

LEATHER BACK SIGHTING NOTE

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NEED TO WRITE TO UCHIDA

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George -

CALL AVON

Thanks for your letter. I'm enclosing a map of the basic cruise tracks which are followed each year. I've circled the tracklines that are probably of most interest: the end of the first leg of the McArthur going into Hilo and the beginning of the second leg. Dates are approximately 20 Aug - 10 Sep if these legs are used. Question: is this area suitable? Too far north?

If you get some Japanese help I think that will be great. It would then be logical to offer a spot to a Japanese - would you go with Uchida? Safety will surely be a primary concern and two people required. Since the ship is already cramped as it is, taking an additional 2 people and boat will take some convincing - first to get NMFS backing and then to PMC (who runs the ships). It won't be an easy sell so you will have all your ducks lined up (so to speak) before we approach Barrett. In the meantime I agree best to keep it low profile.

See you at the end of August -

Tim

Navy. We would especially like to acknowledge the efforts of the Instituto Nacional de Pesca.

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THANE WIBBELS

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RECAPTURE OF A "LIVING-TAGGED" KEMP'S RIDLEY

MTN No. 24
MARCH 83

During 1980, John R. and Lupe P. Hendrickson used autografting and chemical procedures in an experimental attempt to produce permanent living tags on approximately 800 hatchling sea turtles (Hendrickson and Hendrickson, 1981a, 1981b; see Editorial, Marine Turtle Newsletter, 1982, 22, 1-2, for a photograph). After 10-11 months, the majority of these turtles were released. The recent recapture of one of these turtles furnished the rare opportunity to evaluate a living tag after a prolonged period in the wild. The recaptured turtle was a Kemp's ridley which had been headstarted by the Galveston Laboratory of the National Marine Fisheries Service (under Mexican permit No. 1147 and U.S. Fish and Wildlife permit No. PRT-2-4481) and was released on June 2, 1981 near Padre Island National Seashore, Texas. On March 17, 1982, during a period of strong onshore winds, it was found alive and in good condition on a beach ca. 23 km northeast of its release site. During the 289 days since its release into the Gulf of Mexico it had grown from a weight of 1037 g and a carapace length of 17.7 cm to a weight of 2746 g and a carapace length of 25.5 cm.

This turtle had acquired its living tag at an age of 7 weeks during August of 1980. The living tag consisted of a reciprocal tissue graft in which a disc of carapace tissue was exchanged with a disc of plastral tissue. This resulted in a white disk on the dark carapace and a dark disk on the white plastron. The graft on the carapace (located between the 2nd and 3rd costal scutes) had enlarged and darkened slightly. Additionally the border between the 2nd and 3rd costal scutes had darkened considerably. Nevertheless, the graft was still readily visible. The plastral graft, however, was not readily visible; either the graft had failed or the grafted tissue had not retained its melanistic properties. The turtle had its Monel tag intact, so there was no question of its identity.

The NMFS project is only one facet of an international effort to protect Kemp's ridley. Other agencies involved include the Instituto Nacional de Pesca (Mexico), the U.S. Fish and Wildlife Service, the National Park Service, the Texas Parks and Wildlife Department, the U.S. Coast Guard, and the U.S. Navy. We would especially like to acknowledge the efforts of the Instituto Nacional de Pesca.

Hendrickson, J.R. and L.P. Hendrickson. 1981a. "Living tags" for sea turtles. Final report to the U.S. Fish and Wildlife Service (Contract No. 14-16-0002-80-229), 25 pp.

Hendrickson, L.P. and J.R. Hendrickson. 1981b. A new method for marking sea turtles. Marine Turtle Newsletter 19:6-7.

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TWO TAGGING RECORDS FROM TRINIDAD

A leatherback turtle tagged "T 16" at Matura Beach on the East coast of Trinidad on 26th May, 1970, was recorded while nesting at Tacarib Bay on the North coast of Trinidad on 26th April, 1975. Two years later, on 23rd September, 1977, that is 7 years and 4 months after it had been tagged in Trinidad, this turtle "T 16" was found dead on Rockaway Beach, New York.

A leatherback turtle tagged "T 69" at Matura Beach on 5th May, 1972 was killed by poachers on the same beach on 11th May, 1979, that is 7 years after tagging. Matura Beach is the most accessible nesting beach used by at least 4 species of turtles but it is also the beach where poachers are most active. There are laws to protect turtles and their eggs, but unfortunately they are not enforced.

IAN LAMBIE

Trinidad and Tobago Field Naturalists' Club, 64 Roberts Street, Woodbrook, Port of Spain, Trinidad.

OLIVE RIDLEYS IN INDIA

A fair number of letters have been written to Prime Minister Gandhi expressing concern about the management of olive ridleys on the east coast of India (see Marine Turtle Newsletter No. 24, 1982). If there are readers of this newsletter who have not already written to Mrs Gandhi, they are asked again to write. With a Prime Minister favourable toward conservation, and still turtles there left to conserve, it is important that the authorities there be made aware of world-wide efforts to conserve sea turtles and of what has happened to the arribadas of olive and Kemp's ridleys in Mexico. Letters should be sent to Shrimati Indira Gandhi, Prime Minister of India, South Block, Central Secretariat, New Delhi 110011, India. Please write soon and send a copy of your letter to the editor of this newsletter.

N.M.

MARINE TURTLE NEWSLETTER

For recent readers, a few points may help answer questions arising. The newsletter does not appear regularly but only as often as possible within a context of financial and other constraints. Usually there are 3-5 issues a year. So far it has been possible to avoid charging. With around 80 different countries involved and floating currencies, charging in itself would entail considerable extra costs. However, we have received some helpful



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southwest Fisheries Science Center
P.O. Box 271
8604 La Jolla Shores Dr.
La Jolla, CA 92038

August 14, 1991

Dear George,

As you can see from the letterhead, I am still here at the La Jolla Lab, and still with the photographic group. Do you know Wayne Perryman? He is the new head of this group. Anyway, I have been out in the field for awhile, thus my tardiness in replying to your letter. I must admit that I had at first figured that the project was off, then became involved in other things and totally forgot about our "unfinished business". I will be on vacation (well deserved, and overdue) until Sept 9 and look forward to talking to you after that. My number here is FTS 893-7194.

Sincerely,

A handwritten signature in cursive script, reading "Morgan S. Lynn", is written over the typed name.

Morgan S. Lynn





DEPARTMENT OF ZOOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN

Austin, Texas 78712-1064 • FAX: (512) 471-9651

12 May 1992

George Balazs
Sea Turtle Specialist
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Southwest Fisheries Science Center
Honolulu Laboratory
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear George:

Enclosed is an article I wrote for MTN back in the early 80's. I have a plate of the actual pictures packed away in old files at home. Mrosovsky said that it was not possible to print the plate in MTN so I changed the article to all text. If I did not send you a copy of the plate back in the early 80's, just tell me and I will find it and send a copy to you.

Your seven year sighting sounds great. That type of information is hard to come by and needs to be published.

Best regards,

A handwritten signature in black ink, appearing to read "Thane", with a long horizontal flourish extending to the right.

Thane

Enclosure

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Observations On The Defensive And Aggressive Behavior Of The Leatherback Turtle (*Dermochelys coriacea*) At Sea

We report an unusual encounter with an adult leatherback turtle (*Dermochelys coriacea*) off the coastal waters of the Republic of Palau in the western Pacific Ocean on 17 May 1991. We were plying the waters about 1 km south of Ncheangel (Kayangel) Atoll in the channel between the Atoll and Kossol Reef, approximately 8° 1' 30" N; 134° 44' E. The weather was sunny, the northerly wind light, and the ocean calm. Our boat was an open 7 m fiberglass runabout equipped with two 75-hp outboard engines.

At midday we noticed a large animal surfacing several times as we fished about 300 m away. After 5-10 min we motored toward the unidentified creature and found it to be a leatherback turtle interacting with a large (2 m) gray reef shark (*Carcharinus* sp.). The two animals were behaving aggressively, swimming rapidly about one another, with the turtle frequently breaking the surface alongside our boat. We stopped the boat and watched. The turtle swam erratically, repeatedly surfacing and exposing head, carapace, and flippers, often creating a frothy wake of bubbles as it resubmerged. At one point the turtle swam rapidly toward the shark, forcing it to take evasive action by darting away. Although we at first thought that the turtle had possibly been bitten and wounded by the shark, in fact the turtle appeared uninjured with all flippers intact and no blood in the water. After about 5 min the shark swam away and we did not see it again. The turtle, however, maintained an interest in our boat and continued to swim underneath and beside us, acting much as it did in the presence of the shark.

The turtle then began short rushes toward us, solidly ramming the underside of our boat. The turtle typically made shallow dives (5-15 m) in between each surfacing and hitting of the boat. It appeared to be ramming us with the leading edge of its carapace, or the upper part of the carapace itself, as opposed to its head. Although this butting was solid and could have thrown an inattentive person off one's feet, we did not notice any blood in the water or damage to the turtle's carapace. The turtle continued to surface frequently, lifting its head, a fore-flipper, and part of its body out of the water. On at least one occasion it surfaced upside down and swam several meters with its plastron up (Fig. 1). After

5-10 min of this behavior, and after hitting our boat half a dozen times, the turtle appeared to lose interest and began to swim away.

At this point, two members of our crew (C. Cook and N. Idechong) donned masks and snorkels and entered the water, jumping in on opposite sides of the boat. When Cook was 3-4 m from the boat the turtle came immediately and aggressively toward him. The turtle approached with mouth agape, but veered away within the last few meters when Cook made a threatening gesture by spreading his arms. Cook climbed quickly back into the boat, whereupon the turtle shifted attention to Idechong, who had lost sight of Cook and was searching for him at the stern of the boat. As the turtle approached, Idechong swam between the propellers of the two outboard engines. The turtle came from below, mouth open, evidently intent on biting the swimmer. Idechong delivered several kicks to the turtle's head, and the turtle backed off. The turtle did not or was not able to bite the swimmer's foot, and at the first opportunity Idechong climbed back into the boat.

The turtle hit the boat several more times, and then appeared to lose interest, moving farther and farther from us. When the turtle was no longer in sight, we started our engines and motored away. The entire encounter lasted 15-20 min.

The turtle was an adult whose carapace length we estimated to be ca. 1.5 m or more. Leatherbacks with a carapace of this length would be expected to weigh about 450 kg (Anonymous 1975, Van Denburgh 1924). The tail was short and the turtle was probably a female. We took several photographs of the animal as it surfaced around our boat (photos on file at the U.S. Fish and Wildlife Service Honolulu Office). The leatherback is occasionally reported in Micronesia (Pritchard 1977) and is thought to be an uncommon or rare species in Palau and Micronesia. Noah Idechong, who grew up in Palau and spent much time on the water, had seen only one leatherback prior to this encounter.



FIG. 1. Adult leatherback turtle surfacing upside down.

Based on our discussion with others familiar with sea turtles, the behavior of this leatherback was unusual (G. Balazs, T. Fritts, J. Woody, J. Richardson, pers. comm.). However, there are several published accounts of leatherbacks that have acted aggressively in response to humans or sharks (Cropp 1979, Schroeder 1965, Van Denburgh 1922). In one of two encounters described by Schroeder (1965), a large leatherback was observed somersaulting over backwards, making repeated vertical dives, and ultimately attacking Schroeder's boat—behaviors similar to those we observed. Cropp

(1979) detailed an encounter of a leatherback and shark off the coast of Australia. According to Cropp, a great white shark circled under a leatherback which was swimming on its back, wildly thrashing all four flippers, flipping, rolling, and diving on an erratic course. When Cropp maneuvered his boat between the turtle and shark, the turtle continued its tumbling and thrashing on the surface, evidently regarding the boat as another predator. We speculate that the aggressive display of the leatherback toward our boat was the result of its encounter with the shark. The turtle, which was clearly sparring with the shark, evidently considered us to be a threat as well.

Reports of turtles being bitten by sharks are relatively common, and the fact that turtles behave aggressively toward them is expected. However, the behaviors that turtles use to fend off sharks are not well documented. Rudloe (1979) reported that during an attack "turtles can sometimes chase off a shark by fleeing to the surface and beating their flippers, making a thunderous slapping noise that may be too much for the shark's delicate nervous system." Rudloe (1979) also wrote that "Archie Carr has told me about turtles blocking shark attacks by actually folding their flippers together under their plastron, bending their head down, and presenting their carapace as a shield."

Based on our encounter and those of others, adult leatherbacks use several different defensive behaviors when threatened, including ramming, biting, erratic swimming, thrashing on the surface, and swimming upside down on the surface. The survival benefits of ramming, biting, and erratic swimming are self-evident, but the value of swimming upside down and splashing on the surface is perhaps less clear. Swimming upside down on the surface may protect the vulnerable underside of a turtle from attacks lower in the water column. Splashing may deter an attack by a shark, but we can neither corroborate nor refute Rudloe's (1979) statement that the slapping noise made by a turtle is "too much for a shark's nervous system." Although leatherbacks may occasionally be preyed upon by sharks, a large healthy adult can obviously defend itself. Situations where leatherbacks are actually killed by sharks are probably exceptional and may occur mostly when a turtle is already wounded or sick.

Acknowledgments.—We thank George Balazs for his many helpful comments on a preliminary draft of the manuscript and for providing us with pertinent literature on leatherbacks. We gleaned much useful information in discussions with George Balazs, Thomas Fritts, Jack Woody, James Richardson, and Scott Eckert. We thank them for their input.

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Herpetological Literature In The International Zoo Yearbook, Volumes 19-29 (1979-1990)

In 1979, Tryon (*Herpetol. Rev.* 10(3):87-90) listed 164 articles pertaining to herpetology published in the *International Zoo Yearbook* by the Zoological Society of London. The scope of the articles ranged from exhibits to disease and treatment, and contained much information not available elsewhere. As Tryon pointed out, the *IZY* tends to be a rather expensive publication and generally is not received by most libraries.

From the 1979 volume (#19) through the 1990 volume (#29), 117 articles related to reptiles and amphibians appeared in the *IZY*. For those individuals without access to the *IZY*, this listing, as with Tryon's review, serves as an introduction to the herpetological information published therein.

Articles are listed alphabetically by author and grouped in nine general categories in the following order: General Titles (13), Exhibits and Construction (8), Disease and Treatment (6), Amphibians (9), Turtles (22), Crocodylians (11), Lizards (21), Snakes (25), Tuataras (2).

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- BLODY, D. A. 1984. An efficient and inexpensive tool for feeding captive reptiles. 23:206-207.
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LEATHERBACK TURTLE

THE SIZE OF A
VOLKSWAGON
DECAPITATED BY
SHARK!

HAWAII FISHING NEWS

FISH CARVERS
OF INDONESIA

THE NEW
SUPERBRAID
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PART II

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GUY TAKAMURA PLUS A
GIANT NEEDLE FISH AND MORE!



THE VOICE OF HAWAII'S FISHERMAN

FEBRUARY 1994

Volume 20, No.1

\$2.75

North Shore- Hale'iwa Harbor

by Capt. Greg Matney



Could this mystery animal photographed with Kame Point in the background be the ill-fated leatherback last seen off Mokapu Pt.?



This 500-plus-lb leatherback (hauled by sharks) held a lot of mahimahi for Hale'iwa anglers. After a two and a half week absence, the leatherback was found again near Mokapu Point.

■ You can lead your boat to aku, but you can't make them bite. There were aku piles everywhere off the North Shore of O'ahu, but the fish just didn't seem to want to cooperate. All of the fishermen were talking about the large piles of medium to large skipjack tuna that they found but could not catch. The standard tricks of going down to extremely light tackle, as small as 12-lb test, didn't seem to be working. We heard the same question over and over, "Why?" If any of us knew the answer, we'd be driving a Cadillac. So, we relied on our resident billfish populations for most of our action and income, and the FADs became our main focal points.

On the way to the buoys, you'll often have a "rat attack" 3 to 4 miles out of the harbor. A "rat attack" is a barrage of strikes from a small pack of striped marlin. These marlin have been ranging from 35 to 100 lbs and are very hard to hook. They seem to have a good time knocking down any lines that are set up. Sometimes, this action will go on for an hour or so. Pretty soon a fisherman can start feeling like a pin boy at Leeward Bowl-set 'em up, and they knock 'em down. You could lose a lot of money in rubber bands like that.

But there is still that occasional nice, big blue marlin that gets caught. That's the fish that always makes you load up the ice, top off the fuel tanks and go right back out. Capt. Rusty Spencer of KUULOA KAI Charters caught one of those "gotta get back out there" marlin during the last week of 1993. Here's Rusty to tell you about it.



Capt. Rusty Spencer stands with his 325-lb "longnose shark."

Spencer for Hire

"It was one of those usual days. I got up at around 6 that morning and picked up my charter clients, two fellows from Australia named Vince and Tim. They were nice guys and had some experience fishing, so it seemed like the day was going to go well. We stopped by the ice house, picked up 200 lbs of ice and went to the boat. After loading our gear, ice, bait and lunches, we headed for the ill-buoy. The weatherman was calling for 15- to 20-mph trade winds, but the wind seemed to reach 20 mph right off the bat.

"I got to the buoy and did my regular routine—reeling in all of the big lures after the first pass (if nothing takes off), then starting to jig for a live bait. The action was really slow; we weren't even hooking any of the small 'ahi that had been there lately. We eventually caught two small aku, bridled them and ran them back. We didn't have any takers on our baits, and they eventually died. We ended up just dragging around the dead aku for 'slap bait,' hoping for anything to happen.

"My passengers were still jiggling when one of the dead aku took off. Tim looked at me and said it was a shark that had the bait, so I said, 'Just keep jiggling,' figuring I'd let the shark have the bait. The line kept going out, then stopping. Going and stopping like a shark will do. After my 14/0 [reel] was half-empty, I decided it was time to get the line back, so I headed the KUULOA KAI straight up the line, directly at the fish. The swells were pushing us off a little, so by the time I got about 40 yards from our shark, we were parallel to it. Then our shark broke water. That was the first shark I'd ever seen with two sharp fins and a long bill!

"The whole scene changed from that point. It went from 'Oh, darn, it's just a shark,' to 'Put that bang stick away. Grab those gloves, Tim. You yank and, Vince, you crank.' I got the boat turned around, and the battle was on. We were able to keep the fish on the surface, so the fight only lasted a half-hour. When it came to the transom, we were able to sink a fixed gaff on the first shot to hold it, then a meat hook went in."

Leatherback Turtle Update

In the December 1993 issue of HFN, I wrote about a very large leatherback turtle that had been wounded by sharks. I told how the KANA NUI, DIAMOND 5 and GRACE K had harvested almost a ton of mahimahi from around the turtle. I also mentioned that the wounded animal was very, very large, looking like a floating Volkswagen and drifting from the North Shore toward the Kame'ohi side of O'ahu.

Approximately two and a half weeks later, the turtle was found again by fishermen. By all accounts it was the same wounded animal. Russ Miya from the National Marine Fisheries Service called the HFN office to report that a fisherman named Scott had called their office from a cellular phone and

had described the same turtle. Scott and his crew were fishing near Mokapu Point when they found it. They managed to pick up a few mahimahi from around it, but it didn't have as much fish with it as it had on the North Shore.

That's where any good news ended. While Scott and his crew were hanging around the turtle, they actually saw a Galapagos shark attack the wounded leatherback and decapitate it. The shark finally put the turtle out of its misery. Initial shark attacks had taken off the turtle's left front flipper and shoulder. The poor creature was left to drift with the current and surely would have died from starvation, if nothing else. As cruel as it seems, nature always seems to take care of its own.

If you have seen this turtle while out fishing, please contact Russ with the NMFS Turtle Research Division at 943-1276.

continued...



HAWAII FISHING NEWS

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WHERE OCEAN GIANTS MEET



Near Shark Bay, Australia, migratory paths cross

Manta ray, escorted by diver and school of remoras, swims through the waters of Shark Bay.

THE GREAT JAWS of the white shark slid along the whale carcass, open wide, chomping, mouthing, trying to sink its teeth into the broad surface. Now the teeth locked onto the tough hide, jaws pushed way out, horribly distended. The five-meter shark shook its head violently, tail thrashing, pushing, wrenching, and a twenty-five kilogram bite of blubber came away.

We took a close look at the huge bite, then maneuvered the shark cage into the water between our boat and the sperm whale carcass. I had never filmed sharks from a cage before, but I would not enter these waters without one. This white shark was hungry, he had a whole whale to eat, but would surely prefer a smaller-sized meal, one that his jaws could encompass more easily.

We were anchored off the Albany whal-

ing station beside three buoyed sperm whales caught the day before. Flensers were working on three more at the factory. When the ramp was cleared, these three would soon be hauled away. The shark had less than an hour to feast on the banquet; we had the same amount of time to film his frenzied feeding.

My inexperience with cages was revealed when I hurriedly jumped overboard to film the shark. This one overbalanced, almost tipping upside down, and shoving my legs well beyond the bars: not a comforting thought. Eventually I righted the cage and slipped deep inside. By the time I recovered one whale was being towed away, and the tender boat was already coupling up the second one. In a few minutes the third whale would be hauled away too.

It was extremely frustrating to be

trapped in an immovable cage waiting for the shark to perform, knowing that only a short moment remained to capture on film this savage eating machine.

The shark sensed that his banquet was to be a brief one. He ran his jaws along the slippery hide pushing, biting, impatient to tear the thick blubber away and get at the red meat. The great hulk of the whale slowly slid past me, as if brought back to life and in motion again. The white shark plodded behind, gave an angry chomp at the disappearing fluke, then he too glided away into the gloom.

We later discovered that inside one of the sperm whales was a monster squid swallowed whole, still intact. The squid's body, together with its shorter tentacles, measured four and a half meters. The two long tentacles were missing, but they would have made the animal an amazing thirteen

meters in length. We think of such great creatures as mythical sea monsters. Here, off Albany, they are very real. A second, smaller squid measured eight meters long. If the bigger squid's tentacles were stretched apart, the way we measure octopuses, they would span an incredible twenty-four meters.

That night my colleague, Hugh Edwards, caught the whale-eating shark on one of his four carefully set baits. It measured five meters. The next morning, flash-frozen, he loaded it onto a trailer and headed for the Perth Royal Show where it would be on exhibit.

Even if the shark had not been caught on Hugh's oversized hook, it would most likely have been his last whale meal anyway. Thankfully, the last whaling station in Australia has finally closed down. Our encounter with the hungry shark occurred during the final days of whaling. Economics and persistent pressure from conservationists had finally relieved the magnificent leviathan, freeing it to roam the Australian seas unmolested.

The sperm whales migrate north from the Antarctic to the southwest corner of Australia near Albany. On the edge of the continental shelf they dive deep for the giant squid, and huge sucker marks around their heads testify to the tenacious struggle between two ocean giants. The sperm whales appear to briefly touch the southwest coast, then curve seaward in a migratory loop back to the Antarctic.

Pods of orcas migrate with the whales, and the white shark we had met in Albany was an ocean traveler too. We know for sure that the white sharks, which follow the dead whales to shore, are not local ones. Hugh Edwards noted that each visitor was a newcomer, a pelagic creature diverted to Albany by the wake of a towed and irresistible meal.

The humpback whale also migrates north from the Antarctic in the early winter, and swings close to the coast off Geraldton, heading north to its mating and calving area off Shark Bay. Reprieved from the harpoon in 1964, the decimated humpbacks have slowly increased and returned to their traditional migratory route to replenish their species.

While filming the whaling and white sharks in Albany, I realized I was witnessing the beginning of a great story. What happened at Albany is history now. Shark Bay, the place where the whales come to mate, is the real fascination. In their urgent need to propagate, the humpbacks converge on this sanctuary: a crossroad where ocean giants meet.

The stark outline of the Zuytdorp Cliffs stretched northward to disappear in the gray dawn. In the half-light I could just distinguish the section of cliff where the Dutch treasure ship *Zuytdorp* ran aground in 1712. Those few who survived soon perished on the inhospitable coast, leaving a huge treasure of a quarter of a million silver guilders in the pounding surf. The treasure ship is protected by Australian law, but the treacherous cliffs prove a more formidable barrier.

While natural blowholes erupted along the rocky cliffs in regular geysers, it was the spurts of spray to seaward we constantly monitored. A pod of humpbacks was always in view, relentlessly pushing northward.

By noon we ran along Dirk Hartog Island which fronts and protects the deep indentation of Shark Bay. Off Cape Inscription the whale pod changed course, swung in an arc closer to the coast, and slowed down. With my binoculars, I picked out more spurts of spray ahead; another group of whales was already off the cape.

I turned my boat *Beva* toward the swirl of disappearing flukes and tried to guess where the monsters would surface. Without warning a fourteen-meter shape suddenly rose up from the sea, bringing its great hulk alongside us before collapsing in the water with an enormous splash.

Cautiously we approached the whales again, not wanting another breach so close. We let them get used to the boat, moved gradually nearer, and after two hours they finally accepted us.

It was a magnificent sight. The leviathans glided upward, long flippers outspread and almost touching *Beva*, bodies as long as the boat. A burst of spray from twin blowholes formed a rainbow over two of the whales, which were so near that I had a problem framing both animals in my wide-angle lens.

As the whales angled across *Beva's* bow, we throttled back. A great tail rose up, poised momentarily with the water cascading off, then down it plunged into the ocean depths.

Whaling was one of Australia's oldest industries. During the peak year of 1845 some 300 sailing ships harpooned the whales off the south coast. By the 1960s the humpback was commercially extinct off the west coast.

On the beach at Norwegian Bay stand the ruins of an abandoned whaling factory, one of many along the northwest coast. In 1956, this Carnarvon-based company harpooned over 1,000 humpback whales. Their 1963 season was disastrous. Out of an allo-

cation of 550 whales, they only managed to capture 87. As a result the International Whaling Commission (IWC) banned the hunting of humpbacks in the Southern Hemisphere.

The battery of rusting boilers at Norwegian Bay is an ugly reminder of an ugly business. Out on the reef lay the wreckage of one of their whale chasers, the *Fin*. Close by a tiny sand cay sparkled in the clear water. The nesting terns swarmed by the thousands to this Frazer Island as the sun set. It was a beautiful living contrast to the history of slaughter in the bay.

IT WAS LATE IN THE DAY when we left the group of whales and made for the anchorage behind Cape Inscription. In the fading light we almost ran over another gentle giant. The white spots on a broad back and a ten-meter length easily distinguished a whale shark. Like the humpback, it was on a migration north and feeding on the same planktonic diet.

Opposite the southern tip of Dirk Hartog Island is Steep Point, the westernmost extremity of the Australian mainland. Huge Indian Ocean swells crash with unbelievable fury against the sheer cliffs of this well-known landmark. On the tip of this point we found more than a dozen rock cairns clustered together. They bore scrawled names on bottles, rock, and wood of the intrepid modern explorers who had crossed Australia from east to west. One had succeeded on foot, others on bikes or four-wheel drive vehicles. Another, a girl, had traversed the desert by camel.

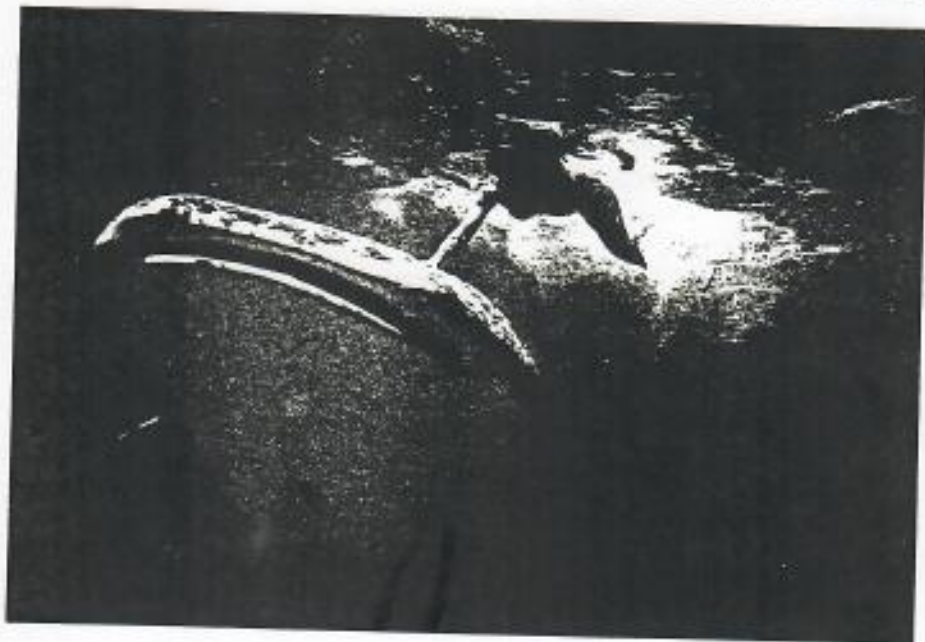
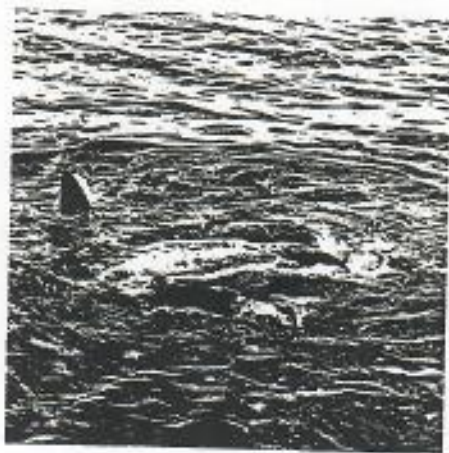
We had come the long way round. *Beva's* log now read 10,000 nautical miles since we had left home on the eastern end of Australia eighteen months ago. We added our own rock cairn, with an inscribed list of *Beva's* crew.

Though we failed to meet the whale shark again, we did encounter many other migratory giants. Twin wing tips of manta rays sliced the surface off Cape Inscription, and the dorsal fins of sharks cruised along the beach edge, occasionally thrashing into a school of pilchards. These pilchards also migrate along the coast, continually harassed by pelagic fish and the sharks. Above, the booby gannets and pied cormorants rocketed relentlessly into the chopping turmoil of fish.

The English buccaneer, William Dampier, was observant when he named this migratory meeting place Shark Bay in 1699. He stayed eight days and wrote of the strange jumping marsupials he described as a sort of raccoon and good to eat.

Dampier was not a pirate at heart. He

Left: Green turtles mating. Right: Leathery turtle evades shark attack by turning on its back and thrashing wildly. (Lynn Patterson) Below: Snorkler strokes the back of a thirty-five foot whale shark which swims lazily along the surface. The whale shark, a plankton feeder, is quite harmless.



had an irresistible longing to travel, to see strange lands and the people and animals that lived on them. However, on his long exploratory voyage in the *Cygnar*, his crew was less honorable. They had decided if the food ran out, Captain Swan, a fat man, was to be eaten first, then Dampier, though he was thin and wiry. It is recorded in history that "The pirates were spared a bout of indigestion!" Perhaps the kangaroos and the captured sharks at Shark Bay saved Dampier. Captain Swan was able to joke later, "Ah Dampier, you would have made them a poor meal."

We were two miles off Steep Point, sweeping the deep water for whales or whale sharks, when a splashing of water caught my eye. I ran *Beva* over, and was surprised to see a large leathery turtle on its back, wildly thrashing with all four flippers. Now it flipped and rolled over several times, dived briefly on an erratic course, then surfaced and continued the thrashing and tumbling.

I thought it was crazy—until I spotted the shark. It was a big white, a silent shadow circling under the turtle. Fortunately I was able to film this extraordinary tactic. It is rare enough to meet a sea turtle, and this evasive tumbling behavior had never before been documented.

The great white nosed upward, a graceful but ominous threat to the poor reptile. We gunned the motors and cut the shark off by running alongside the turtle. We had successfully tried this before when a tiger had harassed a green turtle to the point of exhaustion.

The shark brushed the port side of *Beva* and dived straight down. On the starboard side the leathery turtle went into another violent burst of tumbling and thrashing on the surface, yet the shark had gone. I realized the turtle was regarding the boat as a new predator. By instinct it continued to perform its frenzied evasive maneuvers.

The leathery turtle is another migratory giant. This one had traveled far from the closest known nesting site at Trengganu in Malaya. The next rookery is in Fiji, and there is another at French Guiana in South America. The leathery is the largest of all marine turtles and is classified as a critically endangered species. It is not known to nest in Australia, and feeds principally on a jellyfish diet. This one must have been some two and a half meters in length, and weighed about 500 kilograms. Unlike other turtles, the outer covering of the leathery carapace is not composed of scales but rather of a thick skin. The white shark is perhaps the only predator of the adult turtle.

Besides the migratory ocean giants that feed on the plankton or the migratory fish, Shark Bay still supplies an enormous amount of food to the indigenous marine life. Deep inside Shark Bay are a series of long and shallow indentations with inglorious names such as Useless Loop, Hopeless Reach, and Disappointment Reach. Possibly to the navigator they were so, but for the marine inhabitants they provide a rich source of estuarine nutrients. It is a vital and complex ecosystem, a nursery swarming with the juveniles of all the larger fish species.

In Freycinet Estuary we were exploring along the beds of seagrass, viewing the abundant juvenile marine life when I noticed some wreckage ashore. It proved to be part of a significant chapter in Australia's brief contact with the enemy during World War II.

On November 19, 1941, the HMAS *Sydney* fought a desperate battle with a German raider, the *Kormoran*, off Shark Bay. Both ships sank, the *Sydney* with all hands. From the *Kormoran*, 317 German survivors reached Shark Bay, and this skeletal wreck was one of their lifeboats.

Along the seagrass beds we spotted many dugongs, surfacing briefly between their feeding forays. Around the tip of Heirisson Prong, just past the huge salt works at Useless Loop, we ran into dozens of dugongs. They were all heading north out of the shallow estuaries and curving around into South Passage.

Fisheries Inspector Derek Blackman, at the tiny township of Denhem, explained that the dugong herd here numbered around a thousand, probably the largest group surviving in Australia.

Because dugongs are normally shy of people and generally live in dirty water, no one has filmed them underwater before. Derek told me that the dugong herd I saw was heading for the entrance to South Passage. Opposite Steep Point on the southern end of Dirk Hartog Island is a tongue of reef on which ocean swells crash heavily. The sheltered clear water behind this reef is the favorite winter meeting place of the dugongs.

We used the Beaufort rubber dinghy to run in behind the thundering swells as they surged across the shallows and dissipated above the dugongs' feeding ground. A dozen brown shapes rose on the swells, sucked in air, and went down again. We anchored the dinghy fifty meters away and quietly slipped in with our cameras.

Visibility was good. Every crevice was filled with the bristling antennae of crayfish, but our interest was now only in the

blurred big shapes up ahead. I dived and quietly moved over the bottom, fingers tugging at waving seaweed as I crawled closer. Though I kept low among the waving fronds of the algae, camera running, the nearest dugong stopped browsing when I was two meters away.

Two of the dugongs had fat calves swimming close alongside. One calf ceased nursing on the tiny nipple hidden under the stubby front flipper. Now it slipped onto the back of its barrel-shaped mother and perched, rather than clung, with its little flippers squatting on her broad back. The parent flipped away, the calf remained in its piggy-back position, carried smoothly along by the bow wave.

I grabbed a quick breath of air and sunk prone on the bottom in the weeds again. Mother and calf went up for air too, then together they dived and approached me. The calf was still astride its mother's back, but as she inquisitively came closer, the little one slipped off and hugged her blind side.

The mother weighed at least five hundred kilograms, a cylindrical bulk over three meters long. She stopped barely a meter away, her little pig-like eye watching.

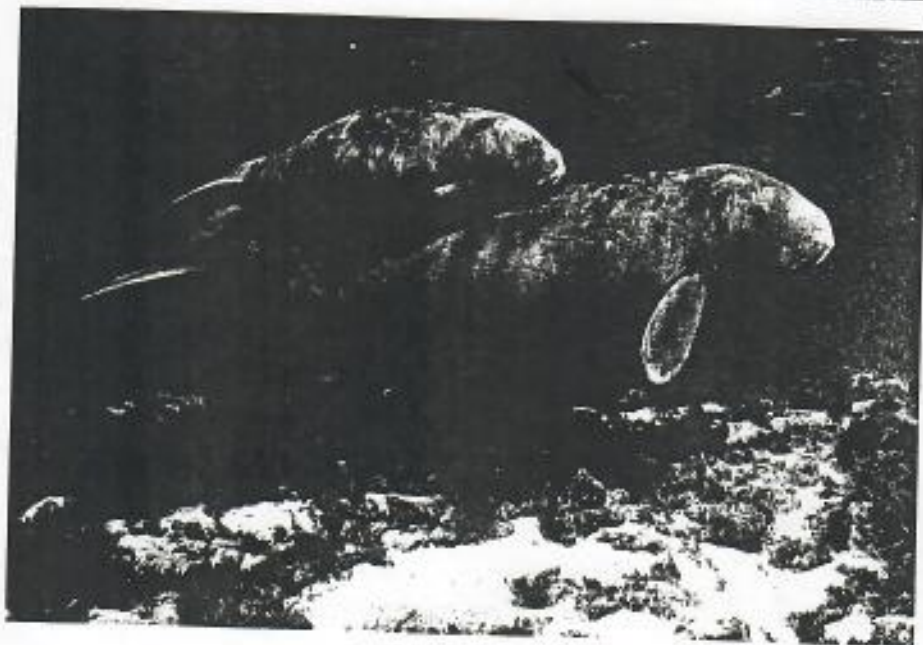
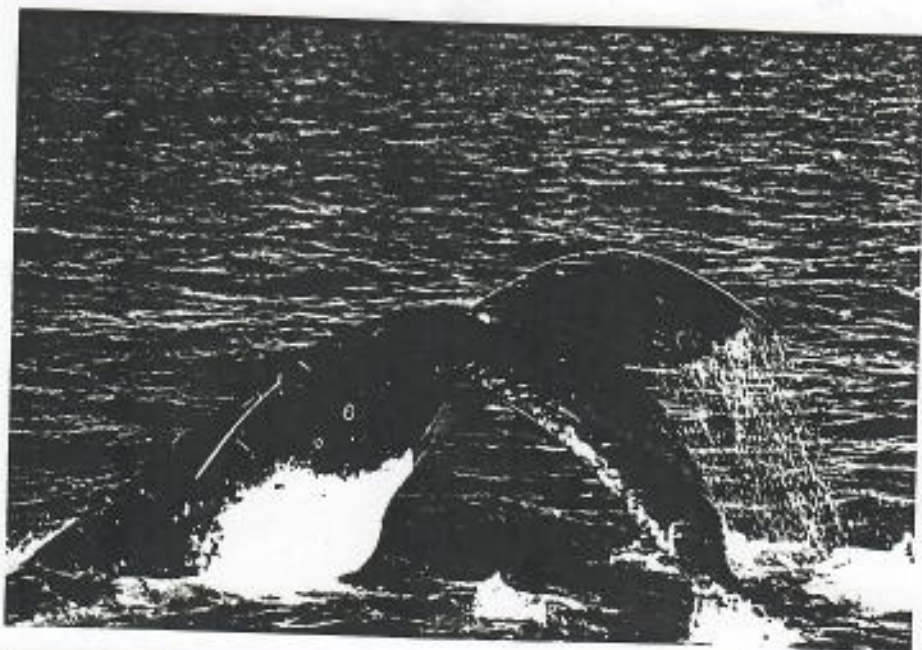
It seems impossible that this ugly creature could be responsible for the myth of the mermaid. Only a dugong could find a dugong attractive. Not in my wildest imagination could I see one human female attribute in this ponderous animal before me. The legendary mermaid must have developed through distorted tales that sailors told and retold over the centuries. From this legend, scientists named the species "sireniens".

These gentle herds in Shark Bay are a naturalist's dream, where their little-known behavior can be studied at close quarters. Unlike the brief imaginative glimpse by a medieval sailor, or an indistinct shape surfacing from tropical muddy water, here, at Shark Bay, we have a clear view of the dugong character. It is a shy, inoffensive, ponderous creature, a homely, ugly "mermaid"!

The bountiful waters of Shark Bay harbor all the marine animals necessary to sustain life. It is an unspoiled ecosystem. From tiny plankton to large fish, Shark Bay nourishes the ocean traveler—the crossroad where ocean giants meet.

Ben Cropp is an Australian photographer and writer who has authored a number of books about the sea and produced more than a dozen color underwater films for international television.

Top: Forty-foot humpback dives beside author's boat on its migratory route from the antarctic to breeding grounds off northwest Australia. Below: Australian dugongs, mother and calf, swim through the clear waters of Shark Bay.



Sea Turtle Rocks the Boat in Palau — Scares Shark Away

In tranquil waters off the coast of Palau, Chuck Cook, Director of The Nature Conservancy's Micronesia Field Office, occasionally finds time to do a little fishing with his friend Noah Idechong, Director of Palau's Division of Marine Resources. Usually, these excursions are peaceful affairs, but on May 17, 1991, the outing turned a bit toward the wild side.

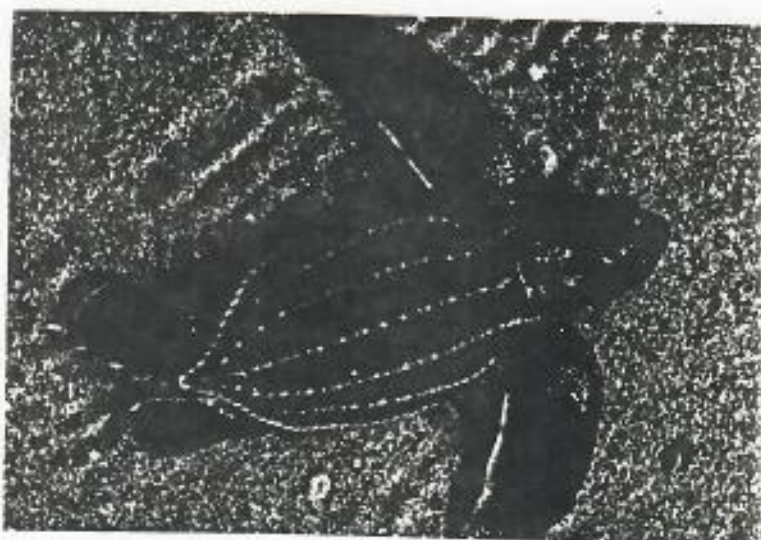
It was about noon when Chuck and Noah noticed a large animal surfacing about 300 meters from the boat. Chuck motored his seven meter Runabout over to the area to discover an adult leatherback turtle (*Dermochelys coriacea*) scuffling with a grey reef shark (*Carcharinus* sp.). The turtle was enormous! Chuck and Noah estimated the shell to be a little over one and a half meters long, and the turtle around 1,000 pounds (450 kilograms). The shark was also large, about six feet (two meters) long.

The leatherback, which surfaced many times near the boat, nearly emerged completely out of the water, as the two animals rapidly chased each other. At first, Chuck and Noah thought that the shark may have wounded the turtle, but they could not see any injuries or blood in the water.

At one point the turtle actually swam straight for its opponent, forcing the shark to take evasive action. Eventually, apparently fed up with the confrontation, the shark swam away.

The leatherback, however, appeared a bit confused and lunged directly into Chuck's boat! The turtle swam around erratically, and on one occasion surfaced and swam upside down, which scientists later speculated may be a defensive mechanism to protect the turtle's underbelly. Chuck and Noah were nearly knocked off their feet as the turtle continued to ram the boat repeatedly with the top front edge of its shell. Finally, the turtle lost interest and began to swim away.

Not wanting to pass up a research



This juvenile leatherback turtle, a rare species in Palau and Micronesia, grows to weigh as much as 1,500 pounds.

opportunity, Chuck and Noah slipped on their snorkel gear and plunged into the water. Chuck was not more than four meters from the boat when the leatherback, mouth agape, charged directly toward him! Chuck, just short of panic, quickly spread his arms in a threatening gesture. The turtle retreated and Chuck dove back into the boat.

Meanwhile, Noah remained unaware of Chuck's near miss and was searching for the turtle and Chuck at the stern of the boat. The turtle made another rush. Noah hid between the propellers of the two 75 horsepower engines. As the turtle approached from below with its mouth open, Noah delivered several kicks to the animal's head. The turtle veered off and Noah climbed back into the boat. After slamming into the boat a few more times, the turtle finally lost interest and swam away.

The leatherback turtle is an endangered species and very uncommon in Micronesia. Noah grew up in Palau and has spent a lot of time in and on the water, but he had seen a leatherback only once before. The Nature Conservancy and the Palau government are currently working together to help protect this and other rare and endangered species. If the turtle had known this, perhaps it would have been more hospitable when it met up with Chuck and Noah. ■

- I am not yet a member of The Nature Conservancy of Hawai'i. Please send me more information.
- I am not yet a member, but I would like to be. I am enclosing \$25 for my first year's dues.
- I'd like to send a gift membership to the person listed below. Enclosed is \$25 for his/her first year's dues.
- I am already a member, but would like to make the enclosed contribution.
- Please send me/my friend a copy of *Hawai'i: The Islands of Life*. I have enclosed \$19.95 (member) or \$24.95 (non-member), plus \$3 for shipping per book.

Gift Recipient:

My Name/ Address

Please complete form and mail to:

The Nature Conservancy of Hawai'i, 1116 Smith Street, Honolulu, Hawai'i 96817

August 10, 1989

Dear George,

Here's the first draft of the "Great White, Upside-down Turtle" paper. Let me know what you think.

I have begun investigating getting better pictures made. Do you have any more information on the San Francisco place? I think that Cibachrome is just a process of turning color transparencies into color prints. There is a black and white photo lab here in San Diego that advertises computer enhancements. I will look into them when I get the time.

Ciao,

Morgan Zimm

P.S. Most of it is descriptive observation, but I got a head start on analysis in the last paragraph

{Draft}

OBSERVATIONS ON AN UNUSUAL LEATHERBACK TURTLE

Morgan S. Lynn

Flying in a helicopter launched from a ship in support of the SWFC's Monitoring of Porpoise Stocks project accords one a unique opportunity to sight and observe different aspects of the pelagic environment and its inhabitants. One such inhabitant is the Leatherback turtle (Dermodochelys coriacea).

On November 9, 1988, while flying in search of dolphin schools, we observed a Leatherback turtle that was unusual in both color and behavior. It was 1215 on a clear, bright day. The water was a brilliant light blue with no whitecaps, a number 2 on the Beaufort scale. The first thing that we noticed was a white speck on the surface of the water about a mile away. Our position at this time was 15° 01' N and 99° 06' W, or about 100 nautical miles from the coast of southern Mexico. As we approached, we were surprised to see the speck resolve itself into the shape of a Leatherback turtle.

The reason for our surprise was that the white color was not a trick of the light. We had seen two Leatherbacks, and numerous other turtles, the preceding day and they had all been the dark color one would expect to see. The turtle's carapace was

approximately 4 feet in length and it's shape and dorsal, longitudinal ridges easily visible. The animal appeared to be entirely white at first, but upon closer inspection there was some darker areas or mottling on both the carapace and skin. Overall, however, the animal was much more pale than has been described for this species. This is especially true for the dorsal surface (Pritchard, 1979). Very light colored turtles have been seen in hatchling green turtles but they seemed to develop more slowly or die early and few have been seen as adults (Harrison, 1963).

The Leatherback's behavior was also found to be different. In the past, marine turtles have tended to dive out of sight if the helicopter has approached too close. Using a 35 mm camera with a 28-200 zoom lens and loaded with Kodacolor 200 print film, I took several "safety" pictures from 700 ft high. We circled the turtle for 10 minutes at a speed of 30 knots, gradually reducing altitude to approximately 50 ft. Observation was not constant due to losing sight of it occasionally during turns. The turtle was swimming at, or just below, the surface at a very slow speed and was using just 4 or 5 strokes of its flippers per minute. It seemed to be unaware of the helicopter because it exhibited no alarmed or frantic motions, even at low altitude, and did not immediately dive. It was the pictures taken at this time that revealed the most unusual behavior. At some point when the animal was unobserved, it had turned over and was swimming on its back. The first lower altitude picture shows an animal dorsal side up. The longitudinal ridges are clearly visible (fig.). During a subsequent circle,

another picture was taken. Although the animal is somewhat deeper, it is also closer. No ridges can be seen and the turtle appears to be swimming ventral side up (fig.). The fact that the animal was upside down was not visually noted at the time due to the difficulty of trying to take the picture, and the fact that there was no color cue to indicate that the turtle had turned over. The turtle slowly dove from sight after this circle and no further observations were possible.

Observation of Leatherback turtles at sea is rare, but there have been some anecdotal stories of upside down swimming. The behavior is sometimes linked to a threat, such as sharks, and accompanied by wild thrashing (Cropp, 1979). Just after the picture was taken that showed the animal on it's back, the turtle dove from sight. This could suggest that the behavior was indeed part defensive or investigative in nature. There was, however, no flailing noticed.

ACKNOWLEDGEMENTS

I would like to thank pilot Bill Hines and fellow helicopter observer Mark Lowry.

ROBERT E. SCHROEDER

SOMETHING RICH

1965

184 pp



AND STRANGE

FULL FATHOM FIVE THY FATHER LIES,
OF HIS BONES ARE CORAL MADE.
THOSE ARE PEARLS THAT WERE HIS EYES
NOTHING OF HIM THAT DOETH FADE,
BUT DOETH SUFFER A SEA-CHANGE
INTO SOMETHING RICH, AND STRANGE.

WILLIAM SHAKESPEARE IN *The Tempest*

HARPER & ROW, PUBLISHERS, NEW YORK AND EVANSTON

picture. At the pop of my flash he turned the big fellow loose. I was nearly bowled over in its blind dash for freedom.

Several times after that we found large turtles on the shallow ledge at night. Like the fish, they were blinded by the lights and blundered helplessly when attempting to swim away; but often, if we did not touch them, they did not even move.

Turtles are pestered by external parasites just as much as reef fish are. There is a species of barnacle found only on the shells of marine turtles, and also a marine leech with frilly gills that attaches itself to exposed areas of skin. Once I pecked under a turtle sleeping on the reef and saw a small crab running busily on its lower shell. I could not see what the crab was doing, but he could have been picking off and eating turtle leeches, or possibly eggs that leeches attach to the turtle shells.

A friend once brought me the body of a small green turtle that had washed up on the beach. Its eyes had been blinded by large fringy warts growing from the lids. It was literally crawling with leeches. Turtles often grow such warty masses at sites of irritation, and it may have been that the leeches caused the warts, thus causing the blinded turtle to starve to death. Or the obverse could have been true; a blind turtle could not have visited leech-pickers, and the leeches would have multiplied unchecked. The dead turtle's body was covered with patches of yellow leech eggs, laid close and thick, like an obscene mosaic.

Sea turtles have powerful jaws that can easily amputate an arm or leg, but the loggerheads, hawksbills, and green turtles usually encountered on the reefs are peaceful creatures. They make no real attempt to bite a diver who catches and rides them, unless some part of his anatomy is actually presented to their mouths. When released they only try to escape.

This is not true of the leatherback, largest of sea turtles. The leatherback is an active swimmer of deep oceanic waters, but occasionally he may be encountered along the deeper offshore reefs. This bruiser often has a shell six or seven feet long and weighs well over a thousand pounds. Some have been caught that weighed nearly a ton. The leatherback is best left strictly alone!

When I was new to diving, a friend and I spied one of the big leatherbacks sporting himself in the deep blue Gulf Stream waters off Fort Lauderdale. Up he came to take a mighty gasp of air, somersault over backwards, and dive down vertically. Every minute or two he came up for another breath, and as he went down again his ludicrous mottled pink and green tail, a foot in diameter and half a yard long, stuck up in the air.

The sight fascinated us. We ran the boat alongside to poke the disappearing tail experimentally with a paddle. Down went the huge brown shell, as large as a living room carpet; then, looping around, it came rushing up at the boat. Wham, he hit the bottom! The boat rocked violently, and we grabbed for support to keep from being tossed out. He lifted his enormous head to grasp the rail in his jaws: *crunch!* The wood splintered like a matchstick. He tore off several feet of rail and made toothpicks out of it. While he was busy with that we gunned the motor and left!

A few weeks later, apparently not having learned anything on the first encounter, another diver and I found a large leatherback swimming near an offshore reef in eighty feet of water. This time we were in the water. Small turtles may flee from a diver, but this fellow paid no more attention to such insignificant creatures than he would to a couple of amberjack. We conceived the hare-brained idea of riding him. Swimming up behind, we both slipped onto his back, grabbing the forward edge of the shell. The turtle was at

least six feet long, so there was plenty of room on it for us both—but he didn't think so!

He took off like a torpedo, tearing through the water so fast that I was afraid my face mask would be swept away. It was impossible to steer him. Up and over he went in loop after loop, tipping his head back to glare at us. His head was as big as a nail keg, and the wicked beak was fourteen or fifteen inches long. With belated prudence, we let go and slid off the huge shell.

The leatherback was not willing to let it go at that. Around he came, boring straight at us. I remembered that rail on the boat. We put our long pole spears against the skin between his flippers and neck, trying to hold him off, but he pressed straight on in, pushing us violently backward through the water, snapping his huge beak in a rage. We shoved him down under us and headed fast for the surface, but around he came again. We were forced to hold him off again with our spears. The situation was ugly. If he kept this up, ultimately at least one of us would get it. But the second time we pushed him off he gave up, swimming huffily down the reef. I think I was never so happy to see a specimen get away. **Leatherbacks are not for playing.**

I do not remember by date or sequence the most interesting dives we made along the Florida Coast. Some people have orderly minds that fix a date and time on each thing that happens in their lives. I do not. To me, those dives are an assembly of shining events, each identified by such titillating titles as "The Night The Boat Got Away," and "The Time We Rode The Turtle," and "The Squid That Posed For Pictures." If I were required to place these events in time and sequence, I should be at a loss. The information is in my files and that, I think, is where it belongs.

High on my list of memories is "The Night We Couldn't Find

The Boat." Walter and I had anchored in the middle of the reef where there was no convenient ledge to guide us back, and were depending only on our underwater beacon. Except for the remarkable water clarity, it was a marginal night, with a stiff breeze blowing and long-backed ocean breakers crashing across the reef. We were pushing a point by diving at all, and we pushed it even farther by diving without a boat tender. Neither of us wanted to remain in the rocking boat.

We wandered far over the reef, and I began to enjoy the wild night. Photography was impossible because we could not focus a camera while being swept a yard back and forth with each passing wave. But the reef creatures were out and the sightseeing was excellent. It was some time before I realized that I could no longer see the underwater beacon.

I waggled my headlamp at Walter, and we rose to the surface. "Can you see it?" I received a blank stare.

"It can't have broken loose again," said Walter, "That anchor in the coral would hold a battleship. The line's brand new! It's got to be somewhere. Let's find it!"

I nodded, but had an awful feeling that I had been here before. Maybe the bulb had only burned out.

We spread as far apart as we dared, and made crosswind sweeps along the reef. The long anchor line made a big target; I was sure we could not miss it. But all we saw was reef-top. It would be a long swim home.

Distances and directions are deceptive at night. Every so often we popped up to look for the boat's riding lights, but all we could see were enormous waves towering over us. Half the time we couldn't even spot Alligator lighthouse, only a mile away and high above the horizon. I was certain we had crossed and recrossed the spot



Department of Zoology

University of Toronto - Toronto - Ontario - Canada M5S 1A1

July 6, 1989

Dr. G. Balazs
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Center Honolulu Laboratory
2570 Dale Street
Honolulu, Hawaii 96822-2396
U S A

Dear George,

Your letter was a timely reminder that I had been meaning to write to you, to compliment you on the superb job you did with the IUCN certificates. So far I have sent one out, to a grass roots worker in Suriname. I hope the lashings of gold are appreciated.

The case of the upside down "albino" leatherback ... quite remarkable. I have indeed seen one leatherback that spent quite a bit of time upside down, and it was also very pale in colour! You have seen that turtle too., It was the juvenile animal that was raised at the Miami sea aquarium; we (the turtle group) visited it after one of those meetings. You probably only saw it outside, while I spent some time observing it in its tank on another occasion and taking temperatures (1980 Amer Zool.). Probably it was just a coincidence, associated with captivity, that it was pale.

My reading of the literature is that there are a few anecdotes of leatherbacks thrashing around taking avoiding action, and maybe turning over, but nothing systematic. I have been busy writing a book on Physiology, and my leatherback MS still languishes for want of a publisher, since I fell out with Harvard University Press over the matter of illustrations.

Best regards, and see you perhaps at one of these meeting sometimes (although I attend rather few now).

Yours,

Nicholas Mrosovsky

NM/bm

hunted for their meat and oil. The oil is used for varnishing boats, fuelling lamps as well as for medicinal purposes.

Can we estimate the economic value of a leatherback in dollars and cents?

The leatherback is a priceless heritage. It is impossible to put a dollar value to its worth. We can, however, estimate its value as an egg producer. Each female leatherback lays an average of about 450 eggs per season. At the current price of \$1.80 per egg, this works out to a value of about \$800 worth of eggs per season. Tagged turtles have been found to be still actively laying eggs 15 years after they have been tagged on the beach. Since they lay eggs every alternate year, each female, if not killed prematurely, is capable of breeding at least 7 times in her lifetime. Hence each female leatherback is worth at least \$5,600 for her eggs alone. What about her value as a tourist attraction, and her biological value as a survivor of the primitive mammoth reptiles? It is indeed impossible to state these in monetary terms.

THE LEATHERBACK TURTLE: A MALAYSIAN HERITAGE

o the eggs in the markets contain live embryos?

When freshly laid eggs are kept in the laboratory for incubation at normal room temperature, the developing embryo becomes clearly discernible after one week. By 10 days, the heart is already well-developed and can be seen actively pumping blood through the fine blood vessels surrounding the embryo. It is quite possible for the fresh eggs in the markets to develop to this point.

Why are people so attracted to the leatherbacks?

The leatherbacks hold people in awe. They are enormous, look very primitive and seem so mysterious as they creep silently ashore from the dark seas to perform the laborious feat of nesting, and then, just as unobtrusively, disappear into the night seas again. Unlike most other wildlife, leatherbacks are gentle creatures and are safe to watch, even at close range. They do not attack and are utterly defenceless on the beach. People who have heard of this wondrous creature often make it a point to see the real thing for themselves. Tourists come not only from all parts of Malaysia, but from foreign lands as well.

How many tourists visit Rantau Abang each year to watch the turtles nest?

In 1980, Leong and Siow reported that about 800 tourists visit Rantau Abang each month during the peak season. This figure is a very conservative estimate. In 1982, Siow and Moll reported that at least 50,000 tourists flock to the beaches in Rantau Abang each year. In 1984, the present authors made actual counts on the total number of tourists entering one tendered area alone for three consecutive nights and came up with an average of 300 tourists per night.

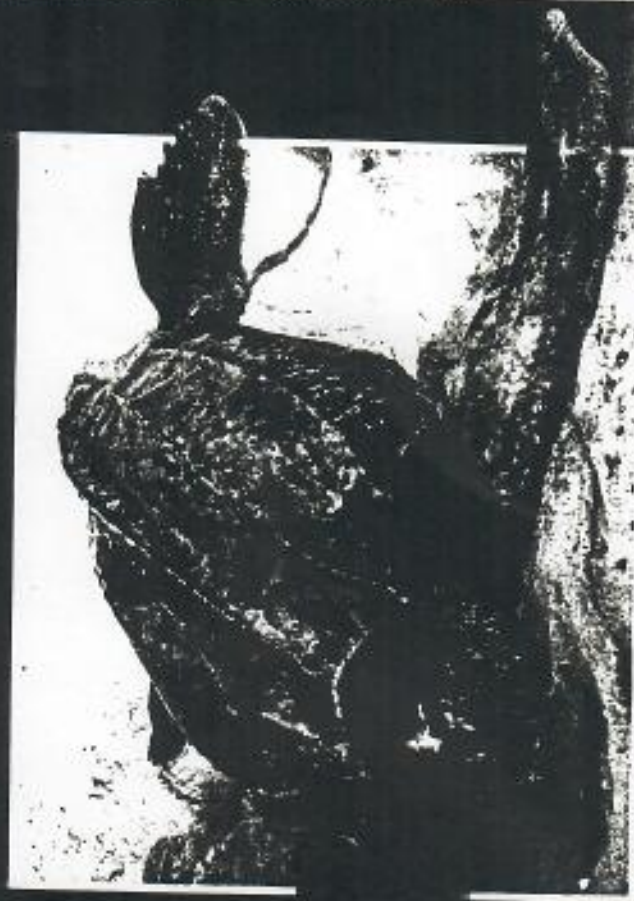
Are the leatherbacks killed for their meat and other products?

In Malaysia, fortunately, the leatherbacks are never intentionally killed for their meat or other products. Most of the coastal villagers associated with the leatherback are Muslims who are prohibited by religion from eating turtle meat. However, elsewhere, especially in Mexico and Irian Jaya (Indonesia), the leatherbacks are diligently

THE LEATHERBACK TURTLE

A MALAYSIAN HERITAGE

Chan Eng Heng and Liew Hock Chark



Chan Eng Heng and Liew Hock Chark

THE LEATHERBACK TURTLE: A Malaysian Heritage

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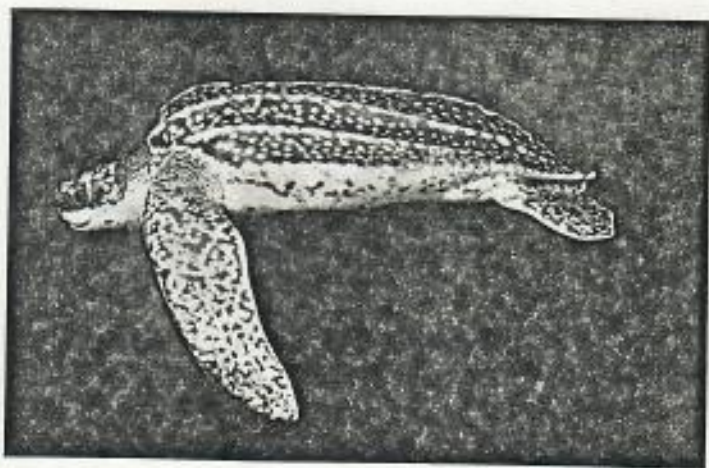
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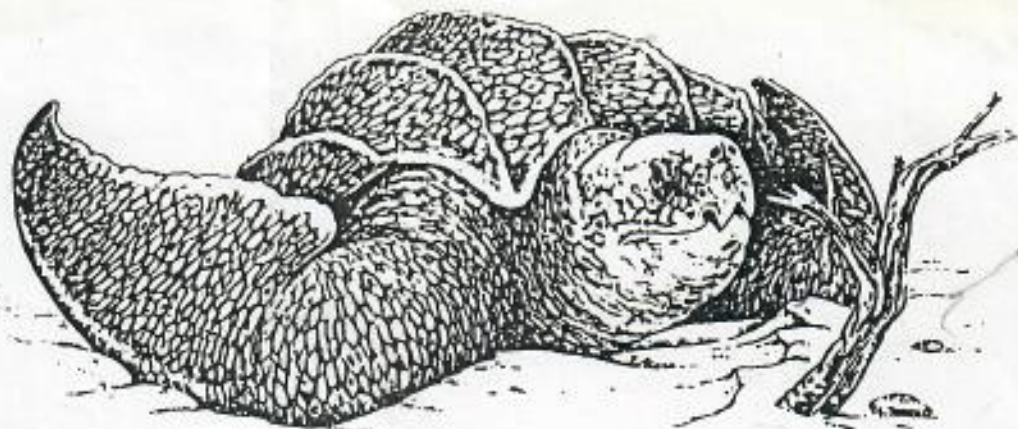
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2

Dermochelys coriacea (age 21 months) $\times 1$

LIBRARY OF
GEORGE H. BALAZS



Dear George,

Your letter was sent to me in French Guiana at the end of the 1989 nesting season.

I have been waiting to see an albino come out of the sea for a long time. It would be my "white whale". And now, you tell me you have seen a white leatherback! How amazing!

So far I have seen nothing but a few albino embryos in their late developing stage and not likely to live (an ivory carapace with bluish ridges, blue eyes and cephalic deformations)*

I have never seen any leatherback swimming upside-down or heard of such a behaviour reported by fishermen. I think this could result from motion troubles of the flippers. It would be interesting to discuss it with an anatomist.

Could you send me a copy of the pictures of this mysterious white leatherback... I would then be able to give you my opinion more precisely.

Sincerely

Jacques FRETEY

* They can be watched at the Museum in Paris.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southwest Fisheries Center
La Jolla Laboratory

George Balazs
Honolulu Laboratory

May 1, 1989

Dear George,

I am sorry it has taken me so long to respond. Things have been very hectic here analyzing last years' data, and getting ready for this years cruise. I am also resigning from the NOAA Corps and will hopefully be hired on here.

I am still very interested in writing something on the "albino" turtle sighting. I have had reprints and slight enlargements of the pictures I took made and they are enclosed. The one marked "A" is the one you saw while you were here. The picture you didn't see is marked "B". It was taken from slightly farther away, but the animal is closer to the surface. I think it looks more like the turtle is right side up and is albino (or at least lighter than usual), but it is still ambiguous enough for me to be unsure. Also, I don't know enough about what the underside of a Leatherback looks like. What do you think?

I found the article interesting. It describes the behavior of the upside down turtle as "tumbling" and "thrashing with all four flippers". My turtle was not engaged in any frantic activity at all. I saw it as a white object before the helicopter could have affected its behavior, and saw no sharks. From a higher altitude, I observed it to dive out of sight with no change in its light color. But because memory can be such such a fickle thing sometimes, I only wish the pictures wouldn't cast any doubt! Because I haven't written anything for publication, except for an admin report, I would appreciate any advise on where and how to go about it.

Thanks for everything, Robin says hello and says she has not recieved any roses lately, but is working on it!

Aloha,

Morgan





UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

September 28, 1989

Dear George,

I am returning your leatherback turtle slide to you. I haven't done anymore work on the "white" turtle paper, but I have been thinking. Maybe we should emphasize more that it is also the opinion of other experts looking at the picture who think that it is upside down, since nobody in the helicopter remembers seeing it that way.

Anyway, it's back to sea in the ETP for me! I will definitely keep my eyes open for Whitey, or anything else unusual. I will also try extra hard from now on to get better pictures and observations. I will be back at the Lab after December 7. I can be contacted through Jim Gilpatrick (x195).

Take care,

Morgan





The University of Rhode Island, Kingston, RI 02881 USA
Department of Zoology (401) 792-2372

December 4, 1989

Dr. Georges Balazs
NOAA-NMFS
Southwest Fisheries Center
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear George:

Thanks very much for your letter of 28 November. It is always good to hear from you!

No, I have never seen a leatherback swimming upside down, but I have probably seen less than a hundred in the open ocean. I have, however, been frequently fooled by ocean sunfish (Mola) lying at the surface, or on their sides, sometimes tipping, or flapping around. At first, they look very much like leatherbacks and are associated with jellyfish (also). I can't tell you how many times I asked the pilot to circle, only to find a "scrambling" Mola responding to our low-level pass. We have lots of Mola pictures turned in as "probable leatherback." There is no reason, of course, that a leatherback has to swim with carapace toward the surface.

I look forward to seeing you at Hilton Head. We have another bomb to drop in our paper

Cheers.

Sincerely,

A handwritten signature in black ink, appearing to read 'C. Shoop'.

C. Robert Shoop
Professor of Zoology

CRS/rld

SINCE NINETEEN HUNDRED



"THE VOICE OF CONSERVATION"

Dr. George Balazs
NMFS
SW Fisheries Center
2570 Dole Street
Honolulu
Hawai'i 96822-2396

January 10 1990

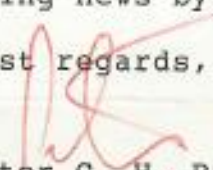
Dear George:

Thanks for your two letters. I was glad you enjoyed the "reply to Frazier." Maybe I'll hear from him too in due course...

The two photos were intriguing, and so was the enigmatic nature of your query about them. Clearly George knows a leatherback when he sees one, I thought, so what is the actual problem? Of course, the turtle seemed to be a little whiter than is usual, but this could possibly be attributed to reflection from choppy water conditions. But then, looking more closely, I think I see what you were asking about. One photo clearly shows the turtle from an antero-dorsal viewpoint, with the longitudinal ridges of the carapace showing. But the other seems to be different. My impression (not absolutely certain) is that this turtle has flipped over and is "sunning its plastron." Is this how you interpret the same picture? Most curious behavior indeed.

I look forward to seeing you in South Carolina. I'll be in all three of the Guianas before then, on various turtle-related missions, so hope to have some interesting news by then.

Best regards,


Peter C. H. Pritchard Ph.D.

FLORIDA AUDUBON SOCIETY

1101 Audubon Way • Maitland, Florida 32751 • (407) 647-2615

Marine Turtle Newsletter

Dr. Karen L. Eckert
National Marine Fisheries Service
Southwest Fisheries Center
8604 La Jolla Shores Drive
La Jolla, California 92037 USA

14 November 1989

George Balazs
NMFS SWFC Honolulu Lab
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear George,

Thank you for all the wonderful material you have sent lately!! I did some rearranging and included your article on initiatives in the Pacific in the "October" issue of the MTN (which is still sitting in my computer until the printing and mailing funds are transferred from the Univ of GA to the Regents of the Univ of CA); I had to make a few editorial adjustments, but I believe you will find it to your liking. Space was of the essence. I am not sure about "wider distribution" of Margies' thesis -- I can't even get a hold of it! It is almost 600 pages long and in two huge volumes!! She really needs to distill and publish it. It appears to contain some really neat info. I look forward to meeting her; I have not had the pleasure yet, but Peter and Donna brought her to the SWFC to hear a Seminar I gave the other day. However, there were so many questions at the end of the talk that they had to leave before we had a chance to be introduced.

I have distilled some of the newspaper clipping info that you shared; find enclosed. I would like to make note of the situation in Bali, and also of the turtle "farred" in Hawaii. What do you think of the excerpts in this regard? We don't have the space to print whole newspaper articles, but I think MTN readers will be particularly interested in the young green turtle. Can you give us an update? We will publish in the January issue if you agree.

X The "upside-down" leatherback sure is interesting! Goodness! No, we have never seen such a thing. Maybe the upside-down position was just a prelude to the dive?? Let us know if anyone shares insight. Bob Shoop may be a good one to ask; he has done lots of aerial work off the east coast. Gonna come to the February Workshop? Would love to see you. Keep in touch; all the best.

Fond regards,



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George Balazs
SWFC, HONOLULU LAB
2570 DOLE ST.
HONOLULU, HAWAII, 96822-2396

I am just now catching up on some correspondence and your note of Sept. 25 is up. I suspect it is so long ago you don't remember sending it! Sorry about that... You've described a hissing behavior by a leatherback when approached by a helo. and sent a xerox of photos. I don't believe I've ever heard of such behavior before - though I've never flown over a leatherback before either. I'm sure both Pritchard and Shoop have though, so you might check with them. As to the coloration the xerox is too hard to tell - but it doesn't look too light to me. The leatherbacks I've seen do have a large amount of white on the plastral surface - but without a better image I ~~do~~ don't know if this particular animal is unique.

Sorry I'm not of further help.

Sincerely
Scott Eckert.

P.S. Rumar has it that you'll be at the workshop in S. Carolina this year. I look forward to seeing you there.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

January 31, 1990

Dear George,

Sorry it's taken me a while to get these pictures back to you. Things have been pretty hectic around here after returning from sea, and going through that whole holiday thing. I also took some time off.

As you said, you don't know til you try, but I guess the "enhanced" or B&W pictures don't help a lot in the interpretability of the "upside down" turtle. They do look nicer though. They also don't make the turtle look as white as the other pictures, or as I remember it being. I mean, it really stood out in the ocean. We noticed it from quite a distance away.

Consensus (of both experts and non-experts) seems to be for an upside down animal, but with some uncertainty. I still can see it both ways. It reminds me of that optical illusion that looks like a candle stick or two faces facing each other, depending on how you look at it!

I think the white spot in the picture is a piece of trash of some sort. The edges look to sharp and square to be a jellyfish or something like that.

Take care,

Morgan



Headless Leatherback on Ocean Shores beach

by Kathleen Wolgemuth

Even without a head, it was still magnificent, as inert as a giant mushroom near the high tide line north of the Butter Clam approach off Ocean Shores Boulevard.

It was over six feet long and three feet wide, its flippers extended fore and aft. Two crows feasting on fragrant morsels fluttered upward to eye us as we circled.

It was a leatherback turtle, its carapace not the hard stuff of tortoise-shell combs, but a smooth leather featuring longitudinal ridges. Leatherbacks are the largest of the sea turtles, up to nine feet long, and at home in tropical waters.

Why, then, was this one here, and what had killed it--besides the severed head? In the next ten days I called the Ocean Shores city hall and police, Washington State Wildlife (Olympia and Montesano offices), Burke Museum, U. S. Forest Service, Seattle Aquarium, National Marine Fisheries, Marine Animal Resources Center, U. S. Pacific Sea Turtle Recovery Team (out on a job), Olympic Wildlife Rescue Center, and Washington State Patrol's Seattle, Aberdeen and Olympia offices.

Here's what I found:

First, "The Case of the Missing Head." Bear in mind that I write fiction; any errors in what follows are my unwitting own.

Since last July, three dead turtles have washed ashore on Long Beach Peninsula. The first was transported, intact, to the Burke Museum, premier Northwest repository for dead turtles, where a necropsy uncovered no apparent cause of death. The second turtle, a leatherback in a location inaccessible to vehicles, was too unwieldy to move by hand. Its head was sent to the Burke instead, and the carcass buried as best a 1500 pound carcass can be: shallowly, on a sloping shelf of sand.

High tides pounded in and--probably--that Headless Turtle set off "to haunt another beach," to quote Ocean Shores' police officer Wade: our beach.

Why had this leatherback come to our cold waters? Keith Aubrey, wildlife biologist with the U. S. Forest Service and volunteer curator of reptiles and amphibians at the Burke Museum--he of the necropsy--says that although tropical, leatherbacks have been sighted as far north as Alaska and New England. Studies suggest that they



navigate by very faint intensities of starlight, he said, orienting back into the ocean by light refracted in salt spray. With settlements springing up along their breeding beaches, their ability to find their way back has been severely affected.

They are the most pelagic (deep sea) of the turtles, he said. They're well adapted for diving, with their smooth carapaces and their ability to eat underwater. Their esophagus and mouth are around five feet long, and contain "pliable white spines that point backwards." When the diving turtles take in a healthy serving of squid or jellyfish and sea water, these spines trap the slippery prey while the water is expelled.

How many are there? Aubrey says, "We know very little about sea turtles, period." Rare to begin with, there are constraints on studying any endangered species.

My next "turtle people" were Kelly McAllister, wildlife biologist for the State Department of Wildlife in Olympia, and Susie Snyder, laboratory supervisor, Seattle Aquarium. I learned that five species of sea turtles have been found along the Washington coast: the Pacific Ridley (up to 2 feet long); Hawksbill (3 feet); Pacific Green turtle (5 feet); Loggerhead (7 feet); and Leatherback (8-9). The first four are hard-shelled. All sea turtles are protected and under the jurisdiction of the National Marine Fisheries Service. Humans present many perils such as hunting them for shells and food (eggs and meat); entangling them in fishing nets; beach development of traditional nesting sites; and pollution.

Any sea turtle found ashore, unless it is breeding, is not a well turtle. Since turtles breed only in tropical waters and nowhere along

the U. S. Pacific coast, any we see here are in trouble. Their only hope is to be quickly treated, at the Seattle Aquarium, the Northwest center for sea turtle rehab.

Aquarium advice: Don't assume a beached turtle is dead that looks dead (missing a head is a different matter). Don't move it back into the water; it's already suffering cold shock. Keep dogs and people to a distance, and phone the Washington State Patrol (see below). They will alert the proper authorities.

Arriving experts will move it on a foam pad in an enclosed vehicle to the alerted Seattle Aquarium. There, the medical profession awaits with fluids and antibiotics, blood tests and cultures. Stabilized, the turtle is placed in a saltwater pool that's gradually heated to Maui or Mazatlan levels.

Two of the Aquarium's four turtles since November 1989 were from Ocean Shores--a green and a ridley, both reported by Ocean Shores gift shop owner and champion beachcomber, Doc Bedilion. A 170-pound green arrived two months later, and the Aquarium's first loggerhead in 1991. The large green, Snyder says, was very sweet. "They're fascinating creatures," she says.

Then, when the turtles are well again and the waters off the California coast deemed sufficiently warm, Alaska Airlines has donated space for them on their California flights.

I picture a nicely-behaved turtle drifting to sleep across seats A and B while the passenger in C props a book on its back.

Not so. It's back to that foam-pad. In San Diego, a turtle person bundles the tagged animal to a waiting fishing boat which tootles out to the deep sea. Then, overboard, and freedom.

The Ocean
Observer
12/93
Seattle(?)
Washington

- 2) Rare taxa are older than most faunas sampled in cave deposits.

The latter explanation needs further comment. Auffenberg (1967) noted that most Antillean sites which produced fossil *Geochelone* were cemented cave and fissure breccias, and suggested that these deposits were older than the typical cave-fills. Late Pleistocene cave sites that have yielded tortoise material, such as those on Mona Island and the Bahamas, may indicate that tortoises persisted on certain islands for a time after they disappeared from other islands. Auffenberg (1967) thought that this reflected a trend toward range reduction and relictual distribution that was characteristic of tortoises in the late Pleistocene. Pregill (1981) suggested that the West Indies had a cool, dry climate 15,000–20,000 years ago, the approximate age of the oldest known cave deposits from Hispaniola. By 13,000 years ago the climate had shifted to become more mesic, and xerophiles like tortoises may have been restricted to coastal areas (such as near Bayaguana). Thus, *Geochelone* may have been extremely rare during the times when fossils were being deposited in Hispaniolan caves. Most deposits in Hispaniola analyzed to date are younger than 10,000 BP (unpublished data). This is a University of Florida contribution to Vertebrate Paleontology, number 221.

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A Leatherback Turtle (*Dermochelys coriacea*) Feeding in the Wild

J. F. EISENBERG AND J. FRAZIER, *National Zoological Park, Smithsonian Institution, Washington, D.C. 20008, USA.*

Since Brongersma's (1969) extensive review of the stomach contents of *Dermochelys coriacea* (L.) in Europe, more and more evidence has accumulated indicating that this, the largest of all testudines, specializes on pelagic medusae, salps and other objects of similar appearance. Foster and

Chapman (1975), Witham (1977, 1980); Witham and Futch (1977) have described the consumption of the jellyfish *Cassiopea xamachana* by young captive turtles and the importance of a jellyfish diet for successful captive rearing. The seasonal concurrence of these turtles and large numbers of jellyfish in the Gulf of Maine (Lazell, 1976, 1980) and off the coast of Peru (Frazier, 1979), and the common occurrence of large amounts of plastic in intestines (Mrosovsky, 1981; Frazier, pers. obs.) indicates a strong association in the wild between turtles and medusae or like objects. Although Foster and Chapman (1975) relate that "local boatmen had seen marine turtles in the wild feeding on various species of jellyfish," there seems to be no published account of feeding habits in wild turtles or adults. Here follows an account from notes made by J. F. Eisenberg (JFE).

On August 3, 1981, I (JFE) left the Westport dock, Washington State, at approximately 0455 hours (PST), and about 45 minutes later was nearly 2.5 km from the coast and some 11 km south of Westport (46°40'N, 124°15'W). We encountered a swarm of Aurelia, the extent of which was difficult to estimate, but decreasing our speed to about 8 knots, we were continuously surrounded by the jellyfish for some ten minutes. I then observed, approximately 30 meters from the boat, what appeared to be a log but on closer inspection, given its rounded contours, I felt it might be a capsized hull. Suddenly, a head appeared out of the water and my first impression was that of a seal; however, the body was floating too high in the water. We changed course and closed, dead slow, to about 20 m. It became apparent that we were observing a *Dermochelys coriacea*, approximately 2 m in length. The animal periodically raised and then lowered its head into the water and was swimming slowly. We were immediately able to perceive that it was feeding, the head being lifted from the water to assist in swallowing. When we were at most 8 m away, the animal lifted its head. We could see smaller tentacular elements at the corners of the partially opened mouth. It then swallowed, lowered its head, and dove. Although we remained idle for some five minutes, it did not reappear on the surface.

Clearly, we had witnessed surface feeding by *Dermochelys* on the jellyfish. I inquired of the skipper how frequently leatherback turtles were sighted and he reported a sighting two years ago, producing a polaroid photograph to substantiate it. National Marine Fisheries Service personnel made sightings along the Pacific coast in 1981 (T. MacIntyre, pers. comm.), hence there may be opportunities to conduct detailed observations on the feeding behavior of *Dermochelys*.

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Journal of Herpetology

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Accepted: 11 March 1982.

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Feeding by *Trionyx spiniferus* in Backwaters of the Upper Mississippi River

PHILIP A. COCHRAN¹ AND DAVID R. MCCONVILLE,
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Minnesota 55987, USA.*

The spiny softshell turtle (*Trionyx spiniferus*) is a common element of the Upper Mississippi River community. Webb (1962) reviewed the literature on its food habits, much of which is anecdotal. The data reported herein are based on a larger sample size than most earlier reports and permit preliminary inferences about prey selectivity and other aspects of feeding behavior.

Trionyx spiniferus were captured during the summers of 1975 and 1976 in unbaited fyke nets used during fisheries investigations in three backwater areas. The Weaver Bottoms of Pool 5, the Fountain City Bay backwaters of Pool 5A, and Sam Gordy's Slough of Pool 6 are located along the Upper Mississippi River within a 40 km stretch upstream from Winona, Minnesota. Since the nets were set primarily to catch fish, the box ends were often submerged, and sets lasted for approximately 24 hours. Excised stomachs of turtles that

drowned in the traps were frozen for future analysis; most of the surviving turtles were released.

Fremling et al. (1979) reported on a survey of the benthos of the Fountain City Bay backwaters in 1975. Two sets of Ponar dredge samples that coincide closely in time with collections of turtles approximate the range of organisms potentially available to turtles foraging over soft bottoms. Organisms in one set of eight samples collected on 24 June were compared to prey items in the gut contents of eleven turtles collected on 26 June, 27 June, and 2 July; the organisms in nine grabs on 6 August were compared to the contents of nine turtles collected on the same date. Both groups of turtles were collected in traps set in quiet water off Devil's Cut, a deep fast-flowing channel that empties into Fountain City Bay. Each Ponar grab covered a bottom area of 0.06 m and was sieved through a No. 40 soil sieve before processing. Because annelid worms typically fragment during sieving, the numbers of annelids recorded are the numbers of fragments. For further details, as well as descriptions of the three study areas, refer to Fremling et al. (1979).

Stomachs from 31 turtles were examined (carapace length: mean = 205 mm, range = 91-401 mm; mass: mean = 967 g, range = 57-5216 g). Two stomachs were empty. The remaining 29 stomachs contained over 382 insects (Table 1). Dragonfly naiads, *Hexagenia* mayfly naiads, and crayfish were found in the greatest proportions of stomachs. Many items were swallowed whole, including 5 cm dragonfly naiads, 5 cm white crappie (*Pomoxis annularis*) fingerlings, and the sand cases of trichopteran.

Fish remains, in some cases single scales, were found in eight stomachs. This result must be interpreted with caution since trapped turtles were often confined in close quarters with fish. Indeed, partially consumed fish were often found in the fyke nets, although other turtle species were often also present. On one occasion, a net contained a large number of white crappie fingerlings and two softshells that had eaten one and fifteen fingerlings respectively.

Relatively more female turtles than males contained fish remains ($\chi^2 = 6.73$; $P < 0.025$); relatively more males contained dragonfly naiads ($\chi^2 = 4.15$; $P < 0.05$). There were no significant differences between sexes for crayfish ($\chi^2 = 0.93$) or *Hexagenia* naiads ($\chi^2 = 0.24$). Plummer and Farar (1981) found a greater propensity for female *Trionyx muticus* to eat fish, a phenomenon perhaps related to body size. Other sexual dietary differences were thought to be related to differential use of microhabitats.

Trionyx spiniferus might be classified as a generalist feeder because of the wide variety of prey taxa it consumes. However, there are two extremes in the way that such overall variability in diet may be generated by a predator that typically contains large numbers of small prey items. A wide variety of prey types may each be found in large

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Ben Cropp

had an irresistible longing to travel, to see strange lands and the people and animals that lived on them. However, on his long exploratory voyage in the *Cygnat*, his crew was less honorable. They had decided if the food ran out, Captain Swan, a fat man, was to be eaten first, then Dampier, though he was thin and wiry. It is recorded in history that "The pirates were spared a bout of indigestion!" Perhaps the kangaroos and the captured sharks at Shark Bay saved Dampier. Captain Swan was able to joke later, "Ah Dampier, you would have made them a poor meal."

We were two miles off Steep Point, sweeping the deep water for whales or whale sharks, when a splashing of water caught my eye. I ran *Beva* over, and was surprised to see a large leathery turtle on its back, wildly thrashing with all four flippers. Now it flipped and rolled over several times, dived briefly on an erratic course, then surfaced and continued the thrashing and tumbling.

I thought it was crazy—until I spotted the shark. It was a big white, a silent shadow circling under the turtle. Fortunately I was able to film this extraordinary tactic. It is rare enough to meet a sea turtle, and this evasive tumbling behavior had never before been documented.

The great white nosed upward, a graceful but ominous threat to the poor reptile. We gunned the motors and cut the shark off by running alongside the turtle. We had successfully tried this before when a tiger had harassed a green turtle to the point of exhaustion.

The shark brushed the port side of *Beva* and dived straight down. On the starboard side the leathery turtle went into another violent burst of tumbling and thrashing on the surface, yet the shark had gone. I realized the turtle was regarding the boat as a new predator. By instinct it continued to perform its frenzied evasive maneuvers.

The leathery turtle is another migratory giant. This one had traveled far from the closest known nesting site at Trengganu in Malaya. The next rookery is in Fiji, and there is another at French Guiana in South America. The leathery is the largest of all marine turtles and is classified as a critically endangered species. It is not known to nest in Australia, and feeds principally on a jellyfish diet. This one must have been some two and a half meters in length, and weighed about 500 kilograms. Unlike other turtles, the outer covering of the leathery carapace is not composed of scales but rather of a thick skin. The white shark is perhaps the only predator of the adult turtle.

Besides the migratory ocean giants that feed on the plankton or the migratory fish, Shark Bay still supplies an enormous amount of food to the indigenous marine life. Deep inside Shark Bay are a series of long and shallow indentations with inglorious names such as Useless Loop, Hopeless Reach, and Disappointment Reach. Possibly to the navigator they were so, but for the marine inhabitants they provide a rich source of estuarine nutrients. It is a vital and complex ecosystem, a nursery swarming with the juveniles of all the larger fish species.

In Freycinet Estuary we were exploring along the beds of seagrass, viewing the abundant juvenile marine life when I noticed some wreckage ashore. It proved to be part of a significant chapter in Australia's brief contact with the enemy during World War II.

On November 19, 1941, the HMAS *Sydney* fought a desperate battle with a German raider, the *Kormoran*, off Shark Bay. Both ships sank, the *Sydney* with all hands. From the *Kormoran*, 317 German survivors reached Shark Bay, and this skeletal wreck was one of their lifeboats.

Along the seagrass beds we spotted many dugongs, surfacing briefly between their feeding forays. Around the tip of Heirisson Prong, just past the huge salt works at Useless Loop, we ran into dozens of dugongs. They were all heading north out of the shallow estuaries and curving around into South Passage.

Fisheries Inspector Derek Blackman, at the tiny township of Denhem, explained that the dugong herd here numbered around a thousand, probably the largest group surviving in Australia.

Because dugongs are normally shy of people and generally live in dirty water, no one has filmed them underwater before. Derek told me that the dugong herd I saw was heading for the entrance to South Passage. Opposite Steep Point on the southern end of Dirk Hartog Island is a tongue of reef on which ocean swells crash heavily. The sheltered clear water behind this reef is the favorite winter meeting place of the dugongs.

We used the Beaufort rubber dinghy to run in behind the thundering swells as they surged across the shallows and dissipated above the dugongs' feeding ground. A dozen brown shapes rose on the swells, sucked in air, and went down again. We anchored the dinghy fifty meters away and quietly slipped in with our cameras.

Visibility was good. Every crevice was filled with the bristling antennas of crayfish, but our interest was now only in the

blurred big shapes up ahead. I dived and quietly moved over the bottom, fingers tugging at waving seaweed as I crawled closer. Though I kept low among the waving fronds of the algae, camera running, the nearest dugong stopped browsing when I was two meters away.

Two of the dugongs had fat calves swimming close alongside. One calf ceased nursing on the tiny nipple hidden under the stubby front flipper. Now it slipped onto the back of its barrel-shaped mother and perched, rather than clung, with its little flippers squatting on her broad back. The parent flipped away, the calf remained in its piggy-back position, carried smoothly along by the bow wave.

I grabbed a quick breath of air and sunk prone on the bottom in the weeds again. Mother and calf went up for air too, then together they dived and approached me. The calf was still astride its mother's back, but as she inquisitively came closer, the little one slipped off and hugged her blind side.

The mother weighed at least five hundred kilograms, a cylindrical brown bulk over three meters long. She stopped barely a meter away, her little pig-like eye watching.

It seems impossible that this ugly creature could be responsible for the myth of the mermaid. Only a dugong could find a dugong attractive. Not in my wildest imagination could I see one human female attribute in this ponderous animal before me. The legendary mermaid must have developed through distorted tales that sailors told and retold over the centuries. From this legend, scientists named the species "sirenians".

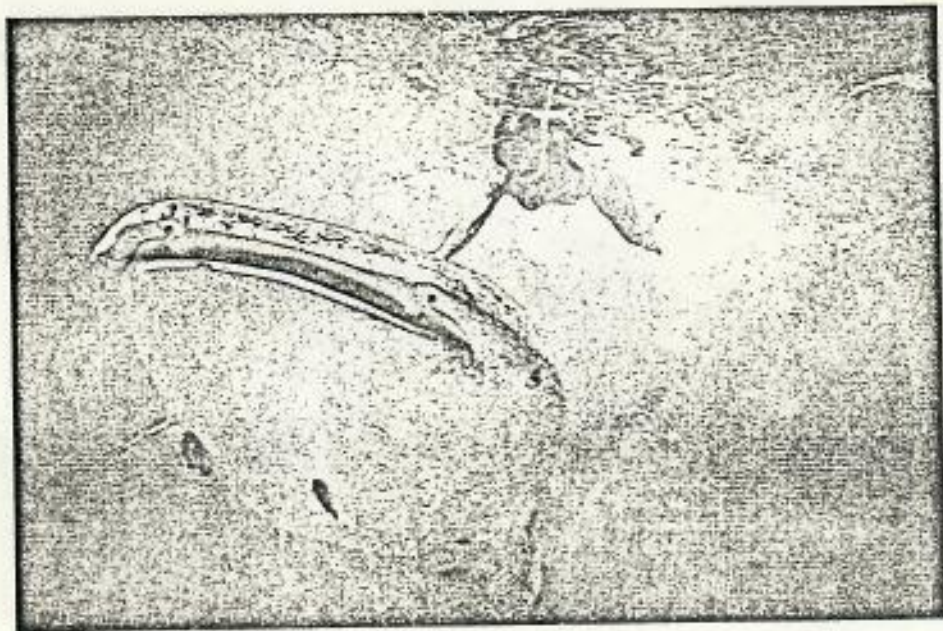
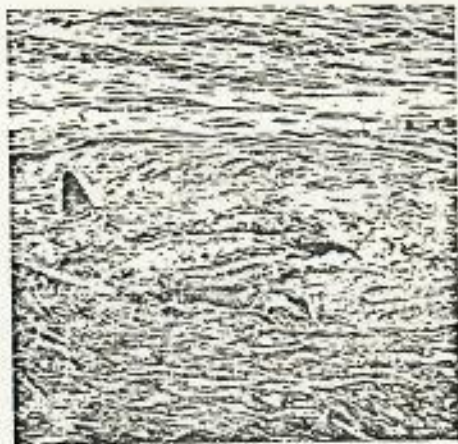
These gentle herds in Shark Bay are a naturalist's dream, where their little-known behavior can be studied at close quarters. Unlike the brief imaginative glimpse by a medieval sailor, or an indistinct shape surfacing from tropical muddy water, here, in Shark Bay, we have a clear view of the dugong character. It is a shy, inoffensive, ponderous creature, a homely, ugly "mermaid"!

The bountiful waters of Shark Bay harbor all the marine animals necessary to sustain life. It is an unspoiled ecosystem. From tiny plankton to large fish, Shark Bay nourishes the ocean traveler—the crossroad where ocean giants meet.

Ben Cropp is an Australian photographer and writer who has authored a number of books about the sea and produced more than a dozen color underwater films for international television.

Trunkback Demoschelys

Left: Green turtles mating. Right: Leathery turtle evades shark attack by turning on its back and thrashing wildly. [Lynn Patterson] Below: Snorkler strokes the back of a thirty-five foot whale shark which swims lazily along the surface. The whale shark, a plankton feeder, is quite harmless.



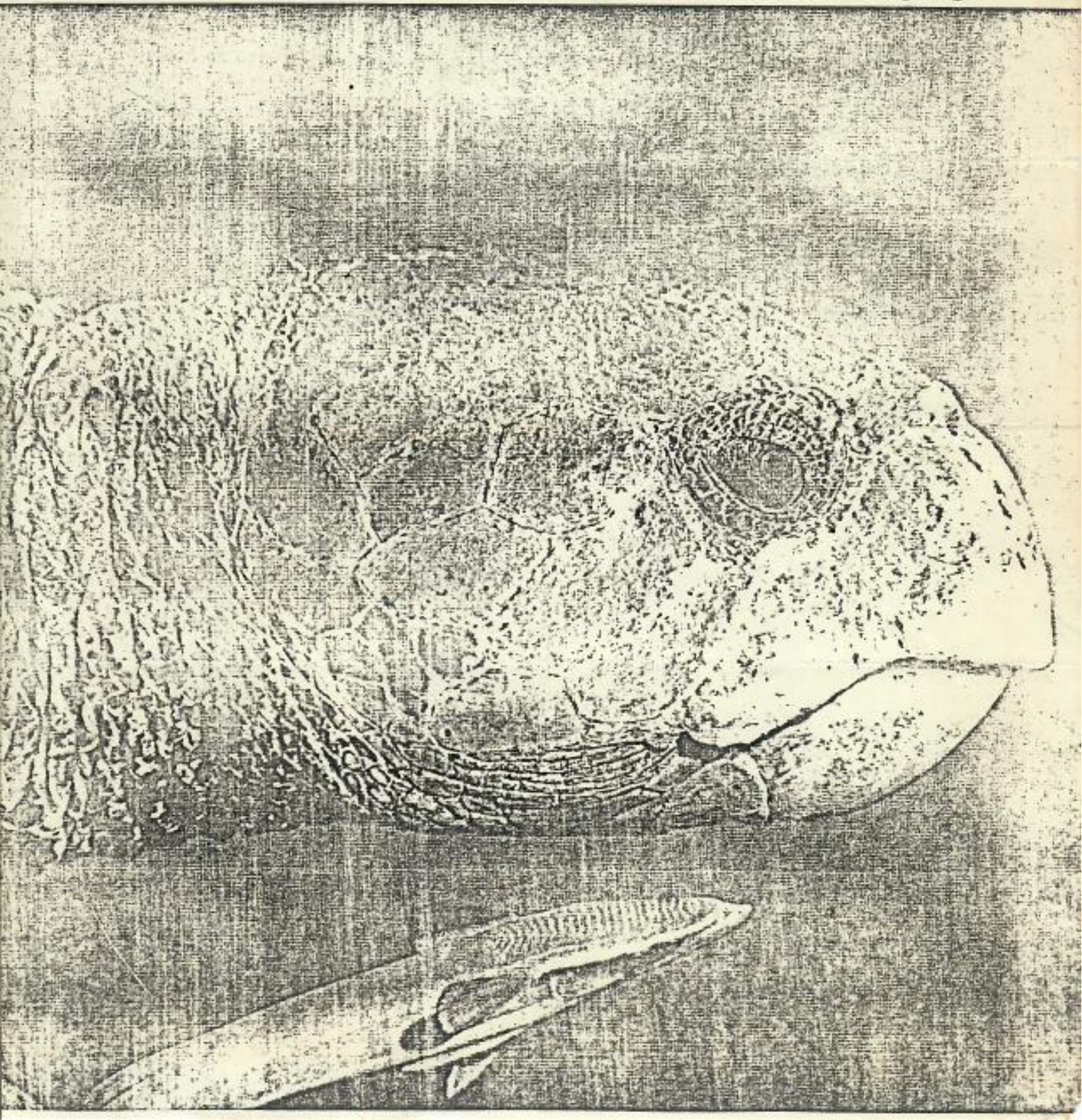
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**JUVENILE LEATHERY TURTLES, *Dermochelys coriacea*
(Linnaeus), IN CAPTIVITY***Elmar Birkenmeier****I. INTRODUCTION.**

The Hassanal Bolkiah Aquarium was very fortunate to obtain a number of hatchlings of the Leathery Turtle (*Dermochelys coriacea*) in September and November, 1970. Very little information on the biology and practically none on the development of this species is available. The Leathery Turtle is listed as an endangered species by the International Union for the Conservation of Nature and Natural Resources. Although only one out of our eight young turtles has survived, our experiences described below may be of value for any future conservation programme which normally involves the rearing of hatchlings for several months up to an age when their chances for survival in the open sea have greatly improved.

The author should like to thank the Fisheries Division of the Malaysian Ministry of Agriculture & Co-operatives for kindly supplying the Hassanal Bolkiah Aquarium with Leathery Turtle hatchlings. Thanks are also due to the Aquarium's Head Aquarist, Awang Ibrahim b. Mumin and the Foreman Aquarist, Awang Haji Suhaili b. Metassan for their patient assistance during the rearing period of the turtles.

II. SYSTEMATICS AND DISTRIBUTION.

Generally two families and five species of sea turtles are recognized. Four of these species belong to the family *Cheloniidae*, whilst the fifth, the Leathery Turtle, is the only member of the family *Dermochelidae*. This species is further sub-divided into two sub-species: *Dermochelys c. coriacea* of the Atlantic and *Dermochelys c. schlegelii* of the Indo-Pacific Region.

The Leathery Turtle can be easily distinguished from all other species of sea turtles by its lack of the horny dorsal and ventral plates which are covering carapace and plastron of all members of the family *Cheloniidae*. The Leathery Turtle's carapace and plastron consist of thick, leathery skin in which small and irregularly shaped bones are embedded. Seven longitudinal ridges are found dorsally and five ventrally. Adult Leathery Turtles are black in colour, juveniles have markings which are usually described as yellow in the literature, but are white in our specimens from Trengganu.

The Leathery Turtle is the largest living chelonian and normally reaches a length of 150 to 185 cm. Larger specimens have been found. Recorded weights vary from 630 to 680 kg.

The distribution is more or less circumtropical, but single specimens may wander far off into cooler seas and may occasionally even reach the British Isles (PRITCHARD, 1967). They are also found in the Mediterranean where they are considered to be rare (ZETZ in REED, 1963). In 1949 the author has seen a

* The drawings are by Erika Birkenmeier.

ELMAR BIRKENMEIER

specimen of approximately 150 cm carapace length caught by fishermen near Banyuls sur Mer, France. These turtles enter the Mediterranean through the Straits of Gibraltar and do not breed there.

III. BREEDING.

The only detailed knowledge we have on the biology of the Leathery Turtle concerns its breeding habits. This is the only time this species comes ashore and can be observed. Once the hatchlings have entered the sea they disperse widely and "..... medium-sized specimens seem to be almost unknown and are never found" (PRITCHARD). According to HUGHES (1969), "biologists have speculated for years on what might happen to the hatchlings during their first years of life, but so far not one genus of marine turtles has had its life cycle described in any way approaching exactitude. The first years are a complete mystery as to distribution and it is not even known on what the hatchlings feed."

Only when they have reached maturity the Leathery Turtles return to the beaches for egg-laying and probably mating in coastal areas. The other marine turtle species are reported to come ashore occasionally for a short sun bath and are not unfrequently found in coastal areas.

The egg-laying of Leathery Turtles more or less follows the usual pattern of sea turtles. The number of eggs in one clutch varies between 50 and 130 and the eggs are buried about 60 to 90 cm deep. The eggs are larger than those of the other marine turtle species and can, in size, be compared with a tennis-ball. The incubation period is about two months.

According to PRITCHARD the only places where Leathery Turtles are known to nest regularly are Matina Beach (Costa Rica), Trengganu (east coast of West-Malaysia), Surinam and French Guiana. Other occasional nesting beaches are to be found on the south coast of Ceylon, the coast of Tenasserim (Burma), Zululand, British Guiana and at various less definite localities at the West Indies, Bahamas, Dry Tortugas, Honduras, Nicaragua and the coast of Brazil.

IV. OBSERVATIONS IN CAPTIVITY.

A) CAPTIVITY RECORDS

Leathery Turtles are very rarely kept in captivity and the "Census of Rare Animals in Captivity" for 1969 (INTERNATIONAL ZOO YEARBOOK 10, 1970) lists only three as being kept at that time in Hawaii and one in Brno, Czechoslovakia. Enquiries in Hawaii and Brno revealed that no Leathery Turtles are kept there any longer.

Correspondence with several institutions all over the world showed that some had attempted to rear hatchlings, but failed and the general opinion appears to be that it is almost impossible to keep this species in captivity. The main difficulty, repeatedly emphasized, is the apparent incapability of the Leathery Turtle, a species which is much more pelagic than other marine turtles, to adapt to the limited space of a tank. Being used to the obstacle-free environment of the open oceans, this species constantly swims against walls and glass of its tank, damaging itself and, finally, dying as a result of the damage sustained.

The rearing of hatchlings has so far proved impossible with only one published exception known to the author. DERANIYAGALA (1939) describes one

Leathery Turtle which was kept from hatching to the age of two years. He emphasizes the importance of clean water and the danger of the animals damaging themselves.

B) SPECIMENS RECEIVED

We received two batches of Leathery Turtles freshly hatched just before dispatch (Figure 1). The first consignment was received on 29th September, 1970 and 5 hatchlings measuring 5.7 to 6 cm each (carapace length) survived the air transport. The second batch arrived on 6th November with 3 specimens surviving. The carapace lengths were 5.8, 5.8 and 6 cm and the weights 41.45 and 47 g.

Several specimens which had arrived dead were dissected and they contained an astonishingly large amount of yolk, the largest yolk sac weighing 5 g and measuring 30 mm across, (Figure 2). The umbilical fissure was not completely closed and the egg tooth was still attached to the rostral shield (Figures 3 and 4), but was lost a few days later.

C) ACCOMMODATION

The first batch of turtles was kept in a perspex tank measuring 122 x 91 x 65 cm and containing 677 l of natural sea water. The water was filtered over a sandfilter at the rate of 200 l per hour and the filter box contained a 20 Watt ultraviolet lamp. Half the volume of the water was changed once a week. It was hoped that the turtles would be less liable to damage if their tanks were made of a comparatively soft material like perspex. Their constant swimming against the walls, however, caused nevertheless some abrasions on the head when they grew older and were swimming more powerfully. Darkening the walls and lighting the water surface only produced no results as their movements did not seem to be guided by light.

The second batch was placed in a round plastic bowl with a diameter of 53 cm and a water height of 16 cm. The water was not filtered, but changed every two to three days. Little damage was observed with these turtles, but fungus infections occurred on head, carapace and plastron.

On 20th December both batches of turtles were transferred to large concrete tanks which were painted with epoxy-resin and had the walls and front glass lined with cloth over wooden frames in order to avoid further damage to the turtles.

We found that the second batch of turtles kept in the circular plastic bowl sustained less damage than the first batch in the larger perspex tank. Observations have shown, however, that this was not due to the circular shape of the bowl. The animals, when moving, were not following the outside wall, but were swimming against it as the others did in the square tank. The absence of noticeable damage was probably due to the softer material of the bowl and also to its smaller size which did not permit the turtles to gather momentum before hitting the wall.

HENDRICKSON (pers. comm., 1970) had a "fence" of polyethylene sheeting inside the circular rigid-walled tank in which his turtles were kept. He also created a circular current with the aid of the inflowing water and says: "The circular current gave them something to orient against and inclined them to spend less time battering themselves against the tank walls."

D) FOOD

Very little is known about the feeding habits of the Leathery Turtle. According to DERANIYAGALA the stomach contents of an adult male were *Scyphomedusae*, while a female contained a small quantity of blue-green algae. Prawns and fishes have also been recorded as food. Jellyfishes are often cited as the main diet. HENDRICKSON tried to feed his young turtles with jellyfish, but had little response. He considers squids and small clams to be the best food in captivity. DERANIYAGALA fed his young Leathery Turtles with fish, eggs, bred, *Caulerpa* algae and live young octopus. GLÜSING (1967) believed that the small hatchlings filter plankton out of the surrounding water, but it is difficult to explain how this could be achieved.

One of our turtles' intestines (including esophagus), at the age of two months, measured 980 mm which is a considerable length for an animal with a carapace measuring 105 mm. It might indicate an at least partial vegetarian diet or a diet of little nutritional value (jellyfish, for instance).

Both batches of hatchlings were, at the time of arrival, two to three days old. There was, however, a significant difference between their early feeding habits. The five turtles of the first shipment initially ignored any food offered. Forced feeding was not successful. As mentioned earlier dissections of a few hatchlings which had not survived the transport, revealed a very large yolk sac (Figure 2). This and their behaviour seemed to indicate that the hatchlings would, during their first days of life, devote all their energy and time to get away from the more dangerous coastal areas, not bothering to feed during this period, but living on their yolk supply. They refused any food up to the age of eleven days. By that time the yolk supply might have been consumed. The umbilical fissure was then completely closed. They started showing interest in food by biting into small pieces of prawns, but spit them out again. They were then offered the much softer flesh of the Spanish Mackerel (*Scomberomorus* sp.) and this was eagerly accepted.

The second batch of three turtles, although on arrival of the same age as the first (two to three days old), behaved entirely different by accepting fish meat on the second day after their arrival. This behaviour does not corroborate the theory mentioned above and many more observations would be required for a satisfactory explanation.

Feeding the turtles was a time-consuming exercise as they did not search for food actively. Best results were obtained when the small turtles were placed on the palm of one hand, just a few centimetres below the water surface. They would then start to bite into the hand indiscriminately and food placed just below their lower jaw would be taken. Larger pieces, especially when offered from in front of the head, would often get stuck on the prominent corner cusps of the upper beak (Figure 4) resulting in frantic movements in order to dislodge the piece of food. Their extremely long front flippers would be of little use as an aid to feeding and are never used for this purpose. In contrast, young Green Turtles (*Chelonia mydas*), possessing much shorter flippers, push pieces of food into a better position with the aid of their front limbs and other chelonians, of course, make regular use of their front feet and claws for positioning food or for tearing off pieces.

At the age of two months with the first batch and at 32 days with the second, interest in food declined and pieces of fresh prawns were substituted for fish resulting in an increased intake of food. From the age of 92 days onwards pieces of heart of buffalo were added to their daily diet.

Between the ages of 95 and 126 days the two remaining turtles became more independent and did not like to be placed on the hand any longer. Since then the remaining specimen takes food from the fingers and actively swims towards the source of food.

Food offered in captivity is, of course, a substitute only and will have to remain so until more is known of the Leathery Turtle's natural feeding habits. It appeared that very soft food was preferred during the early stages of their development and firmer food later on. Our observations make it rather unlikely that Leathery Turtle hatchlings would be able to actively hunt for food. Their feeding is probably more passive initially. It is possible that a turtle, when meeting with, say a swarm of small jellyfish, will snap indiscriminately left and right, catching more or less automatically what comes into its way.

E) BEHAVIOUR

From our experiences it can be assumed that the *Dermochelys* hatchlings' eyesight is extremely poor and that they take very little notice of their surroundings, at least during the first few weeks of their lives. They probably find the sea after hatching by simply heading for the brightest area on the horizon as it is known from other turtle species. How their orientation works once they have reached the sea is still a mystery.

Up to the age of three months no fright reaction was noticeable under almost all circumstances. Only after having been taken out of water or, in a few cases, after having been pulled under water for some distance, would they react with jerky movements, sometimes flapping their front flippers up and down so that they would stand almost vertically in the water. Otherwise they could be touched, held, placed on the hand and fed without the slightest sign of any defensive behaviour or fright reaction.

At the age of about three months the young turtles began to object to being held by struggling and would react to removal from the water by discharging excreta. When restrained under water the remaining specimen frantically flaps its flippers and quickly swims away when released. It does not object to being merely touched and since the age of about three months it has slowly learned to come to the place of feeding. It takes food from the fingers and shows no signs of fear.

At the time of writing this paper our specimen has not learned to adjust to the restricted space of its tank and keeps swimming against its sides. The small turtles are very powerful swimmers already and move through the water swiftly with the aid of their strong front flippers. These are at first as long as the carapace (Figure 1), but after a few weeks this relation changes in favour of the carapace.

There is little else to remark on the behaviour of our Leathery Turtles and one would, of course, not expect very complex behaviour patterns from an animal living in such an undifferentiated environment.

F) GROWTH RATE

The Leathery Turtles were weighed and measured once a week. The surviving specimen weighed 45 g on arrival and 4,540 g at the age of 29 weeks. After that time weighing of the struggling turtle became too difficult and inaccurate and was, for these reasons, discontinued.

Irrespective of its age the growth rate of this specimen was surprisingly regular and, with a few exceptions when the intake of food was reduced, its carapace length increased by roughly 1 cm per week (Table I). The increase in weight was far more erratic as can be seen from Table II. However, weighing the turtles was not easy because they were struggling vigorously when taken out of the water and placed on the scales. This may explain some of the leaps in weight measurements which are shown in Table II.

TABLE I
Growth Rate of Leathery Turtles in captivity (Carapace length in mm)

AGE IN WEEKS	GROWTH RATE OF SPECIMENS-NUMBERS								
	1	2	3	4	5	6	7	8	9
1	75	75	75	75	70	72	86	70	—
2	80	80	80	80	70	85	90	85	—
3	92	91	90	85	80	105	101	95	70
4	112	105	105	100	85	112	106	105	85
5	112	112	111	103	93	120	116	107	102
6	120	117	115	107	100	125	120	116	—
7	130	125	123	110	105	—	125	120	—
8	132	130	123	112	—	—	—	—	—
9	142	140	123	118	—	—	—	—	—
10	151	150	132	120	—	—	—	—	—
11	158	158	140	—	—	—	—	—	—
12	162	160	140	—	—	—	—	—	—
13	167	160	—	—	—	—	—	—	137
14	182	170	—	—	—	—	—	—	—
15	190	—	—	—	—	—	—	—	—
16	200	—	—	—	—	—	—	—	—
17	215	—	—	—	—	—	—	—	—
18	225	—	—	—	—	—	—	—	—
19	235	—	—	—	—	—	—	—	—
20	247	—	—	—	—	—	—	—	—
21	264	—	—	—	—	—	—	—	—
22	275	—	—	—	—	—	—	—	—
23	295	—	—	—	—	—	—	—	—
24	305	—	—	—	—	—	—	—	—
25	315	—	—	—	—	—	—	—	—
26	335	—	—	—	—	—	—	—	—
27	337	—	—	—	—	—	—	—	225
28	360	—	—	—	—	—	—	—	—
29	370	—	—	—	—	—	—	—	—
30	375	—	—	—	—	—	—	—	—
31	385	—	—	—	—	—	—	—	302
32	385	—	—	—	—	—	—	—	—
33	400	—	—	—	—	—	—	—	—

Specimens 1 to 5: First batch received on 29.9.70.

Specimens 6 to 8: Second batch received on 6.11.70.

Specimen 9: For comparison data given by DERANIYAGALA (1939) for one specimen reaching an age of two years.

TABLE II:
Weekly increases in carapace length (shown in mm) and weight (shown in g)
of a Leathery Turtle.

AGE IN WEEKS	LENGTH INCREASE	WEIGHT INCREASE
2	5	25
3	12	25
4	20	50
5	0	20
6	8	45
7	10	35
8	2	20
9	10	30
10	9	160
11	7	20
12	4	60
13	5	0
14	15	65
15	8	423
16	10	170
17	15	113
18	10	199
19	10	57
20	12	312
21	17	170
22	11	500
23	20	471
24	10	51
25	15	368
26	20	563
27	2	618
28	23	40
29	10	60

The Leathery Turtle is much deeper-bodied than other marine turtles and weight increases or decreases may in some cases affect its girth more than its carapace length. This probably accounts for the occasional gains in weight without corresponding gains in carapace length.

G) CAUSES OF DEATH

At the time of writing this paper only one out of the original eight hatchling turtles is still alive. DERANIYAGALA stresses the importance of clean sea water for the well-being of the turtles: "Like other aquatic reptiles *Dermochelys* takes water into its pharynx and cloaca for respiratory purposes and a young specimen weighing 6 lb 12 oz discharged 20 cc from its cloaca. Hence absolutely clean sea water is essential if specimens are to be reared for long in captivity, especially as this form persists in swimming into the sides of its aquarium and soon damages its snout and flippers which would quickly suppurate in polluted water."

The technical difficulties in obtaining sufficient quantities of sea water for our turtle rearing experiment were great and the fact that none of the second batch of three turtles survived longer than 56 days can probably be attributed to the impossibility of more frequent water changes and the absence of filtration in their small container. Every one of these three turtles developed a severe fungus infection. Their condition did not respond to treatment with iodine and proflavine.

Amongst the five turtles of the first batch one only suffered from fungus infection. Two refused food, became increasingly emaciated and died without the cause being determinable. The fourth appeared to contain air under the left side of the carapace, was floating lop-sided on the surface, but did not seem to be much bothered by this condition at first. However, it died two months after this condition was first spotted.

Summing up, fungus infections killed 50% of our turtles, emaciation with unknown cause 25%, a mysterious "air-bubble disease" 12.5% and the survival rate was 12.5%. Compared with the generally assumed very poor survival rate in nature this result may not be too discouraging, but improvements are undoubtedly possible, especially through a more frequent change of water of the turtle's containers.

V. SUMMARY.

The Leathery Turtle is the rarest of the marine turtles and little is known of its biology. In spite of the many rearing attempts there is only one record in the literature of the successful rearing of this species in captivity. Yet conservation measures will have little success unless a way is found to rear the young turtles for at least several months after hatching. The Hassanal Bolkiah Aquarium obtained eight hatchlings from Trengganu in 1970 and of these one has survived up to the time of writing this paper. Feeding was very time-consuming, but presented no problems. At the early stages the turtles took the soft flesh of the Spanish Mackerel, but later on preferred the firmer prawns. During all observed stages the growth rate was, at a rough average, 1 cm of carapace length per week. If this growth rate should continue the Leathery Turtles would be 60 cm at one year, 120 cm at two and 180 cm at three years of age. They would be adult and sexually mature when between two and three years old. Experiences gained indicate that a second rearing attempt would be more successful provided the turtles were kept in relatively small and well-padded containers and the containers' water would be changed daily.

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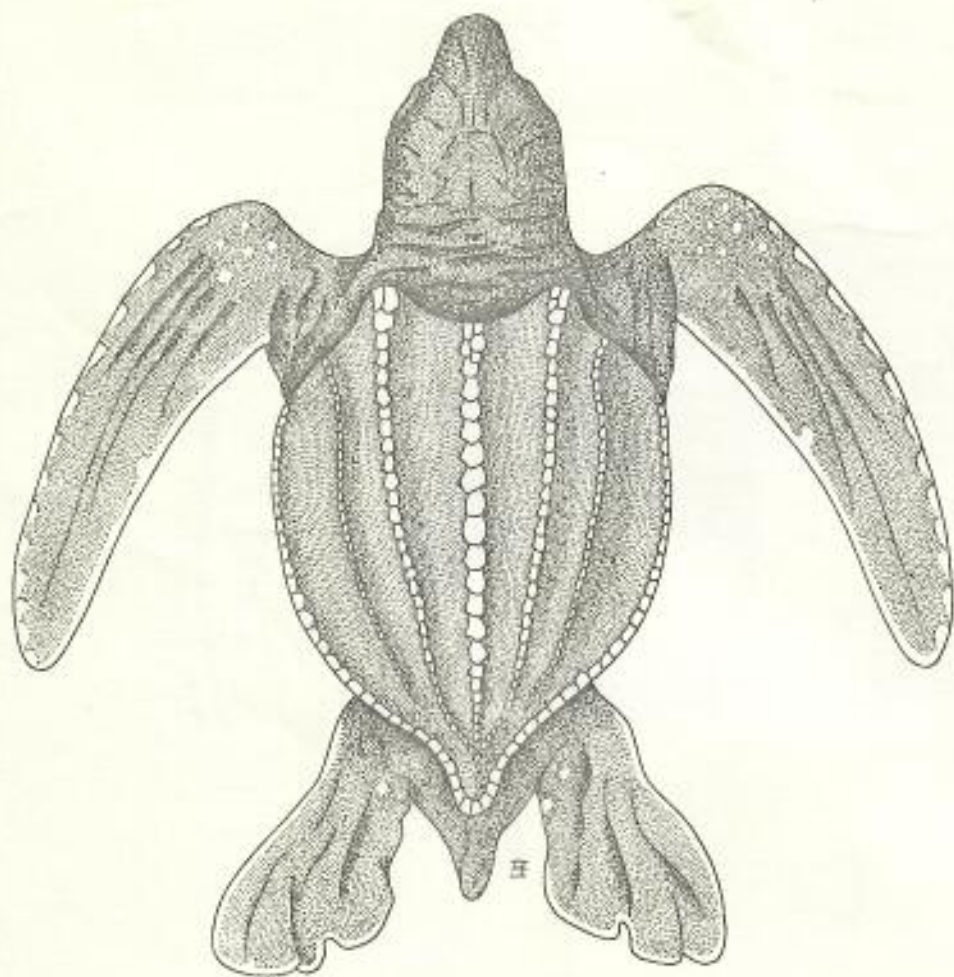


FIGURE 1:
Freshly hatched Dermochelys coriacea: dorsal view.

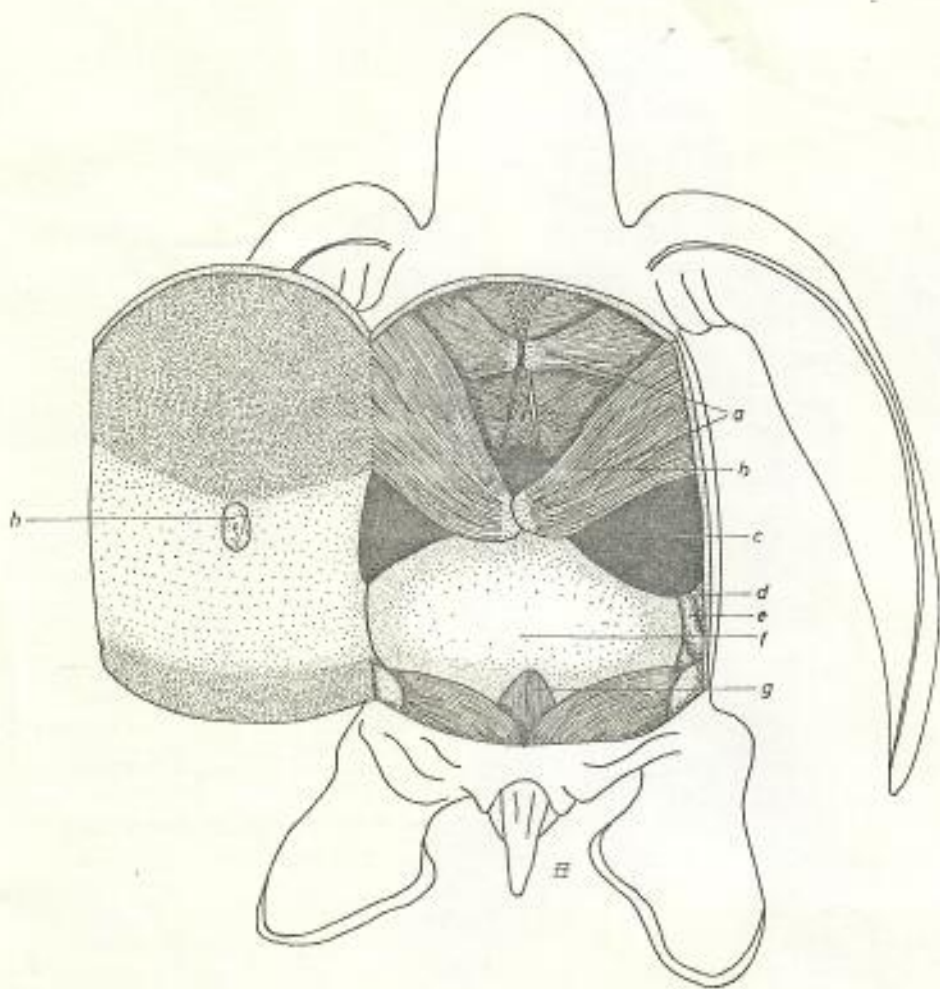


FIGURE 2:

Freshly hatched Dermochelys coriacea; ventral view with plastron opened.
a — petoral girdle; b — heart; c — liver; d — esophagus; e — portion
of intestine; f — yolk sac; g — pelvis; h — inner section of umbilical region.

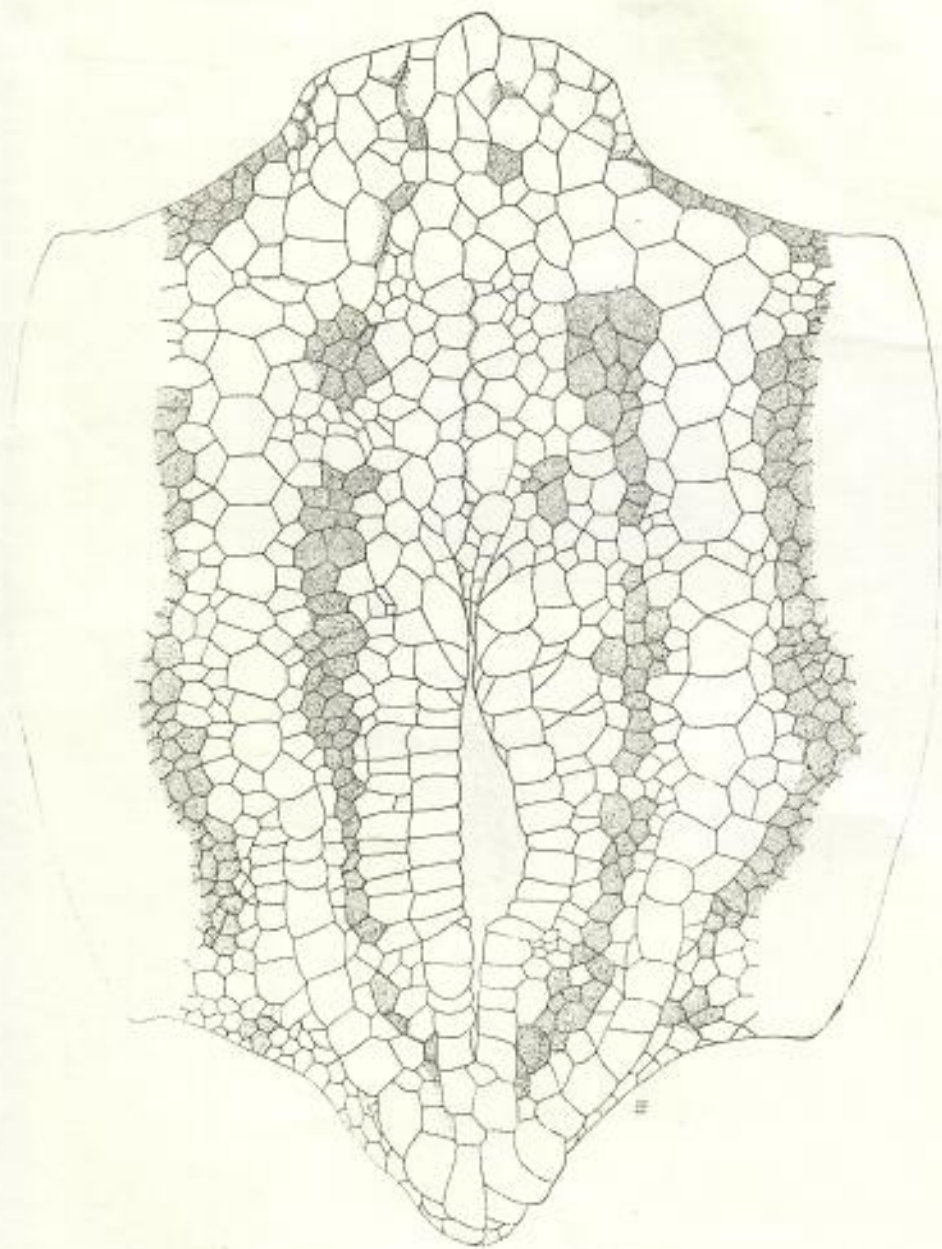


FIGURE 3:
Freshly hatched Dermochelys coriacea; plastron with umbilical fissure.

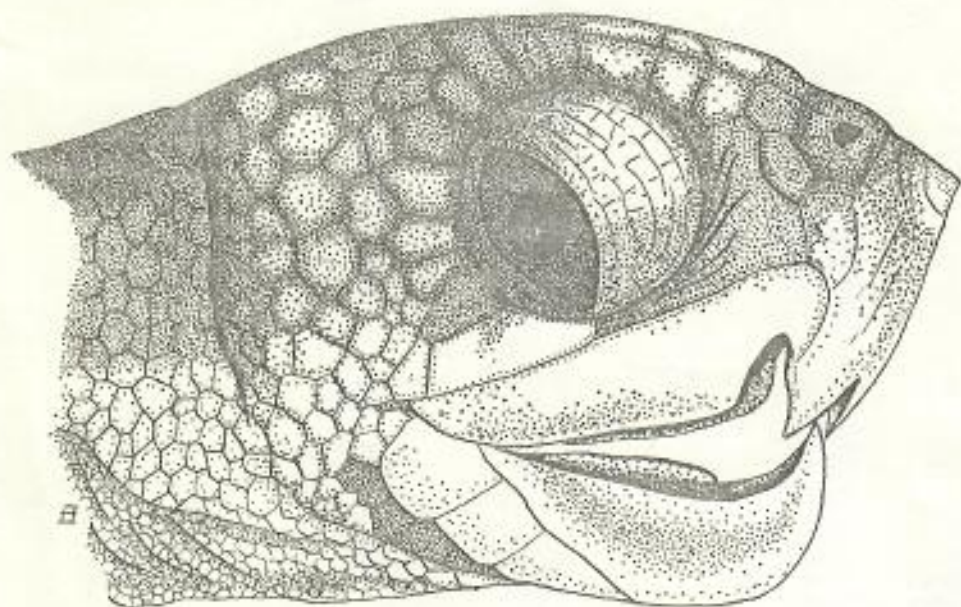


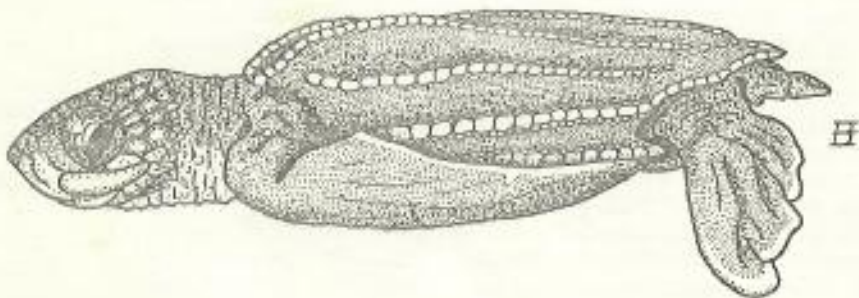
FIGURE 4;
Freshly hatched Dermochelys coriacea; head with egg tooth.

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FIGURE 5:
Resting position of juvenile turtles:
above: *Chelonia mydas*
below: *Dermochelys coriacea*



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Fr. Liza

FOUR BRIEF NOTES ON THE HISTORY OF BRUNEI

By D. E. Brown

I

In the first issue of the *Brunei Museum Journal* F. Delor Angeles describes the role of the Pengiran Seri Lela in the Spanish attack on Brunei in 1578: "Seri Lela, a *pengiran* and half-brother of the Sultan, appeared in Manila and solicited Spanish assistance against his own brother" (1969: 123). As we shall see, there are a number of other sources which state that Pengiran Seri Lela sought Spanish assistance against an usurper to the Brunei throne. These accounts contrast with Brunei views, e.g.: ".....when the Castilians made war, the Pengiran Seri Lela went over to them, and the country was conquered....." (Low 1880: 10).

As evidence for his statement, Delor Angeles cites documentary material which dates from 1576, a history written in 1609 by Antonio de Morga, and a history written by Joaquin Martinez de Zuñiga in 1803 (1969: 131 notes 15 and 17). All of these accounts are from periods earlier than any Brunei document can be dated with complete confidence. Given the rich documentation available to Spanish or Philippine authorities, and given the shortage of such documents available in Borneo, it would seem safe to accept the Spanish-Philippine version. However, the Brunei account is correct.

Note that the first source cited by Delor Angeles dates from *before* the alleged attack. The pages cited are the same cited in Delor Angeles' note 13, and there is no reference to the Spanish attack on those pages. But the volume which Delor Angeles refers to does indeed contain a series of eye-witness accounts of the Spanish attack on Brunei (BLAIR AND ROBERTSON 1903-1909: IV). These eye-witness accounts show that the Brunei version of the behaviour of the Pengiran Seri Lela is substantially correct. This is not the place for an exhaustive analysis of the Spanish attacks on Brunei, but the following points may be noted. Before their force arrived in Brunei in 1578 the Spaniards had neither met nor heard of the Pengiran Seri Lela. He is stated to have been an uncle of the Sultan, Saif-ul-Rijal, and to have fought against the Spaniards. The Spaniards took the city, but found it unhealthy. When they withdrew they left the Pengiran Maharaja Di-Raja in charge. They also left with the Pengiran Maharaja Di-Raja and the Pengiran Seri Lela letters of "assurance and friendship". The Spaniards took a daughter of the Pengiran Seri Lela with them to Manila. In the following year, 1579, a smaller force was sent again to Brunei. They found that the Sultan had returned to the city, from which he fled the previous year, and he allegedly had the Pengiran Seri Lela poisoned. The Pengiran Maharaja Di-Raja was sent off to the south. Finding the reception unfriendly, the Spaniards withdrew without attacking the city a second time. In short, the Pengiran Seri Lela "collaborated" with the invaders, and suffered the consequences. This is fairly close to the Brunei version of his actions.

What then of the other sources cited by Delor Angeles? A perusal of Morga's work shows that he made no reference to Pengiran Seri Lela's alleged appeal to Manila. There is, however, a footnote, added by José Rizal in an 1890