as a preventive measure against raccoons, but did little to safeguard nest cavity invasion by sand crabs. As the raccoon population diminished, the sand crabs (part of the raccoon's diet) increased. The voracious sand crabs invariably locate eggs that are situated between normal high tide and vegetation line, the beach zone in which the crabs tunnel their peculiar residences in the sand. Tunneling directly into nest cavities, several crabs wreak havoc on the egg complement and discard empty shells at the entrance to their burrows. All enemies of developing young are not animal predators, for often the plant kingdom did its damage. When nests were located within the dense sea oats or other beach grasses, the roots systems of such plants that were cut or otherwise altered by the excavating adult turtle, would begin regrowth and often by the end of the incubation period, root masses would be in such profusion they would entangle newly-hatched young and eliminate any possible escape. Losses by root entanglement accounted for a high percentage of mortality.

Incidents of depredation during the 1968 turtle nesting season were recorded to determine the mortality of eggs during incubation and to establish the numerical loss of the declining population. Losses during seasons previous to the current year were also startling but are not necessary to show the impact that takes place each year. During 1968 186 nests of the

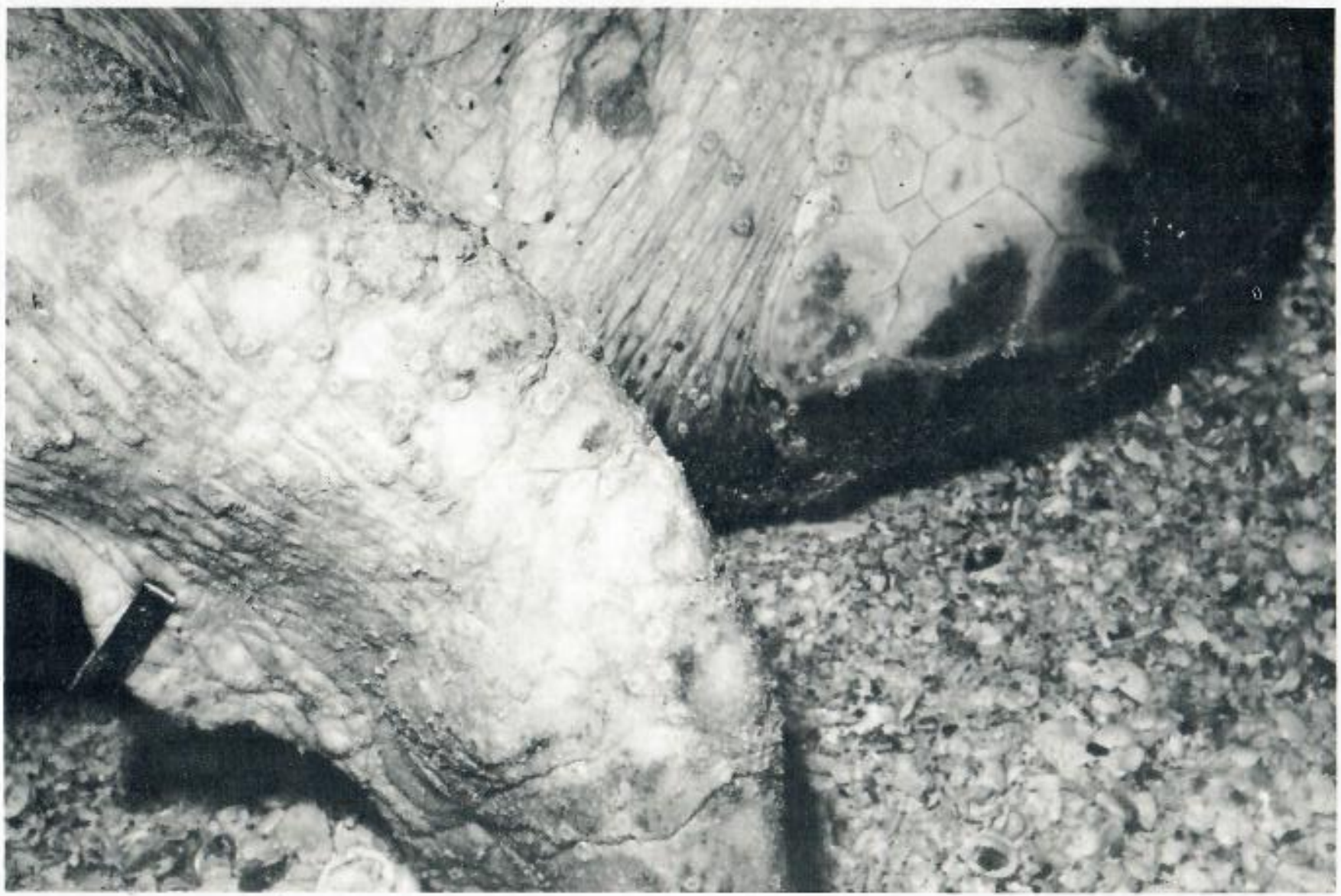
Atlantic loggerhead were located on Sanibel and Captiva Islands, situated on the Gulf beach from the Sanibel Lighthouse westward to Turner Park on Captiva. Nest destruction—the number of nests destroyed by each type of predation—was alarming and disheartening. Nest sites were counted and plotted to establish what portions of the above area were best utilized by the turtle and to determine the influences of beach contours upon nesting success and also to allow examination at a later date to evaluate survival accomplishment. Humans maliciously excavated 15 nests, raccoons dug and consumed 6, sand crabs tunneled into 24, storm tides in early June destroyed 16, normal erosion took 4, and predation of an undetermined nature accounted for the loss of 8 egg complements. This is a total of 73 egg sites destroyed by marauding predators or other natural means, and a loss of 39% of the season's loggerhead productivity. Theoretically the population loss can be projected to illustrate the problem. If it is assumed that each site destroyed contained the average number of eggs for nests on Sanibel and Captiva (110), the loss, if all eggs hatched, would be in the neighborhood of some 8,030 hatchlings. Realistically, 8,030 little turtlets would not reach the water to grow up and reproduce, nor will the 12,430 young theoretically produced in the nests that escaped destruction. Sampling studies during the investigation of egg complements revealed that many eggs contained in the clutches fail to hatch. This failure can be attributed to infertility, extremely high tides which produce flooding of cavities beyond the tolerance of developing eggs, and other unknown factors that may kill embryos in any stage of development. If one half of the eggs contained in the surviving 113 nests successfully hatched and the young safely reached the surf, 6,215 loggerhead turtles were produced on island beaches during 1968. Such annual production is, at best, insignificant in the realm of marine turtle conservation. Development of eggs on land, with all destructive forces bearing directly on a population, cannot equal the tragedy that awaits the young of the year when they reach their destination—the sea, with its ravenous creatures that make continued depletion in the numbers of young. If the hatchlings are safe, wherever it is that little loggerheads can find safety, they reach sexual maturity in six to ten years and return to the sandy beaches from which they emerged long before. Of the 6,215 hatchlings that reached the sea during 1968, perhaps 15 will escape the burdening hazards of survival and crawl the island beaches in 1974. With their size very diminutive, there is no logical way that the young turtles may be marked for identification at a future time. The growth in a free state and survival ratio of loggerhead turtles will have to remain unknown. Only when they return as mature individuals may they be marked for study.

Tagging Marine Turtles

Marking wildlife by various devices has been instrumental in producing new information on the life history of the particular species marked and has added a wealth of information to man's knowledge. As birds are banded we learn such important facts as growth, movement, longevity, and navigational ability of an easily observed segment of the earth's wildlife. For years biologists received information on marine turtles from all points of the globe. Some of the information passed on centered on the remarkable ability of navigation and the sudden appearance of great numbers of sea turtles in specific areas during certain seasons of the year. To explore and gather data on the life history of these impressive reptiles in American waters, a tagging program was undertaken by scientists dedicated to the future of the world's marine turtles. Young birds are banded in nesting areas and are captured by hand or as adults in special nets. Sea turtles are not so easily collected and must be captured on nesting beaches or occasionally netted in feeding areas. Initially, turtles were tagged with a monel disc which was wired or riveted to the rear margin of the carapace or upper shell. Tags were individually numbered and contained the address of the organization responsible for the tagging and offered a reward for the return of the tag. Over a period of several years it was discovered that during courtship these tags were often dislodged by the male turtle, and the disc tag was discontinued. In its place a special tag indentical to the type used as an ear tag on cattle was introduced. Also of long-lived monel, this tag was attached to the front flipper of the adult turtle, and recaptures revealed the tag very well suited for this use.

Tagging of nesting loggerhead turtles on Sanibel and Captiva Islands began in the summer of 1964 and continued through the turtle's nesting season of 1968. Tags were placed on the turtle's front flipper as close to the shell as possible. Actual tagging was accomplished following egg laying whenever possible, and the turtle was not disturbed until she had completed that process. Following covering of the nest cavity, the turtle was allowed to begin her return trip to the water and was turned upside down. A sharp chisel was employed to puncture the rear edge of the flipper, thus penetrating the armor-like skin and seldom causing discomfort to the turtle. The tag, placed in a special pliers, was inserted into the opening, and pressed in place where it locked and became a permanent means of identification. The tag number, location on the beach, the carapace length, climatological data, and contour of the beach site were noted in each case. The turtle was then uprighted and allowed to return safely to the sea.

Results from the tagging phase of marine turtle studies has yielded valuable information on the life history of the loggerhead that would otherwise have remained unknown. For example, tagging elsewhere had shown that loggerheads lay more often than the once-per-nesting-season previously supposed. This multiple nesting was well demonstrated on Sanibel and Captiva Islands by tagging. Data produced through the marking method indicated that sea turtles lay eggs more than once and have the potential to lay as many as four times in a specific egg-laying season. Following the initial nesting, the females are again fertilized by the promiscuous males which continually patrol the nesting beach perimeter. Following fertilization, a recycling occurs, and the females again leave the water to nest. This multiple nesting continues throughout the reproductive season until the season is terminated through biological methods. Studies on Sanibel and Captiva indicate that the recycling or return to the beach consumes an average period of 14 days. The male loggerheads never leave the water although at times they follow



While enroute to the water the turtle is turned, measured and tagged. The monel tag is visible in the lower left. Had the photographer been a poacher the turtle would have been killed while in this position with a dull axe or knife.

the female quite close to the shoreline. Only once during the ten year study was a male found actually on the water's edge. This individual was badly wounded from a possible encounter with a shark, but apparently survived for its remains never reached the beach.

Tagging also has revealed that during multiple laying the loggerhead has the remarkable ability to return quite close to the location of a previous nesting. Often returning females were located within a quarter mile from where they nested previously. Continuance of the tagging work will aid in further understanding of the complexity of marine turtle navigation, reproductive habits, and tendency to return quite close to the location of earlier nesting emergences.

Some fine examples of the effectiveness of marine turtles tagging were demonstrated on Sanibel-Captiva during 1968. The first loggerhead tagged (5/13/68) for the year was encountered just after the individual stranded on the beach. She crawled the beach in an attempt to locate a suitable egg site, did not succeed, and returned to the water. Just prior to when this individual reached the water, she was turned and tagged. Several nights later this turtle was found in the act of egg deposition eight miles to the west of her initial seasonal emergence. Another example was a female tagged following a false crawl on Turner Beach. Two nights later this individual was recaptured, engaged in egg-laying two miles east of her previous crawl site. These turtles were not disturbed or frightened by observers or any natural means, and the only explanation for their emergence and non-nesting can be that they were in an incorrect location. The beach grades and contours in both instances were optimum sites for nesting. This evidence could have been discovered only through tagging when the turtles were concluding their false crawls.

That the loggerhead possesses an excellent navigational system was shown when an individual returned within a hundred yards of the location where she deposited eggs and was tagged fourteen nights earlier. On her first emergence this individual deposited 146 eggs; the highest number of eggs counted during the study.

Turtle Watching

Many inquiries are made each turtle season by persons interested in observing the spectacular sight of one of the large marine turtles in the act of egg-laying. This process can easily be observed providing one adheres to a few "turtle-watching rules."

Walk on the Gulf beach after dark, keeping in mind that sea turtles are easily frightened following initial stranding on the beach. A loud voice, flashlight beam, or even a cigarette will send them back to the sea.

Watch the edge of the water directly ahead of you for emerging turtles or crawl imprints. A single crawl will indicate the turtle is still on the beach, while a double crawl reveals that the turtle has returned to the water. If a turtle is encountered ascending the beach, one should remain as far away as possible and allow ten to fifteen minutes' time for the reptile to begin egg laying.

Once actual egg laying is under way, it is safe to turn on flashlights, for then the turtle will not be alarmed and will continue egg laying.

It is against the State Laws to molest sea turtles, their nests or eggs. Therefore, the turtle or eggs should not be handled.

Don't forget a camera and flash attachment.

Further Conservation

To enhance the potential marine turtle capacity of Lee County waters and to insure that the Atlantic loggerhead sea turtle remains an endemic marine organism dependent on the beaches of Sanibel and Captiva Islands, the following recommendations are presented by the author.

1. **Additional Studies**

Further studies into methods of safeguarding egg complements from mammalian and terrestrial-marine predators should receive more investigation. Various chemicals which have indicated themselves as possible scent eliminators should be utilized in a field study to determine if an economical means of predator control can be contrived.

Beach contours, so unstable on the islands, must receive annual scrutiny to determine if the natural barrier of erosion influences the annual turtle use of areas receiving intensive spring and summer erosion.

Water currents adjacent to the nesting beach may influence the success of a particular nesting season, and changes in ocean currents from one year to the next must have direct bearing on marine turtle productivity in a given turtle season. Satellite photographs have shown their most efficient use in weather reporting and are now being used considerably in oceanography and the study of major ocean currents. Examination of such photographs will be invaluable in comparing turtle success with current influences or changes in prevailing currents from one season to the next.

A method for adequately marking hatchling turtles for future identification should be sought. Such identification would not entail individualistic marking, but suitable and identical marking of all young reared in a particular egg complement. In this manner studies over a lengthy period will indicate loss from the original number marked and the ability, if such actually exists, of the turtles to return as adults to within close proximity of their origin.

Captive rearing of loggerheads and selection of a means for marking sub-adults should be attempted. Rearing under artificial conditions will reduce mortality and enable a larger percentage of the seasonal production to survive. Young turtles should be maintained until yearling size and then released at the location of the original egg site from which eggs were removed.

2. **Public Education**

An educational program is recommended to be directed toward summer visitors, informing them of the status of the loggerhead turtle as an endangered animal and the importance of the islands to the future of the loggerhead. Such an educational program would be aided by the erection of suitable signs at each avenue of public access to the Gulf beach. Such signs would carry a message informing

the public that the nests and eggs of marine turtles and nesting adults are protected under State laws.

3. **Marine Turtle Sanctuary**

Turner Park, a 2½ mile Gulf beach on Captiva Island, received the greatest use by nesting loggerheads during the marine turtle study. This park will be developed by Lee County as a public recreation area and included in their expanding County Park system. It is recommended that the Board of County Commissioners of Lee County pass a resolution which designates Turner Park as a Marine Turtle Sanctuary. Such a resolution would in no way affect public use or development of proposed facilities. It would simply demonstrate to the public at large the County Government's concern for the future of marine turtles and would create the nation's first sanctuary explicitly for the loggerhead turtle.

4. **Committee Establishment**

A marine turtle committee composed of representatives of each civic and conservation organization of both Sanibel and Captiva should be established to coordinate avenues of protection for loggerhead turtles. Protection would be two-fold: to maintain public awareness of work in progress and assist in a program of marine turtle propagation. Annual reports will be distributed to representatives of participating organizations for dissemination to the membership of their respective groups. The residents of Sanibel and Captiva should contribute time and effort for conservation and restoration of their marine turtle colony.

Suggested Reading

Numerous books are available which cover the taxonomy and biology of marine turtles. Two outstanding works are available on the natural history of these remarkable reptiles. Dr. Archie Carr of the University of Florida has authored these turtle-novels and both are recommended reading for all persons interested in wildlife or conservation.

The Windward Road and So Excellent a Fishe are superb volumes and should be read in the order mentioned above for a complete insight into one man's intensive study of the intimate life of the Atlantic loggerhead turtle and its relatives.

SANIBEL-CAPTIVA CONSERVATION FOUNDATION, INC.

STATEMENT OF PURPOSES

The Sanibel-Captiva Conservation Foundation is dedicated to the belief that people, if they have the will to preserve it, can enjoy rather than destroy the world around them. We here have a unique opportunity to demonstrate this by conserving the natural qualities of our islands which set them aside as a distinctive way of life for residents and visitors alike.

Sanibel, Captiva and the chain of islands of which they form a part are still relatively undeveloped. They offer one of the last opportunities to preserve the rich treasury of wildlife and vegetation which flourish in a semi-tropical wilderness.

Time is short, as bitter lessons learned too late in other parts of the country have shown. But the Foundation believes these assets can be preserved by orderly development rather than exploitation. To this end the Foundation, working closely with the conservation groups and continually soliciting the opinions of others, sets forth the following goals. Their achievement will require the support of all interested people.

1. Land acquisition. The Foundation, as successor to the Ding Darling Memorial Committee, is proud to have taken the lead in the creation of the Ding Darling sanctuary. We believe other areas can similarly be set aside. And we feel land developers can be shown the financial rewards for preserving portions of their holdings in a natural state.

2. Wildlife protection. Wildlife cannot flourish isolated even in a sanctuary. Surrounding estuarine areas with the basic nourishment for birds, fish, shellfish and other life must be preserved, unpolluted. And there must be areas for unmolested feeding and breeding. This requires eternal vigilance against the march of industrialization and of campers, picnickers and other invaders. Our islands are as rich in plant as in animal life and this, too, can be preserved. Much can be accomplished by encouraging the retention and planting of native vegetation.

3. Orderly development. In all cases we will seek to cooperate with developers and to provide technical and scientific studies which may point the way to the types of development that can benefit both the developer and the conservationist. As one point, there should be access roads to Upper Captiva and Lecosta islands but this should not include a highway running directly through the island chain.

4. Education. Children and adults, laymen and experts all have much to learn about the other forms of life which share this planet with us. The Foundation will sponsor general educational programs as well as special ecological research. From this we expect to gain knowledge to provide the basis for further steps to conserve the environment cherished by us all.

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