

a background to these. The urgency of the issue of conservation in these islands is obvious to anyone who sees this film with an appreciative eye. It features the Charles Darwin Research Station at Academy Bay, center for active and continuing research on the biology of the Galapagos.

Of immense interest to reef ecologists is the film entitled "The Coral Gardens of Shadwan," made by Helmut and Günther Fleissner, of the Zoological Institute of the University of Frankfurt, Germany. This film was made on coral reefs in the Red Sea and not only shows beautiful reefs, but details of ecological processes and relationships, even including zooxanthellae in the cells of the corals. We hope to have an article on this film and the details of how it was made from Mr. Günther Fleissner, with whom we had the privilege of a visit.

## ORIGINAL OBSERVATIONS

### TOXOPLASMOSIS ON CAROLINE ATOLLS

by G. D. Wallace  
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The epidemiology of toxoplasmosis was investigated on three remote and ecologically simple atolls in the western Pacific. The atolls, Eauripik, Ifalik, and Woleai, are located within 80 miles of each other but travel between them and contact with the outside world is infrequent. The Micronesian residents share the same culture, types of food, and similar environment in general. The prevalence of human infection, as measured by the presence of dye-test antibodies, was high on Ifalik, moderate on Woleai, and nearly absent on Eauripik. On Ifalik and Woleai, there was also serologic evidence of infection in rats, the only wild mammal present, and in the domestic animals, including cats, dogs, and pigs. On Eauripik, however, rats and cats had not become established and the dogs and pigs were serologically negative, except for one dog that had been imported from Woleai. Cats or rats appeared to be the most likely reservoir of *Toxoplasma* in the atolls. The consumption of raw meat did not appear to be an important source of human infection. (Abstract of a detailed account to appear in an early number of the American Journal of Epidemiology.)

### OBSERVATIONS ON THE GREEN TURTLE IN THE MARSHALL ISLANDS

by F. R. Fosberg

Several workers interested in the breeding habits of the green turtle (*Chelone mydas* (L.)) have suggested that I publish certain observations made in the course of field work in the Marshall Islands

in 1951 and 1952. Turtles were observed to come ashore on Jemo Island during a visit to this island December 18-22, 1951 and on Bikar Atoll during a visit from August 6-12, 1952. Since my observations do not agree in every particular with those of others made in different parts of the world, it seems worthwhile to place them on record in detail.

Jemo is a tiny islet on a small segment of reef, with no lagoon, nor even a pond, located at 10°08' N, 169°32' E, in the northern Marshall Islands, between Likiep and Ailuk atolls. The islet is flat, partly covered by a coconut plantation, with thick forest around part of the periphery and scrub around the rest. Part of the shore is coral sand beach, part beachrock, and part a rough erosion ramp. Back of the shore the ground is largely coral sand.

Shortly after our landing I walked around the beach and counted 44 turtle tracks, indicating that in the past several days 22 turtles had crossed the beach from the sea to the sandy ground at the edge of the vegetation, then recrossed it back to the sea. Usually, at the edge of, or just inside, the vegetation, was a shallow pit about a meter across, with a low pile of sand at one side, thrown out of it. I assumed that the clutch of eggs would be buried in the bottom of the pit, and dug in the bottom of a number of the freshest of them. In each case undisturbed roots were found a little below the bottom. In one case I finally located the eggs, 106 of them, in the bottom of a smaller hole located under the broad pile of sand that was thrown out of the larger pit. The hole had been about 60 cm deep and 30 cm across, straight sided, with sand packed back in it on top of the eggs. The eggs were spherical, about the size and appearance of ping-pong balls, white, with a smooth, dull surface and a translucent spot on one side, where the yolk rested. The shells were only slightly calcified, denting on contact with other eggs or with fingers. The whites were completely non-viscous, clear, and did not coagulate on cooking. The yolks were yellow and soft, and when cooked scrambled, they resembled a cheese omelette or an overcooked welsh rabbit, in both taste and consistency. - correct

At 2 a.m. on the 19th I went out and scouted the beach. The moon was full and the tide low. There were only 2 new tracks, and the turtle that made them was found, heading as rapidly as she could scramble back toward the sea. I turned her over to be photographed in the morning. She struggled for a while, then calmed down, emitting a sighing "ah'h" sound, with tears running from her eyes. Next morning she was lying quietly, but struggled violently when disturbed. After she was measured and photographed she was released and lost no time in reaching deep water. She was mottled dark olive-drab above, yellowish below, measured 75 cm across and 120 cm long, from tip of tail to tip of beak with head drawn in, was quite heavy to turn over, but was not weighed. The mouth was a hard triangular beak with sharp jagged edges. She made no attempt to bite. Her front flippers were long and broadly sword-shaped, the hind ones short and broadly spatulate, the tail short and triangular.

Bikar Atoll is a small atoll, with three principal islets and a small sand bank, on a reef around a lagoon, lying at 12°15' N, 170°05' E,

the next to the northernmost of the Marshall Group. Bikar Islet, the largest of the three, is of sand, except for areas in the interior where this has been cemented into phosphate rock. On the western and southern coasts are sand flats with rather open vegetation much frequented by turtles as nesting sites. An outstanding feature of these parts, especially on the south coast, is the way the sand has been churned up by turtles digging holes in it. On the afternoon of August 6 I counted 596 tracks. That night 6 more turtles came ashore, of which 3 were seen by the party. One was measured, being 70 cm across and 135 cm long. She was strong enough to move on land with a small man sitting on its back. When caught she shed tears. When released she headed back to sea, climbing over very rough pitted rock remnants with some difficulty, but successfully. A few turtles came ashore on each of the following five nights, on August 10 about 15. On August 11 three were seen, but probably more came ashore. One night one blundered through our camp, creating much havoc. One that was spotted coming out of the water was frightened by the light and turned back. Two more turtles were measured, one being 80 cm wide and 122.5 cm long, the other 70 cm wide and 115 cm long. Colors and patterns on shells were most varied.

more photographs?

I watched one come ashore at 8:10 p.m., August 11, before the moon rose. She walked about 50 m inland, poked her front end into a large Scaevola bush, stopped and began to scratch with her hind feet, gradually excavating a hole less than 30 cm across and as deep as the short hind flippers could reach, using a peculiar back-hand scooping motion with alternate feet, each time, while digging with one foot, flipping away the sand that was brought up by the other foot previously. This appeared to be a very inefficient method of digging. When the hole was finished the rear end of the turtle projected over the hole and the tail pointed downward. Eggs were expelled 1-2 or even 3-4 at a time, dropping into the hole. This turtle laid 92 eggs, taking 11 minutes for the actual laying process. Then she filled the hole very carefully with sand, which she patted and pressed down in a mound over the eggs. Gradually she spread this mound out and covered it with dead leaves, then dug a pit to one side and threw the dirt over the hole where the eggs were laid, making a low broad mound over it, so that one would scarcely guess where the eggs were laid. The whole process took over three hours.

Newly laid eggs were seen from 3 different individuals, varying somewhat in size from turtle to turtle. In the clutch of 92 mentioned above was one tiny egg, the size of a marble.

The sand flats, outside of and especially in the open Tournefortia belt around the Pisonia forest that covers most of the islet, were thickly spotted with the shallow pits, 60 cm to 1 m across, each with a low mound at one side. Two of these mounds were observed to have small holes in them, with numbers of small flies buzzing about them, and, in one case, hermit crabs in the holes. These holes may have been made by the hermit crabs, but were more probably made by young turtles emerging. One hole had a broken shell in it.

On the night of August 6 a few black baby turtles were seen hurrying toward the sea. They were being attacked by large red hermit crabs (Coenobita perlata) and by rats (Rattus exulans). The hermit

crabs bit through the carapace, the rats through the plastron. On August 10 and 11, at about 8 p.m., batches of young turtles hatched out and came running through camp, on their way to the sea. They followed lights.

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Almost all of the female turtles that visited Bikar Atoll, well over 300 in the 7 nights, August 5-12, came ashore on Bikar Islet. One set of tracks and a pit were noted on Jaboero Islet, a few on the south part of Almeni Islet, but none on Jaliklik Islet, which is rocky and has no loose sand.

The location of the hole containing the eggs beside the pit excavated by the turtle is in marked contrast with the situation in Malaya and Sarawak, reported by Hendrickson (personal communication), where the hole with the eggs is some distance from the pit.

In 1958 Bikar Atoll and Pokak (Taongi) Atoll, which lies to the north of it, were set aside as preserved natural areas by administrative decree by the then District Administrator, Mr. Maynard Neas. It is hoped that this protection may be strengthened, as clearly Bikar is the principal turtle nesting area in the Marshalls and should be kept as a stocking area for the rest of the archipelago.

## PUBLICATIONS

Moreau, R. E., The bird faunas of Africa and its islands. 1-424, Academic Press, London and New York, 1966. \$18.00. This is a superb book. Its interest is far broader than its title suggests, and it will hold an audience far wider than the ornithological fraternity. The first three chapters present an excellent, if brief, picture of the geography and ecology of Africa, not just an areal sketch, but soundly based in the time dimension. This makes it possible to consider the entire range of avian biogeography in a convincing ecological context. The fact comes through very clearly that one cannot understand the present distribution of the birds of Africa except against a background of the vegetation, both present and past, as controlled by the factors responsible for the Pleistocene glaciations. Moreau's command of the available information on African birds, on all aspects of their habitat, and on the topographic and climatic history of the continent is impressive. One has the feeling, reading the book, that if existing information can provide the answer to a biogeographic question, the answer is in this book if birds are in any way involved. One can go the whole way in recommending the "mainland" part of the book.

Our readers, however, are interested in islands. Africa is surrounded by islands with every degree of isolation from the continent. Moreau has chosen to limit his remarks to islands reasonably close to the mainland, except for the oceanic Cape Verde group.

The chapter on the faunas of the West Coast islands is disappointing in that it seems a rather standard zoological discussion, with little of the remarkable ecological interpretation that permeates the earlier