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WHITNEY SOUTH SEA EXPEDITION
of
THE AMERICAN MUSEUM OF NATURAL HISTORY

Extracts from the Journal of

ERNEST H. QUAYLE

Assistant Field Naturalist

Book XXV through Book XXVIII

April 1--June 24, 1922.

AMERICAN MUSEUM OF NATURAL HISTORY

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BOOK XXV

Voyage of the 'France'

from

Ducie Island

to

Henderson, Oeno and Timoe Islands.

April 1--24, 1922.

 April 1

Light squalls during the night with a storm in the galley at six this morning when I insisted upon some hot water in the coffee pot. Admitting that I made the grievous error of putting my unwelcome foot inside the galley door, I still hold the Polynesian cook as decidedly undesirable. A cook who cannot get a pot of coffee ready for seven men by six o'clock in the morning has no business on a white man's ship. This morning to spite Charlie and Curtis he made up

BOOK XIV

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the strongest and blackest coffee imaginable. We sent the pot (there were perhaps three full cups of the ingredient in it) back to be filled with hot water by the cabin boy. He returned the pot with more of the rank saturated solution and no more water. Whereupon I grabbed the pot and made for the galley. Setting it upon the table I demanded it filled with hot water. The insolent kanaki threatened to throw the kettle of hot water at me. By prolonged insistence and paying no attention to his hot-headed clamor I eventually obtained the desired hot water. Louis then had two cups, Charlie and Curtis each one and a half, myself two, and Mr. Beck half (he still had to dilute the stuff with more hot water), and there was some left in the pot. All this was from what was first served us as straight coffee and barely three cups.

We have had a reliable breeze most of the night and if we are traveling but four miles must be some sixty miles plus yesterday's twenty-four (error of forty in yesterday's notes) at noon observation. Eighty or ninety miles away from the island. I have seen but one Ducie shearwater this morning.

Finished up the birds today, though some this afternoon were well advanced towards a green ripeness. I spent the late afternoon clearing up the hold, making skeletons and overhauling eggs. At sunset the sailors thought they saw Henderson Island from the masthead. Early in the night we lay-to some four miles or so by dead reckoning from the land. Wind stronger and ship rolling a little.

April 2

A shower struck us at three-thirty, an hour when one likes well to sleep; but a bath once in two weeks is none too frequent. A little vigorous action was sufficient to remove the first chill, and afterwards the rain was hardly noticeable. A later shower at six o'clock gave an opportunity to soap down all dirty clothes and another one at seven was sufficient to rinse them. We have steamed for ten minutes into anchorage off the west shore opposite a clump of coconut trees, which heats the engine room for drying clothes. Have not yet found good anchorage. Saw some shearwaters and white terns early during the storm this morning. The little Pterodroma is predominantly black here. Few neglected were seen.

The strong breeze seemed to stimulate the shearwaters into rapid cross wind flights, during long stretches of which they never beat their wings but would glide slightly to leeward and then come up in the wind, gaining four or five meters of elevation but little headway. Their general course was slightly to leeward; their speed was remarkable; their wing balancing phenomenal.

But the prince of all aeronauts at sea is the old frigate. One comes out from the land on steady, out-spread wings speedily with the wind, his forked tail twisting slightly as he balances himself. He surveys us a while, lowering and elevating without a single wing stroke; then, marvel of nature, he returns to windward and gains elevation without an apparent effort. The soaring hawk and circling eagle have nothing on

this fellow. Hollow boned, powerfully breasted, with wide-spreading wings and capable rudder tail, he has supreme command of the air. This phase of ornithology arouses my interest more than anything else. I have always wondered how the hawks and eagles soared; now I wonder how the frigate sails. I do not believe there is any sixth sense or unusual power possessed by these particular birds. True, we have developed along entirely different lines than they have since Secondary times. While they specialized upon feathers, man has specialized upon nerve ganglia. We have the curiosity,--have we not the intelligence and ingenuity to discover the science of their flight? I pin my hopes on the ultra speed cinematograph to solve this problem. Gulls following a vessel into the wind would afford the best opportunity for close-up views of still flying into the breeze. Some scientifically inclined camera man should try to settle this question. We could get a few opportunities to photograph the frigate if we had the camera. Dead birds waved from a boat will bring a dozen or more very low down overhead. I would like to see someone do something with the camera on this subject.

Spent practically the entire day hobnailing my boots (I filled them full of nails) and making goat skin moccasins for the dog Noha. Even the coral at Ducie was too severe upon his feet, and the three days spent here previously had him limping. No one can imagine the sharpness of these jagged edged rocks. Coral reefs and atolls are sharp but the natives

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can and do walk freely over them barefooted. Here, however, they pick their steps with the greatest caution and avoid the upper cliffs as much as possible. We are wondering how long Bijoe's shoes (they are the only leather ones aboard except ours) will hold out while he helps me cut a trail into the interior of the island. Given a trail a mile long, I have confidence of obtaining good series of each of the four recorded land birds, and hopes of finding something new,-- ground doves or thrush, for instance.

But I was trying to give an impression of the sharpness of this elevated coral rock. The nearest comparison to make of this "badland" is to ice pinnacles known as "seracs". Glacier pictures approach but do not equal these coral seracs. Rain has cut and carved the easily soluble portions to such an extent that the more resistant parts stand up in all manner of shapes and sizes, and always in jagged cutting edges. The best comparison I can think of is lump sugar over which coffee is poured. The jaggedness of portions not dissolved resembles the surface of this island. Magnify it many hundred times and some idea of the weathered coral can be obtained.

Darwin supposes this to have once been an atoll and very recently elevated, a trifling upheaval of eighty feet not being sufficient to upset his theory of a sunken continent. From our observations from the 'Moana' as we passed Makatea, and from all reports of natives, that island is quite similar to this and of about the same elevation. Why should these two islands at either extremity of the Low Archipelago, or

can and do walk freely over them unprotected. Here, however, they pick their steps with the greatest caution and avoid the upper cliffs as much as possible. We are wondering how long El Joe's shoes (they are the only leather ones aboard except ours) will hold out while he helps me cut a trail into the interior of the island. Given a trail a mile long, I have confidence of obtaining good series of each of the four recorded land birds, and hopes of finding something new,-- ground doves or terns, for instance.

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Barlow supposes this to have once been an atoll and very recently elevated, a trifling upheaval of eighty feet not being sufficient to upset his theory of a sunken continent. From our observations from the 'Hornet', as we passed Makarua, and from all reports of natives, that island is quite similar to this and of about the same elevation. Why should these two islands at either extremity of the low Archipelago, or

Tuamotu, have been elevated? Modern geologists seem to believe in considerable fluctuations of ocean level and land heights. How do they explain the uplifting of these extreme islands when eighty (that should be seventy-eight because Makatea is one of the eighty and Mangareva, Gambier, is in the barrier reef class) intervening ones are of regular height? But barrier reefs are favorable to the sunken continent's continual submersion. Henderson and Makatea controvert, though ever so slightly, the idea.

Darwin says in his "Coral Reefs", Chapter VI, p. 26: "We have, however, no reason to feel surprise at occasional or even frequent alternations of level of the above two kinds." Not surprise but curiosity. What? Where? When? How? Why? Darwin gave us a general hypothesis concerning the islands from here to India and Australia. I am a believer in his general theory, but here is a detail that must be answered. Henderson and Makatea are the "what" and the extremities of the Low Archipelago are the "where"; a paleontologist could probably locate the "when"; but still remain the "how" and "why" of this slight upheaval. It may prove to have been more remote than Darwin supposes. Two or three hundred feet of fringing reef does not grow over night. The distance of this fringing reef from the shore should give evidence of the extent of the period of rest at the present level. But beyond that reef is the shelf of fifteen to twenty fathoms upon which we are now anchored. What is that shelf,--coral, volcanic or

sedimentary? It surrounds the island at various distances from the shore. The mate says we are fifty to seventy-five fathoms off the reef, which here is not that many feet off the shore.

Another point of interest in these elevated islands (Henderson, Makatea, Rurutu and Rimatara) is that they are in all cases surrounded by fringing reefs. In fact, they are the only examples of any sort of fringing reef we have yet struck. Naturally one would expect the fringe to develop about an elevated coral atoll or outside a barrier reef. As I remember, the reef at Makatea is even narrower than this. At Rimatara it is almost a quarter of a mile in width from the land, and at Rurutu fully half a mile wide on one shore. The elevated portions of those two islands are unmistakably the coral of an old barrier reef. Swamps now fill what then was the lagoon channel. The natives have an interesting myth concerning Makatea. Some ruler there would not supply the Tahitian sovereign with fish; so the Tahitian god, in response to the sacrifices and supplications of his worshipper, turned Makatea, which was then like any other Tuamotu, upside down. The sailors' belief in this legend is evidenced by their explaining that Henderson had been turned over too. They cannot otherwise explain why these two islands should be so much more jagged and hard to walk upon than the coral atolls over which they are able to proceed barefooted.

While we are down at this end of the Polynesian Islands it is very interesting to note that Ducie, Oeno and

Timoe are characteristic lagoon islands or coral atolls; Henderson an elevated atoll with fringed reef; and Mangareva a barrier reef and hilly island; while Pitcairn, but a few miles to the south, is quite devoid of coral at the surface, but coral rocks are found along its beach. Surely that island is not beyond the range of surface corals.

While I was ashore no one carried out my intended temperature work. The mate has just agreed to take the noon-day temperatures for me while we are in port, so I must recommence the taking of them when we sail and whenever else I am aboard at the hours of six, twelve, and six P. M. Is there a belt of cold water that strikes Pitcairn and prevents the growth of the corals? Or is that island sinking so rapidly that the corals cannot grow fast enough to counteract the effect of submergence? Rapa and the Bass Rocks are perhaps too far south for reef corals, but lagoon corals grew very well in the harbor at Rapa. As for the Bass Rocks, I think them the last surviving pinnacles of the rim of a volcano, a mountain top that will have disappeared in a few thousand years, leaving a shoal like the Nelson and Portland reefs.

I am anxious to get to the Cook Islands where we encounter four more fringing reefs if Darwin's map is correct. The Marquesas present a very remarkable dilemma. Why are there no reefs about them? Certainly temperature cannot affect them. The Caroline group (not Archipelago) is on the same latitude and but ten or fifteen degrees west. They are atolls. Why no coral at the Marquesas? Is it that the strong equatorial

drift setting westward has prevented the coral planulae from ever reaching those islands? Under present geologic conditions such might have been the case, but in former epochs the Panama Isthmus was a free waterway and no serious barrier to the West Indian corals' migration. However, I am inclined to the belief that this has something to do with that strange phenomenon which a coral map of the world presents. All the western coasts of great land areas are devoid of coral growth. Europe and Africa; North and South America; Australia and Madagascar all agree in general to this. On the eastern coasts are fringing reefs off Africa and Madagascar; east of Australia is the great barrier reef; and east of the Americas are the fringed West Indies. A map of ocean currents should reveal some secrets. In the West Indies the southern shores of Cuba and San Domingo are devoid of coral, according to Darwin's map, yet Jamaica has coral along its southern and not along its northern shore.

I have but a general "Map showing main ocean currents and drifts" in Pirsson and Schuchert "Text-book of Geology", Part I. The Atlantic equatorial drift appears to split on the southeastern West Indies, which are fringed on either side. That portion forming the Gulf Stream flows south of Jamaica; strikes the peninsula of Yucatan which is fringed; passes between Cuba and Florida, both fringed; and then goes through the fringed Bermudas. The outer stream flowing along the Atlantic side of the West Indies has them fringed also.

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the Atlantic side of the West Indies has then fringed also.

But the greatest coral area is from Ducie Island as an apex to the Great Barrier Reef of Australia, with the Caroline Archipelago as the base angles of a very narrow triangle. This area lies almost entirely within the equatorial drift of the Pacific Ocean. The northern half splitting off at about the Solomon Islands swings upwards towards Japan. It is noticeable that neither New Guinea nor the Philippines are extensively fringed with coral. I have no means of finding whether or not the equatorial drift sweeps those shores, ~~or not~~. The south portion, however, strikes Australia along the Great Barrier Reef. My map gives no ocean current in the Indian Sea, but I think the drift there is westward as elsewhere, from the sparsely fringed Dutch East Indies through and around the Chagos Reef and Maldivas Atolls, swinging southward against the African coast at the equator and striking that portion of Madagascar within the tropics. This strikes me as being an idea worth checking over by men who have the facilities and references at hand. There would be two explanations if current and reefs agree with the theory: first, the temperature favorable for coral growth would be found only along the equator after the current had warmed up, which may explain the lack of coral at the Galapagos and Marquesas Isles in the Pacific, and the Canary Isles in the Atlantic; next, the coral planulae would be carried by the currents, and hence could not reach the more easterly islands. The direction of currents through

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Gibraltar and the specific nature of Mediterranean corals should throw some light upon this; also the relationship of corals in the Red Sea and Mediterranean now and those recorded before the Suez Canal was opened, if the data were obtained.

But the night is half spent and we have Henderson coral to fight in the morning.

April 3

Packed up to remain ashore at night. Landed at nine o'clock. Saw a parakeet near coconut trees but could not get him. Bijoe and I stretched oil silk shelter and then ascended cliff to penetrate the interior. The first game was one of the Henderson Island shearwaters found beneath the brush not far from the cliff. The dog routed and finally brought in a second one. Later obtained two warblers when shooting at one with white feathers. Traveling here is not so bad in places as it was and still is on the east and north sides. The bush is tall enough here to permit one to walk beneath it, except in patches which appear to have formerly been coral knolls in the old lagoon. While standing upon the jagged rocks of such a knoll I shot a dove. Bijoe obtained it after considerable effort and chopping.

We cut a trail in a few hundred meters before eleven and stopped to lunch at a place where we had a clear view forward through the bush, but no rails were in evidence.

Heard a curlew while eating. There is a coating of leaves over most of the ground here, and so the dog has fared well without his moccasins. He smells either rats or rails all along the trail. He is now employed chewing up brush and ferns. There is a rather numerous flora here. I will have to do some of the collecting too, to be sure we get most of it.

We found ourselves swinging around to seaward and entering a brushy region, so retraced to place where I shot the dove and tried penetrating farther inland to some pandanus trees on which we had seen three parakeets. Here again the dense entangled brush checked us. We tried an hour of still hunting, for one could see well into the surrounding brush just in the rear of our obstruction. No results. We returned to the tent with the poor catch of three warblers, one dove and four shearwaters. The latter were all located and three killed by the dog. I shot a curlew at the brink of the cliff he had been perched on, an exposed point of rock, but he fell into dense brush and I could not locate him. The shearwaters must be well scattered out through this impenetrable brush. We found no nests or eggs with these four. A pair flies overhead as I write, calling "Clack-clack-clack-clack-clackety-tack-tack-tack-tack-tack", very, very rapidly repeated; it is a distinct call from that of the light breasted Ducie bird, but not very far from it.

I obtained a warbler and parakeet about the back-woods while the boys were getting coconuts. Then I shot a parakeet along the beach which the dog retrieved. Shot one dove of three seen above trees, but the dog could not find it. It probably fell upon the cliff. Have been still hunting for rail beneath the trees below the cliff. Blue ternlets, white and noddies in a few instances about. A few shearwaters but no neglected observed. No rail heard here, so I'm moving my location.

Made a second journey down the short length of beach that is here and obtained one more parakeet. He is merely winged and I hope to use him as a decoy to trap others alive. Heard no sound from rails all evening. Early in the morning, unless I hear them here below, I'll go above the cliff to watch for them. Mr. Beck was out in the little boat this evening and did a good deal of shooting, so I judge he got some shearwaters. I watched for neglected but saw none. Did not shoot any of the others. There was a white reef heron observed from the ship yesterday and this morning. I did not find him upon landing. A tattler along the beach as I ate dinner about dark.

A beautiful moonlight night with the lunar phase of first quarter. The waves roll in here with considerable energy and many break clear across the boat pass. The boys made a good and timely get-away. One swell raised them ten feet or so but they rode her securely. She broke soon after

leaving them and rolled in a surging, seething mass of foam. Here the reef is hardly fifty feet from the beach, which is of very fine coral sand. We found the shearwaters at Ducie and the large sea birds consuming altogether too much corn-meal, so were forced to use Ravaivai sand in which the limes were packed. Sun dried and heated, it proved to be very efficient. It is, of course, soft sand and does not injure the edge on instruments like silicious sand would. This beach will furnish us with a good supply for the rest of the journey.

I heard several of the dark Henderson Island shearwaters giving that clackety call this evening as they soared close to the tree tops above the cliff. It is indeed distinguishable from the call of the Ducie gray-throated, light breasted bird which I imitate by saying "Că-că-că". This is much nearer "Cack-cack" and is not so high in pitch as the other. We have made provisions for the benefit of any possible shipwrecked sailors here; but I promised the boys not to record what we put ashore for them lest some passing ship stop to replenish their larder.

We made up some cyanide bottles on the way over here from Rapa and I have just gathered in four small moths and a beetle. There is a very small black ant here. Tomorrow I shall watch for a colony of them, as they should be very interesting from these islands seldom frequented by ships.

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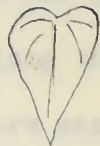
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which I could but compare the jungle dangers of Malay and the jungle solitudes of Polynesia. With no animals larger than rats, no reptiles larger than small skinks or gekkoes, no insect pests, no leeches or other "vermin", one can spread one's blankets upon the soft sands above the beach and listen to the only noise of the night,--the roaring surf with an occasional tatler's call.

April 4

A few heavy showers during the night, but I was wise enough to bring the oiled silk for this camp and so kept everything, including the dog, dry without trouble. We are out at daylight this morning and have taken a position up in the twisted and gnarled trunk branches of the tree which here replaces the hibiscus in forming groves of tangled boughs. The leaf is long, lanceolate and heart shaped, not so remote from the hibiscus in general appearance. From here I command a good range of territory where I can see very well if any rail comes reconnoitering through the fern stalks or brush heaps.



While upon this island my imagination plays incessantly upon the probable life of those two stranded shipwrecked sailors from the 'Essex'. What a place to be washed ashore upon! Did they come entirely empty handed, or in a boat with a pocket knife or other implement? What a time they must have had, if stranded unequipped, to

combat the entangled jungle! Water they found in pools in the rocks and conch shells sufficient to keep them alive until they were eventually rescued. The remains of turtles found by us in caverns is evidence that occasionally they had a glorious feast. I can see them fighting decay by cooking and re cooking it,--or had they the means or skill of obtaining fire? Raw turtle would be rather strong. How with sharp stones and stakes they opened the shelled reptile unless they possessed a knife, or just how they prepared the meat would be interesting to know. Shearwaters and tropic-birds they undoubtedly found, the eggs of which would furnish a delicious morsel even if taken raw. Fish they caught in pools left by receding tides.

White terns are hovering about the tree tops. The first land bird of the morning is a little brown warbler, and as I shoot him some parakeets screech shrilly not far away. No rail seen or heard during the hour. A walk along the short beach, and then back for breakfast before once more assailing the entanglements above the cliffs. Both blow-flies and a smaller *Musca* are here in fair quantities.

The boat came ashore just as I finished breakfast. Some work on sails requires the presence of the entire crew aboard this morning, so I am left to cut my own trail, and plants are not being collected at all. I try the woods above and first thing find myself back at the place of beginning. A cloudy day and nothing to keep one's sense of direction. Trying to avoid bad brush twists one's ideas of distance

and the compass. I have heard two rail this morning and I think the dog routed one from a pile of pandanus leaves; but he will have to speed up to catch them. He located another shearwater, no nest being evident where he found it against a lump of coral. I ascended a tree and called doves with no response. Heard some parakeets and succeeded in enticing them within range. One fell to the southeast and two to the east. I had never thought of taking compass bearings to locate a bird before reading Beebe's "Malay Days". It is a good idea. Given the compass direction and a fair estimate of distance, and then a dog with a good nose, and one should not lose many birds. I am going after the two birds.

I received another surprise by coming upon recent cuts in the brush, and then to my utter astonishment found myself entering a little clearing through which we passed yesterday from the south, when I thought I was considerably north of it. I climb up in a pandanus tree and call for doves. More parakeets heard, and again I succeed in getting them to approach me. They circle at length about the tree, but my footing is too insecure to permit good shooting. I miss three shots with the auxiliary. Then they alight within easy range and I get two of them. The third flies to a tree above the badlands (if any particular portion of this island could be termed so gently and mildly as merely bad), so I refrain from shooting him.

Retreat ordered, as it appears that the badlands stretch across my path for considerable distance. I ascend

another tree and called doves apparently without success until a flutter of wings startles me, and there less than two meters away is a dove. No use shooting at that range, so I take notes as he sits there giving me a thorough scrutinizing. I try a sketch but fail miserably, so blot it out. The gray feathers on the jugulum stand up rather prominently as he sits there turning his head first to one side and then to the other. Now he flies through the tree branches and perches behind me, still within two meters. A warbler squeaks below. These little green fellows do not sing as do the large yellow ones of Tahiti and Hivaoa. Are they not breeding now? I doubt if they really belong in the same genera. The dove flies off a few meters. I aim and pull the right barrel, ^{ing} think_^ that the auxiliary was in it. I held the gun loosely and it kicked clear of my grasp and fell into the branches below me. Thank God, it did not fall to the ground, for at times a little jar trips the other trigger. Fortunately I pulled off my aim and missed the dove.

A short while back I shot a dove and sent the dog to retrieve it. The bird was not yet dead and so he proceeded to kill it. The shearwaters have spoiled him, for the tender dove was soon chewed to a pulp. He laid it down and commenced licking the open wounds, but I don't think he'll do that again. Neither do I expect him to retrieve for awhile after the licking he got. He beat it back down trail and did not show up for an hour. In the badlands I tried his

moccasins on but he raised an awful fuss.

The badlands are a stretch of highly weathered coral from one to two meters in depth, and with holes and crevasses all through them. The tops are like stalagmites, only sharp-edged as chipped flint, if not quite so hard. The holes are big enough to let one's legs into them, but even the crevasses are too narrow for one's entire body to fall into. It is absolutely the most impassable place I have ever seen. My heavily hobnailed shoes are rapidly being cut to pieces. The ball of the foot has given way at the side seam. They are supposed to be moccasin boots, but apparently they are soles and tops, and certainly not worth the high price I paid for them. I was up in a good tall pandanus tree a while back and had a good survey of a great portion of the island. I saw no promise of better traveling conditions anywhere. Beyond the badland stretch there seems to be a considerable swale, which might have been the lagoon of this former atoll (?). I could see only a few isolated shearwaters flying above the trees. One neglected came my way, hence the # 6 shell which kicked the gun from my hands. I hear but few doves calling.

Returned to cliff, but hearing Mr. Beck still shooting I went off into bush again and obtained a dove and a parakeet. Mr. Beck came ashore at noon and seems to have struck good traveling, getting to the badland stretch and back without a machete. He obtained some parakeets and doves.

I cooked and ate an early dinner and came back up

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here at five-thirty to patiently await the pleasure of Porzanoidea atra. Their pleasure seems to be to remain out of sight and perfectly quiet. The Henderson shearwater's clattering somewhat resembles the rail's call, but more loud and slightly different in pitch. How different, indeed, from the other shearwater calls! The shades of night certainly fall rapidly in the tropics. It is but six and almost too dark in here for shooting. Still no sign or sound of rail, and no other bird has been near except one little warbler flitting about in the twigs overhead in his quixotic search for insects. A rat rustled across the fallen leaves and startled me with thoughts of rail. The pandanus dead leaves make so much noise in the breeze that one can hardly hear anything when walking. Too dark to write, so I have little chance of shooting a black bird now.

Familiarity with the trail made the twilight descent uneventful save once while letting myself down off a shelf when I caught my trousers and ripped a large hole in them. Fortunately the rip was only cloth deep. Another night of fascinating moonlight and that ever enjoyable delight of watching the breakers roll over the fringe of reef and come surging up the beach.

April 5

Did not get breakfast over with until nearly six. From the cliff I kept to the left and so found the good

traveling that Mr. Beck had yesterday. Good traveling on this island is, of course, about the worst sort of traveling on an ordinary island even in the tropics. Fortunately the thorny briar vine does not seem to be on this side. I have not yet encountered it. Reached the badlands in one hour this way. Then by keeping to the left of them I found a comparatively good pass through the intricate labyrinth of magnified thorns of coral. I think these badlands are the remnants of the elk-horn coral area inside the ancient atoll reef. Beyond them is the level sandy floor of the lagoon bottom. Here is indeed clear sailing, the bush being high enough to permit comfortable walking.

Through the badland stretch I called three doves. A parakeet came to within a meter of me and scrutinized the dog and me at length, hanging head downward most of the time. At departing he selected that zone of safety surrounding the sun and so eluded my attempts to shoot him. One that I winged I have staked by the leg, according to boyhood custom and Bijoe's advice, inside our live cage, which is perched in the tree above camp. Here in this open woods I can see a good distance and so will pause often to await the pleasure of Porzanoiidea atra.

Called another pair of doves at the last sitting. This level interior was undoubtedly the bottom of the ancient lagoon, for one sees elk-horn, calf-brain and numerous other corals familiar from canoe journeys over shallow lagoon waters. At last I come upon a rail, but find that I have not reloaded

since the last shot. He patiently awaits that performance and then poses for an easy shot. "Sputter!" Damn! One of those bum shells! I let him run until he is about to disappear into the brush and ferns, then blaze away with the large shell. He disappeared. Came a little farther and met another. Once again the auxiliary fails me. Curse those bad shells! Why do I always get them while in rail territory?

A dove is here feeding on a berry which is nearly all stone. Of course it's a good auxiliary now. A wait without further rail visitors. I'm inclined to think that slowly walking through these woods is best. The rail run a short way and then stop to look one over, and if the cartridges were good one might easily get them. I certainly would not call them "common". Well, they are not rare either, for here where I sat down on a log to partake of a little refreshing fruit I have obtained three. Two appear to be young birds and have a strange greenness on the base of their bills. The first one made a noiseless appearance and squatted on a log, peering at me. He was too close, but I shot for his legs and the cartridge was a good one. The second one crossed in front of me before I saw him. He was quiet too, but the third made as much noise in the dry leaves as the breeze does in the pandanus. It is now eleven-thirty, the very time of day one does not expect to find rail.

Warblers are flitting and peeping in the trees about me. While watching for rail I call doves and they answer in the distance. Obtained two after leaving the first rail site. A new location will probably give better results now. I was watching a lizard and about to shoot him when the second rail approached. Here comes a dove, cooing as he approaches. A male with very coarse coo. There are a pair feeding in a low shrub just too far to reach with the auxiliary and too close for the large shell. I creep up and then my aim is deflected by a clattering and black movement on the ground below them, the fourth rail! Only a small green spot on his bill, and the legs more brown than others. They do occur occasionally here at least. Wandered on eastward until the dog jumped a rail and ran it into a pile of dead pandanus leaves. I went to his assistance and routed the bird past him. He seldom sees anything when he has his nose in a clump of brush. Here I obtained two more shots at rail and got my bird with the one cartridge that was good. Hit the other with spattering shot.

Decided to return shoreward, and foolishly by a new route. If I don't get trapped by brush I'm lucky. Have obtained several more doves; picked up some warblers; got one of two parakeets, and have twice run across rail. They make a noise more like a sharp "Clickety cack" than a clatter. I am trying to keep the dog heeling in here, but he's gone the minute anything moves within sight. I climbed a pandanus

tree and found that I have penetrated considerably inland, so much so that I'll have to hustle to get out before five and catch the boat. Still, I'm tempted to spend the night in here with the rail. Another pause of half an hour nets a dove but no rail.

Shot a young rail in pin-feathers and found a pair of Henderson shearwaters under fallen pandanus leaves. Climbed another tree and am still far from shore at four o'clock. Well, I should get some rails even if I do have to sleep out. Have some lunch left and a little water.

This was indeed the day of rails. When, after heading into the setting sun by south, I finally reached that for once welcome badlands and again ascended a pandanus tree to reconnoiter for a passage-way I heard another rail. The lateness of the afternoon could not dissuade me from searching for that trilling rail,--the old ones give the real clattering trill of the rail. Creeping through the brush I secured a place of vantage and waited. There through the ferns was the black shadow moving ever so slightly. The cartridge was a good one. A rush through the dead leaves told of the presence of another. I waited and listened. Light, cautious steps could be heard amongst the blocks of coral behind me. Twisting about I saw him real close over my left shoulder. I dared not move my position for fear of scaring him away. Carefully I put the gun to my left shoulder and brought it around easily. Then I tried to perform

the impossible and aim with my right eye. At last I opened the left and got the bird. Seven or eight rails were the day's bag. Yes, I guess as far as rails go they are "common" in the interior.

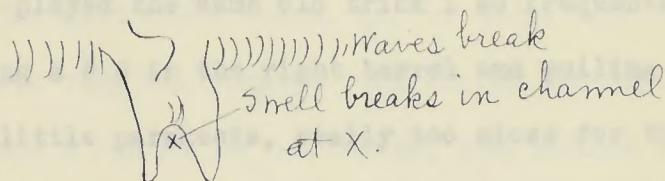
And then the badlands! What would happen if one's footing broke from under one it is hard to say. It seems impossible to escape without serious injury. I wish Mr. Beck would take a good five by seven picture of that stuff. What a barrier it would make before an entrenchment! Barbed wire entanglements can be shot down and cut, but shells would only chip these minarets and spires of coral more sharply than the rain has left them. I have looked down from mountains upon the spires of churches and temples. If the entire city had been mosques and cathedrals in very close order then it would somewhat have resembled this stretch of badland. A giant walking over the city by putting his enormous foot upon a row of steeples would have felt as I did. The interior is not bad for the dog's unprotected feet, but this brings whines of torture from him. He hardly had an inclination to eat this evening; nor did I have sufficient enthusiasm to cook a meal.

The boat came off to get my birds, half a dozen of which I had carelessly left at the top of the cliff. From the badlands I struck very brushy traveling, being farther south than where Bijoe and I went that first day. I tried to bull my way through by fool strength, but finally had to put

long handles in the machete and cut a lane through the low shrubs for several rods. It was there that I left the basket of birds, forgetting to pick it up after the chopping.

The boys had an interesting take-off in the boat.

The channel is bi-partite in its inland extremity.



On the point (X) the boat was left by the outflowing flood which should have carried them clear. The next wave fortunately was not overly high and so did not break clear over the boat, but raised it clear and the ebb carried her out. The following wave boosted them ten feet high in the channel's mouth as it broke on either side, and broke with terrible ferocity on the point they had just left. It would have swamped them completely. There is an element of adventure in this landing on every island. The boys are getting in good practice now, however, and ere we finish this journey will be in good boat shape.

Heard and saw another curlew while chopping brush.

My tatler friend is on the beach again this evening.

April 6

Slept very poorly last night and consequently had little pep for early rising. The trouble was last evening

that I found myself too weary to sleep,--too much brush fighting. I would rather travel twenty or thirty miles in America than the one or two miles traveled yesterday. Ate a cold breakfast and struck out at seven. One hour took me beyond the badlands. Struck old trail occasionally. Have heard very few doves this morning. Warblers about as usual. I played the same old trick I so frequently pull off, having a # 6 in the right barrel and pulling it on two poor little parakeets, really too close for the auxiliary. Well, they didn't suffer long. Have heard rails twice but failed each time to get sight of them. Whenever the surrounding territory looks favorable and a leaning tree trunk or fallen log affords the proper accommodation I sit down and make noises like a rail. Here one came out from the brush and scolded me for not pronouncing my vowels clatteringly enough. They are saucy little black devils all right. They are not very common right here.

I have had rotten luck all day and seem to have missed the good woods of yesterday and struck an unusually vine grown stretch. If anything can be worse than dense brush it is entangled vines. But I should be thankful there are no thorns on it. Climbed a good tall pandanus and found myself farther inland than yesterday. Without sunshine one would have to constantly consult the compass in here. Being a bit tired of tripping through and trying to cut vines, I sat down to call rail. Overhead was a dove,

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Before he moved off the proper distance a rail appeared below him. The dove did not move when I shot, so I got him second. After him another rail showed up. This was about at noon. Now shortly after one I have the fourth for the day. Doves very reticent and scarce today. Hot and sultry now.

The next one I heard, and so crept into their neighborhood very cautiously. Was seated and calling doves when I heard a rustle in the leaves, and looking in that direction saw one rail chasing another across the opening. Both were fluttering their wings rapidly, but certainly were not flying; nor did the two chased by the dog show any ability to fly. They did, however, flutter considerably while running. Until I actually saw one flying I should consider these birds flightless. Obtained only six, and four doves, three parakeets, three warblers, and the three shearwaters. Passed through some very viny country today, much worse than that encountered yesterday. Crossed over my trail and struck the cliff considerably to southward. Went aboard because of lack of water in camp and to get a little repair work done on clothes and shoes.

April 7

Ashore this morning and with Curtis along Bijoe's trail to badlands. While crossing them a young dove came to investigate us. I shot two parakeets that were flying about, but it was foolish because they fell into the deeper recesses

of the badlands. Just beyond where we eventually succeeded in getting I called a dove. While he was in the trees above, two parakeets were flying overhead, a whole family of five warblers were close about, and two rail were making noises beyond a rock. Apparently Curtis has collected very well of the plants. I am pointing out ones that look rare to me, but he has most of them.

We stopped to lunch where we had heard rails, but none showed up. Warblers had been fairly plentiful all morning, but now that we wished to take up a few none were to be seen. I left Curtis behind with all excess baggage. I went out hunting an hour or so and obtained five warblers. Heard two rail but could not get sight of them. They aren't so awfully common even here in the interior. We brought water and food enough, except for the bread we lost, to hold out well tomorrow morning. The dog and I will spend one good night ashore and in the interior, with no shelter if it rains save pandanus leaves. Have not been able to strike that good territory found Wednesday. Like the region I was in yesterday this too is quite brushy. The dog found a hole in a tree stump well filled with water, so he ought easily to go until night, or even morning.

Just after Curtis left I found a pair of shearwaters beside a large tree, virtually beneath the stump. They had a nice nest built of the rotten wood which required more than merely scratching it about. The nest material looked to be newly torn up from an old log leading out from the

stump. Warblers are now chirping about plentifully. I suppose in the morning they will be scarce. This is neither good rail nor dove territory right here. We blazed a good trail this side of the badlands from the Bijoe trail crossing. Curtis is going to put up a flag at that point. I hope to have a good trail going in tomorrow. One keeps in a much better mood when one hasn't brush to cut when tired. The dog found a rat hole in a tree but the wood was so hard that I could not cut it away.

We traveled inland away from the setting sun until well past five. Then arriving at what appeared to be good rail territory we stopped for the night. There is a noticeable bed of leaves above the coral here. In fact I have found rails best where the leaves were the thickest. Today passed almost without rails. But soon after we stopped I heard footsteps beside me, and there he was dodging around the aerial roots of a pandanus. Have heard another here but it will soon be too dark to shoot. As for rails, the evening certainly is no better than the middle of the day. But just to hear the shearwaters clattering overhead is worth sleeping out for, at least once on an island. Having heard several dozens of them, I decide their call very closely resembles the small Ducie bird. Too dark to write. Strong smell of phosphates.

I dozed off to sleep early while still listening to

the clattering call of the shearwaters flying overhead. When I next awoke at eight o'clock perfect silence reigned through the jungle. Nor was there any noise heard during the night except once a shearwater, once a dove and once a rail. I was too uncomfortable to bestir myself into striking a match to note the hour but felt it was early morning, since the late moon was setting.

April 8

Awoke before six after listening to the birds awakening around me. Rails were earliest, then doves, warblers and parakeets. The shearwaters got away fairly quietly; the white terns were a bit noisy nearby. Rather chilly this morning. I have decided that just sitting down is not the way to hunt rail. One should travel until they are seen or heard, and then sit down and let them come up to investigate. Last night I shot a rat near our stop, but it was a male and as we have nine males from here I did not bother to keep it. At seven we have one rail and another rat. It also is a male. The doves are cooing in every direction. A few rails clattering and warblers chirping and feeding all around. There's a shearwater cackling.

The doves were cooing abundantly from seven until eight-thirty, after which they quieted down to an occasional coo. Two were observed in that safety zone between the ranges of the auxiliary and the large shells. The male was cavorting

around the female much as domestic doves do, his feathers all ruffled up, especially about the neck and breast. Later a young dove came into the trees overhead to observe me. Have had no luck whatever in calling either doves or coaxing rail. Have only four of the latter, although I have heard them plentifully about me all morning. Brush is a little too thick to see them well. About same conditions as Thursday prevail, though I have been endeavoring to get into the country traversed on Wednesday. Promises to be a good hot day.

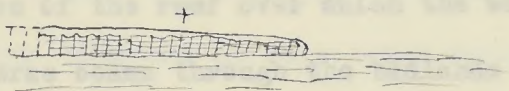
Decided to return, so swung off to the right. I have wandered about so aimlessly, as far as direction is concerned, since this morning that I have little hope of finding my trail. I think I am to the north of it, however, and so when I strike the badlands I'll swing southward hoping to pick up the flag left by Curtis. Have come upon three rail while returning. Hearing them or flushing them, and then standing or sitting while they investigate is the best method of getting them here. If you stop they will stop, but keep moving and they will soon disappear. I found an old and young noddy on a pandanus tree. Shot them both with the auxiliary. While fixing them up, a rail showed up; and while fixing him, another old noddy flew in and lit where the others were.

Eleven o'clock and very hot and sultry. Am beating my way due west and hope to get to the beach about one o'clock. Doves call very seldom here now and the warblers also have quieted down. I did manage to get nine rail before reaching the badlands. The two last ones were obtained just before I arrived there at two o'clock. I found myself farther inland

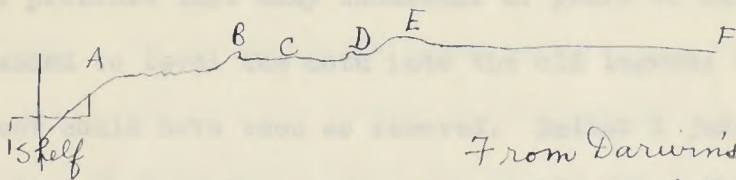
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than I thought, and was unable to pick up the back trail, due to the indiscriminate meandering while hunting this morning. Crossed the badlands after following along them in search of trail. On the other side I struck an old trail and by following the dog I took the right direction and soon reached lunch place of Bijoe and myself on Monday. Arrived at boat at three P. M. and moved everything aboard.

April 9



We are standing off the island and I am decidedly impressed by the appearance of it. There is a decided slope from the interior at about badland distance down to either end where the cliffs are abrupt. All along the face of the island toward us the light colored cliff shows at about the same level as the verge on either end. From the brink of this inland stretches slightly rising timbered, or rather brushed, land back to the badland heights.



From Darwin's
"Coral Reefs"

Taking the cross section sketch from Darwin's "Coral Reefs", I would pass my verdict that the present cliff is at the point "A", where the waves have undermined it and produced a vertical wall. In several places the rounding summit is still noticeable. This, however, should be verified by a specific study of the fossils found in the cliff, all of which are very like living organisms now found on neighboring reefs. This cross section would allow one hundred and fifty yards to the point of the breakers; the badlands are three hundred yards inland, but appear to me to be that narrow, flat portion of the reef over which the waves break heaviest. The transverse seams through the badlands look much like the channels through that portion of the living reefs. Erosion by fresh rain water has certainly disfigured the old reef considerably.

Someday if ever I am fortunate enough to be able to spend a year or so studying coral reefs thoroughly, I shall visit accessible Makatea to make a closer study of one of these uplifted atolls. At Henderson Island there does not appear to have ever been much elevated land in the form of motu. The badlands are the highest portion now existing. Of course it is probable that many thousands of years of rains would have tended to level the motu into the old lagoon; but not many feet could have been so removed. Rather I judge the ancient island to have been a very low atoll with perhaps few motu on its reef, and a very shallow lagoon. Whatever it was, it

is perfectly evident that it was uplifted by a very regular and even movement, since the present elevation is noticeably regular. Beyond the badlands, which are flanked by coral mosses and dikes very similar to those in the Tahiti reef extending lagoonward, there are the mushroom, elk-horn, calf-brain and other typical lagoon shallow corals. Occasionally one comes upon knolls of coral of different types, but for the most part the interior is very even.

There are various types of vegetation according to the local conditions. The verge and upper slopes of the cliffs are densely covered with shrubs, over which one sometimes can crawl safely. Some are of very tough wood, others very soft. Below this shrubbery is a small zone of woodland, mostly composed of irregular, lolling tree trunks and branches. Dead twigs stand up a foot or two above this leaf canopy. Nearer the shore are the pandanus, Tohunu, and the brittle wooded, rough barked, yellow flowered, cedar like tree, common along all beach fronts in Polynesian motu. There is a grass here also, not abundantly in flower. Over the brink of the cliff one enters the real jungle, a mass of intertwining vines, dense shrubs and dwarf trees. I have seen tree trunks half a meter in diameter, yet the trees never exceed six meters in height. The entire jungle seems intent only upon arriving at about three to six meters height and there stopping. One tree vine grows erect about two meters and then branches out with three or four main branches which soon divide into

numerous small vine branchlets which form abominable entanglements of loose, uncuttable, wiry runners. The pandanus tree always has a cleared circle to itself but strews the same with its thorn edged leaves half a meter or more deep, a refuge for rats, rails and lizards, and a safe one too. On the coral knolls where little soil has accumulated, vines and dense shrubs predominate, in some instances so thick that one must go around them. Elsewhere there are patches of what might be termed real woods or forest. In these, vines are reduced to a few stalks, while the leafy entanglements are well overhead. In such places trees with large bowls occur, and here one sits to await the return of aroused rail or to call doves within range.

There is a small crab-apple like berry that grows on a slight bush about two meters high, upon which I have observed the doves feeding. The parakeets are seldom met except as they fly squeaking overhead. Sucking or shrilly whistling will then call them into nearby tree tops. The little warblers are met with everywhere, including the leaf strewn ground. The rail were also found most commonly where the ground was well strewn with dead leaves. The shearwaters are found sparsely throughout the woods.

April 10

Came ashore here at the west end again this morning to hunt land birds before we leave this evening. Heard a dove or two before reaching the badlands, and while crossing them saw three parakeets. It is utter folly to shoot birds above

those innumerable cracks and crevices. The rough country beyond the badlands where I crossed today, for although I followed the old trail I did not come out where Curtis and I did Friday, was exceedingly brushy and extensive. Have heard no rail yet. I am not going to attempt to retrace my steps, but rather will plunge on inland and then back, trusting to luck and good fortune to bring me out somewhere near the trails. I seem to have lost whatever sense of direction I ever did possess, and cannot follow trails traversed several times. No response to any form of bird calling here.

I plunge on, but am unable to locate that easy traveling found Wednesday. At last (nine-thirty) being a bit "het up" with the brush fighting, I sat down and called doves. One came very close before I could get the camera out of its tight case. I tried a snap shot at about six feet,--it had been half as close again. While I was trying for a nearer view, a rail came up behind and saucily "talked" at me. So I laid down the camera and shot the rail and then the dove. There seem to be no more of either here, so I must move on.

I have certainly struck a brushy portion of the island this time. It is, furthermore, somewhat birdless. I have not yet got beyond the coral, although I have been plunging madly through brush for some three hours. Unless I strike better traveling going back I'll have a day of it indeed. I am worried considerably about this bewilderment of direction and distance. Three times now have I failed to find that

good hunting and good traveling I had on Wednesday. What is worse still is my unquenchable thirst. It commences an hour or so after I start in the mornings and worries me into drinking early against my better judgment. In the afternoons it gets unbearable and water gets low quickly. Brush! Brush! I would feel highly elated to come out into the tall woods, but have very little hope of reaching them at all today. It would not be so irritating if one were getting birds; and I suppose if one were not irritated one would get more birds. A few warblers about and doves heard distantly.

Have I mentioned the abundance of the mistletoe here? There is one soft wood tree with a beech-like leaf that is always host to dozens of plants. It grows on other trees also, and is very common generally throughout the island. This was an unprofitable place to stop, but I was tired and mad at the brush, so had to rest to compose myself. How quickly the dense brush ahead will arouse my ire!

Plunged on through the brush in whatever direction I heard rails. Stopped to call at all favorable looking places. Doves were very reticent, and so I obtained but five during the entire day. Two were so tame and came so close that I got out the camera and tried photographing them (1/35 at F 4.5. Shade.) but it's an old film and perhaps will prove no good. I certainly hope it is a good one after lugging that Graflex all day. While photographing the second bird, two rail clattered on either side of me, but neither showed up and I could not find them. Obtained only four rail

during the entire day, and two of them slipped out of the hole which this Henderson brush has worn in the bag of my jacket. But I found one of them, so had three to add to our twenty-one,--a fair series for rail. Also three pickled.

I thought I had worked decidedly southward during the day's plunging chase. So at one o'clock I started well to the north of west; but my bearings were far off. What was worse, I got into the brushiest place I have yet struck, with large patches of badland coral everywhere throughout it. Finally found myself trapped in brush, so set off for nearest shore line in due west course. Had to plunge and cut through some awful brush, which is anything but pleasant at the end of a day. Found or heard both shearwaters nesting as I neared the cliff--inland a hundred meters or so--but was too worn out to cut brush in search of nests, and certainly did not feel like lugging any when we can shoot them from the boats. All land birds scarce along here.

To my utter astonishment I came out on the cliff in the cove south of the coconut grove cove. Had to follow along the brink of the cliff around the point south of the landing. It's quite a thrilling experience to be eighty feet above the breaking waves which strike beneath one and splash upwards. The thrill comes when the brush crowds one out to the very verge and at the same time conceals the treacherous footing on the coral rock, but not quite as terrible footing as the badlands except in places. Strips

of a few meters wide that run off at angles to the cliff are often of badland character. Elsewhere just ordinary rough coral rocks abound.

Reached boat at five and enjoyed two drinking coconuts. I finished my water when I sighted the boat landing. As we rowed out to the ship (a high tide made the get-away perfectly easy and unexciting) a queer looking little steamer with a very tall smoke stack passed about half a mile out. I suppose they were wondering what on earth we could be doing at this island. I certainly am pleased to think that there are very few islands like it, yet for birds it surpasses many. The question with me is how the vegetation and these four birds got here in the first place. Few atolls preserve the flora of the land which once was within the lagoon. At Ravaivai, however, we found a rather extensive flora out on the motu of the reef. There a good variety of plants would be preserved if the island sank to an atoll.



I fear the ocean has made terrible inroads upon Henderson Island since its uplift. The erosion of cliffs of soft limestone must be very rapid indeed. In the water below me today were three or four enormous blocks of the cliff which had been undermined by the waves and had fallen upon the shelf which is at low tide level. On all the points where no protecting beach guards the land, the waves of high

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of the land which once was within the lagoon. At Rapa, however,
we found a rather extensive flora and on the north
of the reef. There a good variety of plants would be pre-
served if the island sank to an atoll.

I fear the ocean has made terrible inroads upon

Bandarabon island since its uplift. The erosion of cliffs
of soft limestone must be very rapid indeed. In the water

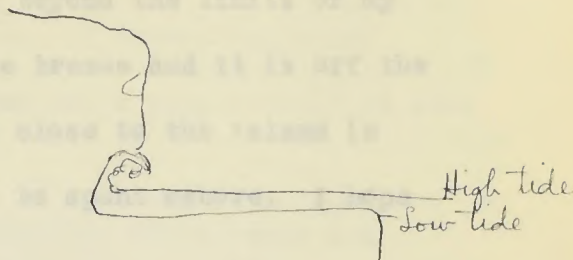
below me today were three or four enormous blocks of the

cliff which had been undermined by the waves and had fallen

upon the shelf which is at low tide level. On all the points

where no protecting beach guards the land, the waves of high

tide strike heavily at the under-mined base of the cliffs,
and I imagine that during storms
there must be a tremendous
wearing away of the readily
washed and rather soluble
coral limestone.



There are level stretches of caverns at two distinct
levels above the present sea level, which seem to indicate
either the general level of under reef caverns or else
periods of short rest during the elevation, which allowed
the waves to eat into the cliffs. These periods of rest
must have been very short because no fringing shelf was
built out at that time. The present level has, no doubt,
been maintained for several thousand years, giving the waves
ample time to cut into the cliffs, and the fringing reef time
to grow a hundred feet or more in width.

One rail I shot today was feeding amongst the fallen
leaves. He was scratching much as chickens do, only with
more rapid kicks which sent leaves and small bits of coral
gravel flying a meter or more astern. That was when I had
but few birds of any sort, so I failed to maintain the proper
scientific curiosity and shot the bird before I had observed
his feeding any length of time. It is so seldom that any-
one ever sees these rail or any rail, that notes concerning
their actions afield should be of about as much interest as
the twenty-fourth skin. But Henderson Island got me off my

scientific feed. That eternal struggling through brush and entangling vines irritated me far beyond the limits of my self-control. We have very little breeze and it is off the beam, so we may find ourselves so close to the island in the morning that another day will be spent ashore. I hope not.

April 11

Latitude, $24^{\circ} 17' S.$ Longitude, $128^{\circ} 39' W.$ Gr.

At five this evening we caught some fish resembling the bonito, with the following measurements: length, 75 centimeters; girth behind lateral fins, 57 centimeters; the weight dressed, about thirty-five pounds. Took a picture dorsal and lateral view. One escaped when Bijoe tried to raise it aboard by the line instead of awaiting the gaff. They are game fighters. These boys seem to have no idea of playing a fish before landing him. Bonito are jerked out of the water on barbless hooks as one would land a small trout with the old style willow and bent pin. But these fish were far too heavy for that method of yanking. The fight they put up was intensely interesting. On small tackle and a light rod they would be a really game fish. They tasted a great deal like bonito. I feared we would not have that best of Polynesian fish dishes called "raw fish" because our lime supply is exhausted; but vinegar was used to pickle the fish and served just as well. It was much better than the cooked.

-43-

There is no reason why trout and especially salmon would not be very delicious when so prepared. If termed "pickled" instead of "raw" even sophisticated white people would be able to enjoy it.

There were a few shearwaters, white terns and boobies about today; but there was a decided scarcity considering our nearness to land. Flying fish we have seen several times during the day,--why not more birds? Evidently they remain near land.

April 12

Latitude, $24^{\circ} 18' S.$ Longitude, $129^{\circ} 19' W.$ Gr.

Louis appeared today clean shaven and with a haircut. Charlie succumbed to itching whiskers some weeks ago. I am now the only fuzzy faced man aboard. We had a dinner wager up and Charlie pays. Papeete was the limit of our shaving. I felt certain they would give in at Mangareva, where report has it that girls abound, famed for their Spanish blood and spirit. But here they have surrendered while at sea. Personally I do not know what an irritating beard is because I can hardly be said to have a real beard after these two months out from Rapa. I'm sticking on just to see how much the rest of the journey will produce, and perhaps just for the fun of it will wait and let the barber do the tough work.

We saw no birds at all today, though we are but seventy-five miles or so from land. A very hot day, good for

drying plant blotters. Spent the day working on eggs, which were blown by Louis while we were at the island. He certainly is a help. Yesterday morning he turned out three frigate birds in three hours and twenty minutes,--better time than I ever made on that bird. In the afternoon I succeeded in finishing one in forty-three minutes,--my average time for most birds the past year. There certainly is something wrong with my skinning,--I think too many superfluous movements and ineffective efforts. Tender skinned birds I still rip up like a beginner, and small birds I handle like a blacksmith mending Swiss watches.

Recapitulation of the results of our trip:

At sea (not including the day	9
we were near Henderson)	
Ravaivai	50
Rapa	188
Bass Rocks	64
Pitcairn	46
Henderson	312
Ducie	<u>303</u>
Total	972

Of these the following groups:

Tubinares	397
Sternidae	216
Other sea birds	94
Shore birds and ducks	25
Land birds	240

(21) More specifically, the groups are:

(2)	<i>Ptilopus huttoni</i>	(Rapa)	19	...	17
(3)	"	<i>insularis</i>	(Henderson)	36	
(6)	<i>Porzаноidea</i>	sp.	(Rapa)	25	
	"	<i>atra</i>	(Henderson)	27	
(9)	<i>Fregetta</i>	<i>grallaria</i>	(Rapa)	56	
(11)	<i>Puffinus</i>	<i>pacificus</i>	(Henderson)	5	
(12)	<i>Puffinus</i>	<i>nativitatis</i>	Rapa		
			Bass		
			Ducie	.....	35
(14)	<i>Pterodroma</i>	<i>neglecta</i>	At sea	2	
			Ravaivai	1	
			Rapa	23	
			Henderson	13	
			Ducie	74	... 113
	<i>Pt. sp.</i>	(Blue shearwater)	Bass Rocks	45	...
	<i>Pt. sp.</i>	(Small white-breasted)	Bass Rocks	3	...
(34)	<i>Pt. parvirostris</i>	(?)			
		(Henderson shearwater)		77	
	<i>Pt. parvirostris</i>	(?)			
		(Ducie shearwater)		61	
(17)	<i>Onychoprion</i>	<i>fuscatus</i>	Bass	3	
			Ducie	2	.... 5
(18)	<i>Procelsterna</i>	<i>cinerea</i>	Ravaivai	11	
			Rapa	11	
			Bass	4	
			Henderson	4	
			Ducie	22	.... 52
(20)	<i>Anous</i>	<i>stolidus pileatus</i>	Ravaivai	7	
			Rapa	15	
			Bass	1	
			Henderson	3	
			Ducie	25	... 51

(21) Megalopterus melanogenys	Ravaivai 7 Henderson 1 Ducie 11	.... 19
(23) Leucanous alba royanus	Ravaivai 18 Rapa 7 Bass 1 Pitcairn 10	.... 36
" " (white-footed)	Henderson 15 Ducie 38	.... 53
(26) Phaeopus tahitiensis	Henderson 8	8
(27) Heteractitis incanus	Rapa Henderson Ducie	.... 3
Crocethis alba	Ducie	.... 1
(30) Anas superciliosa	Rapa	.... 13
(31) Sula piscator	Henderson 9 Ducie 9	..... 18
(33) Sula dactylatra personata	Henderson 1 Ducie 12	... 13
(34) Fregata minor palmerstoni	Ravaivai 1 Henderson 9 Ducie 10	.... 20
(35) Phaethon rubricaudus	At sea 6 Ravaivai 14 Henderson 11 Ducie 10	.... 41
(36) Phaethon lepturus	At sea 1 Ravaivai 1	..... 2
Vini stephani	Henderson	... 43
Conopoderas vaughani	Pitcairn	... 36
C. Taiti	Henderson	... 54

No golden plover has been observed during the entire trip. Curlews were observed at Ducie and heard at Rapa. Tattlers not common, but observed on every island visited, and were heard even on Bass Rocks. Sanderlings observed at Henderson. The reef heron was very common at Ravaivai, but had not been observed thereafter until our second arrival at Henderson Island, where it was impossible to get him. Frigates and boobies were noticeably missing from Rapa, Bass and Pitcairn neighborhoods. Not very abundant here at Henderson and Ducie, but at least a hundred frigates and a few more red-foot boobies about Henderson. Much less of those two at Ducie, where blue-faced boobies probably reach fifty or more.

April 13

Latitude, 24° S. Longitude, $130^{\circ} 18'$ W. Gr.

The mate this morning claimed that he saw a shearwater while I was busy in the hold. At about ten o'clock a yellow-billed tropic came over the ship, but we could not get a shot at it. During my day's rail hunting at Henderson I got considerably scratched, but my system seems to have developed the antitoxins necessary to offset these tropic bacteria, so that thorn scratches and pricks and coral cuts no longer become infected and fester as they were wont to at first. The Captain went ashore at the north end on Monday and obtained several birds. One parakeet was merely wing tipped, so he brought it in alive. It has eaten pumpkin, orange, coconut,

and, strangest of all, the scale insects off the heart-shaped leaves of the common tree along the beach.

Oeno was sighted somewhat before four o'clock, when the engine was started to give us a chance of looking over the island before dark. It is always best to know where these low lying and consequently dangerous atolls are before laying to for the night.

It is interesting to watch Vini stephani exercising along a cane about eight millimeters in diameter. He makes it foot over foot with feet in opposition or opened toward the stick. The swagger he gets off is that of a good rollicking sailor. I saw him "exercising" considerably today. The Captain brought a good bunch of green leaves with scales aboard, which he picks over very carefully.

As we approach Oeno the one important bird note is that very few birds have been observed for the past hour. One or two shearwaters, light below, were the only birds that passed.

At sunset we stopped the engine and brought the ship into the wind to lay to till morning. Four "Kavika" (Onychoprion fuscatus Linne, --17), sooty terns and one "Naw", red-footed booby (Sula piscator Linne, 31) observed flying high overhead towards the island which bears a little north of west, one mile distant. We can well afford to put up some more red-footed boobies from this portion of Oceanica, and sooty terns are quite desirable from these out-lying islands.

But such a paucity of birds we have encountered nowhere else when so near the shore. Where are the shearwaters and white terns? Here's a black shearwater. Mr. Beck says it is too big for P. nativitatis.

Northeast point of Oeno Island:

Latitude, $23^{\circ} 55' 30''$ S. Longitude, $130^{\circ} 44' 20''$ W.

"Oeno Island is an atoll and was discovered by the 'Hercules', but was named after a whaler whose master had not seen it before." It is the "Crescent Island" recorded by the 'Duff' on her way from Tango to the Marquesas via the "Horse Latitudes". The pilot book continues:

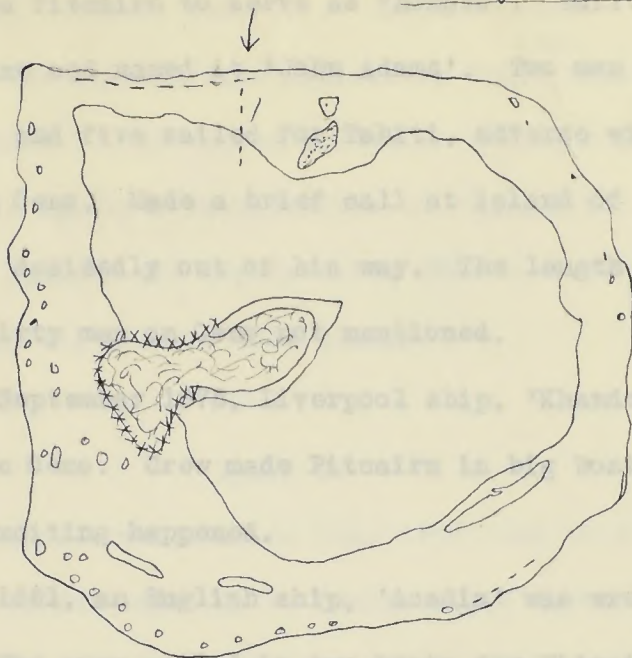
"Landing is extremely dangerous, even when practicable ... The existence is reported of a channel for boats, through the northeast part of the reef encircling this island, leading into the lagoon, eastward of sandy islets."

We could see the reef considerably this side of the wooded island when we lay to this evening. This is a strange atoll which may have some interesting features concerning the make-up of such islands. What has formed the island so far within the reef is one question that arises in my mind tonight while looking over the chart. Why are there no motu of any consequence?

The sketch on the following page is from the United States Hydrographic Chart. The wooded island is composed for the most part of a fine gravelly sand; but towards the west end is a conglomerate base. On the southwest side are sloping strata like those at Scilly Island. Again they

are lagoon formation.

From U.S. Hydrographic Chart.



Twice the "Kavika", sooty tern (17), have passed over the ship since dark. I hope there are enough here to give us a series. They don't seem to be overly plentiful. How pleasing it feels to get into their domain once again! The sooty tern with his quixotic flight and continual calling appeals strongly to me. I like him best of all sea birds outside the Tubinares. His flight is as interesting to watch as is that distinctly different flight of the frigate bird.

In the early part of 1858, according to the "Story of Pitcairn Island", the 'Wild Wave' was wrecked on Oeno. Captain Knowles, the first mate Bartlett, a carpenter, and four seamen went to Pitcairn for help. They found the island

deserted. Their boat was destroyed by waves during the night. Sea birds (reported very abundant on Oeno at the time) were carried to Pitcairn to serve as "homers". Built new boat with only an axe and named it 'John Adams'. Two men remained at Pitcairn, and five sailed for Tahiti, adverse winds keeping them from Oeno. Made a brief call at island of Nukahiva, which was decidedly out of his way. The length of the stay of the thirty men on Oeno not mentioned.

September 1875, Liverpool ship, 'Khandeish' was wrecked on Oeno. Crew made Pitcairn in big boat and gig. Nothing exciting happened.

1881, an English ship, 'Acadia' was wrecked on Ducie Island. The crew sailed in two boats for Pitcairn, stopping one day at Henderson Island. Three men chose to remain on the island; two married; one broke up a couple and was kicked out.

1883, August. The bark 'Oregon' was wrecked on Oeno. All crew and passengers landed safely. Captain Hardy and Mate Walker attempted to make open sea in boats, the former being drowned just as his boat reached open water. The mate saved two men who were with the Captain and then made for Pitcairn, where he arrived on the second night. An Irish sailor in command of the remainder launched third boat and made Pitcairn safely.

There has been one other wreck in more recent times. Our sailor, Teo, was on the 'Fijoran' which came down to salvage the ship. The Captain informed the sailors who could see land

ahead that his course was correct. A few hours later they struck the reef. His calculations were undoubtedly off.

'Sam Jones' wrecked 1920 (?). Captain died.

The Captain says reports in these seas credit Oeno with seven wrecks. What caused them all? Perhaps unfamiliarity with these waters or recklessness in running too close, but only one hundred and eighty miles from here to the nearest Tuamotu doesn't leave much leeway.

April 14

About twelve miles away from land this morning, having been set east ten to twelve miles during the night. When coconut trees are first visible, the South Sea captain judges his distance as ten to twelve miles, allowing two miles variation for height of trees. Seen from the east the trees here have the following appearance.

I III II

Saw a tropic-bird resting upon the water this morning just after breakfast (at which we had a can of fruit to vary the abominable French coffee). As we run in towards the island with the engine, two young red-foot boobies (31) fly about our stern seriously scrutinizing the spoon fish-hook trailing behind. They decided, however, that it wasn't a flying fish, which are more in evidence here than I have

noticed elsewhere on this voyage, and went off to seaward. Two "kavika", sooty terns (17), were also observed. Our chances of finding them are good, although this is not their regular nesting season. A blue-faced booby (33), sailing very low above the waves, crosses our bow and goes off to port and seaward. This is perhaps the bird termed by the Pitcairn boys an albatross. They said large white birds with black wing tips, but insisted that they who had voyaged to New Zealand knew an albatross when they saw one. Now comes a young frigate-bird (34) out to look us over. He circles about us several times. There is very little breeze, so he finds it necessary to stroke more than usual in his flight; but he can soar a circle, or occasionally two, without any perceptible wing beats and not much noticeable loss of elevation. There is another sooty tern off there in the sunshine whither soared the frigate.

A white tern and a sooty as we get within one mile off the reef. Several tropics and a considerable number of frigates observed as we approached. A few more neglected shearwaters seen. Blue-faced and red-footed boobies and white terns are in evidence. The boys are catching several Paihiri as we steam around the reef. A large one, 104 centimeters long and 83 centimeters girth just behind the pectoral fins, caused the most excitement of the morning. Ate canned beef this evening after this catch had been salted down!

noticed albatross on this voyage, and went off to seaward. Two "Kauai", sooty terns (17), were also observed. On chances of finding them are good, although this is not their regular nesting season. A blue-faced booby (23), sailing very low above the waves, crossed our bow and went off to port and seaward. This is perhaps the bird termed by the Hawaiian boys an albatross. They said large white birds with black wing tips, but insisted that they who had voyaged to New Zealand knew an albatross when they saw one. Now comes a young frigate-bird (24) out to look us over. He circles about us several times. There is very little breeze, so he finds it necessary to stroke more than usual in his flight; but he can soar a circle, or occasionally two, without any perceptible wing beats and not much noticeable loss of elevation. There is another sooty tern off there in the sunshine. Whither soared the frigate.

A white tern and a sooty as we got within one mile off the reef. Several tropics and a considerable number of frigates observed as we approached. A few more neglected shearwaters seen. Blue-faced and red-footed boobies and white terns are in evidence. The boys are catching several Palms as we steam around the reef. A large one, 100 centimeters long and 85 centimeters high just behind the pectoral fins, caused the most excitement of the morning. He cannot beat this evening after this catch had been raised down!

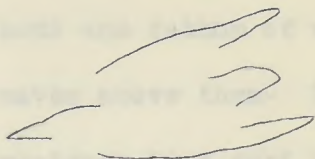
Came ashore today from the northeast, being able to row to west of sandy island where we had more than one fathom depth most of the way in. Part of the 'Sam Jones' stood above the water,--a rudder post or mast. It was quite thrilling when a breaking wave shoved us ahead of it at breakneck speed. On the island we found ample evidence that the Pitcairn boys had been here about ten days ago. Many bird wings and feathers, mostly young tropics, some shearwaters and frigates told the story of the raid.

This island belongs first and foremost to the red-tailed tropic-bird (35), which abounds in great numbers. "Kavika" (17) is here in preliminary flocks to the nesting season. Also more lesser noddy terns, some noddies, and considerable white terns of the blue-footed species. "Shwish-sh-sh-sh-sh", a heavy sound overhead like unto that made by an eagle diving upon an osprey.

With wings held backward, a blue-faced booby comes down from a considerable height.

I have obtained one very white red-footed booby, of several seen. The best surprise of

all is to find them nesting at the innermost end of the island. Here sits a young fairy tern on the branch of a tree, and flying about is an adult bird carrying in its beak a small



fish. The bird lit, but rose again. Have carried one load of birds to the boat and am out after more. We found five blue shearwaters and two pair of Ducie shearwaters, besides the neglected. Also obtained three curlew.

Excessively hot and sultry. Vegetation much more varied than at Ducie, although the old reliable Tohunu tree predominates. Ferns very abundant, but no sign of the rail that the Pitcairn boys said was here. The dog just dug out two mice, one of which he caught. Sent the boys out after more shearwaters while I got a few more terns. Found brackish water in the well which the Pitcairn boys had dug out for us. That means a bath next trip. Teo brought me a booby egg, found on the ground he says, and a blue-faced bird, but it is rather small. Curtis found an old bird setting upon two eggs. I collected them before I thought about pictures.

We have passed out through the channel, which is a very broad, shallow stretch of about one fathom of water with patches of coral which drag the waves above them. In weather such as this there is no danger whatever to a surf boat, though in very bad weather the waves would probably break all the way across here. Returned to the ship at four o'clock.

April 15

Mr. Beck went ashore late this morning to photograph birds, and Curtis went to get more plants. The Captain went

to fish and pull tail feathers, but the Pitcairn boys got away with the greater part of the tail feathers. In the afternoon Mr. Beck brought aboard some more blue shearwaters. We skinned birds until nine-thirty, and finished to # 3005, which makes one thousand and fifteen birds during the seventy-four days of this voyage, an average of thirteen and one third per day. During that time we have spent twenty-nine days at sea, leaving forty-five days at islands, and giving us an average of twenty-two and two ninths birds per day while at land. But six of those days were Sundays, so the average per working day was about twenty-five birds. Louis helped us spasmodically whenever he felt like it. Today he didn't skin a bird. We found coral sand here at Oeno, which is a great improvement for fineness over the Henderson and Ducie sand, which were, in turn, superior to Ravaivai. Except for the few discs and large lumps of coral, all of this passes through the sieve. We are very short on cornmeal, having barely enough for small land birds, white terns and the like. All shearwaters and large birds, including white tropics and boobies, we are working with the sand. If these birds survive without showing grease marks this is a very interesting experiment. Coral sand, of course, which has been sunbaked for ages, should be very absorbent, especially if the calcium carbonate is baked into calcium oxide. We find it very absorbent when heated above our lamp and used while hot.

April 16

Lay to off the island and enjoyed a complete rest. Last evening we enjoyed some of the "oraali" fish, a lagoon fish which the boys netted. It has whiskers like a catfish. The evening before, Friday evening, to dine upon dry canned beef and see a morning's catch of fish hanging out to dry kind of ruffled one's temper. The pumpkins we found and the tara, limes and oranges help a whole lot to keep one's system in order.

Read from Darwin's "Coral Reefs" and Schuchert's "Geology". Oeno is an odd island, with its sandy soil practically throughout and its central location. It doesn't exactly conform to the idea of islets built by storm action upon growing coral reefs. It is built up inside the lagoon and its nearest approach to the reef is to leeward.

April 17

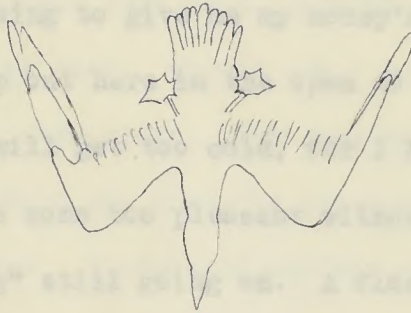
Left Curtis aboard to put plants in press and dry blotters, and sand. As a result I had to pull an oar. It's a long hard pull, with enough work just to move the heavy oar when the boys pull, without catching crabs. I followed around the shore in an attempt to get the white reef heron, but was so taken by surprise when he came out from landward just in front of me that I did not get a shot at him. Found one blue shearwater; no egg. Saw a curlew walking about beneath the trees, picking seeds from grass and herbs. He saw

me, but at the time I was pressing shearwaters and remaining motionless and so did not scare him. When a loose paper fluttered he sneaked off hurriedly. Failed to catch a rat the dog found in a rotten log. Killed two blue-faced boobies. While I was doing so the dog went after another and would not call off. Angrily I took the two not yet dead birds and went to stop his racket, but he scared all the birds and so prevented Mr. Beck from getting a picture of them.

Returning, I found a most valuable record specimen, though it will have to be pickled,--a young, or perhaps merely moulting, adult rail. It appears to be more like the Rapa bird than the large Henderson Island one. The legs and feet are black, bill black, iris of eye reddish orange, orbital ring either already faded or else dark brown. Some gray feathers under the tail are very noticeable; rest of feathers, except throat which is grayish, are black. I have been concentrating on rail ever since this find in the fern-carpeted woods at west end of island.

It was decided that I should remain ashore for the night and hunt rail. Mr. Beck took birds and went aboard to skin, after boys had cooked dinner of fish. I just sat down here in an open woods to watch for rail, rats or lizards. A neglected shearwater came wabbling through the scattered fern fronds, fifteen meters or more distant. Every three meters or less he stopped to rest and look about. Made a direct course to a tree with twisted trunk, ascended three meters

up the tree and took wing without dropping lower than his take-off point. Tropic-birds and sooty terns making a continuous racket. The Ducie shearwater is heard. We found only six or seven of them today, so must search for more. Blue shearwater seems to be getting more common every day. We found that the water in the well here tasted perfectly fresh, with no hardness perceptible. It must have been a boon to shipwrecked sailors, as it is a very welcome luxury to us.



The blue-faced boobies this evening are giving me a wonderful exhibition of high gliding. Twelve just went down overhead with four stragglers behind them. They have been coming down from leeward for some time. The last was the largest flock; the others numbered eight and ten; but most were in two's, three's and four's. How far they descend in a few seconds I would not venture to guess. The "swish" they make does not equal that of an eagle diving after an osprey, but it is a loud "swish" nevertheless, and twelve of

them at once sounds like a heavy gust of wind going through the rigging.

No success with rail this evening. Some clouds look like possible storms during the night. The sooty terns have quieted down like magic just after sundown. Only a few stragglers are "kavicking" now. Blue-faced boobies on the ground are croaking hoarsely at one another. Frigates are quietly soaring about in search of their roosting place; I ought to be off looking for mine. All three species of shearwater were about in considerable more abundance than during the day. Insect pests are going to give me my money's worth tonight. Would like to sleep out here in the open to listen to noises and calls, but it will get too cold, for I have no bedding and the nights here are none too pleasant without a blanket.

"Swishing" still going on. A flock of sooty terns passed over. I cannot make out where they have gone. Am off to find them if possible before dark. They came and went at long intervals throughout the night.

April 18

Awoke before daylight upon hearing what I at first mistook for a rail, but it was the frigate-bird giving a sharp staccato "Cluck-cluck-cluck". I had heard the same call during the moonlight morning and had hopes of finding the rail. Sooty terns were not about this morning, except as a few stragglers. Spent two hours in the fern woods

without any encouragement from the rail. Gathered a few blue shearwaters as I worked along towards the boat landing. The boat arrived bringing grub and ammunition for another night and traps. If I knew where to set the traps I think I could get the rail. Baited traps would only attract hermit crabs. There are patches of open sand throughout the fern woods, but I have never yet seen a rail track in them or elsewhere. The rail I found, of course, was out in the open low brush.

The lower flock of red-footed boobies upon which I had relied for specimens left as a flock when I passed within four hundred yards of them. Curtis and I went after them but obtained only three stragglers. Ran down three blue-faced boobies (33), but could not find the phase of juvenile plumage that Mr. Beck desired. Blue-faced boobies are parked all through the low brush interior. I counted more than twenty in one opening. Terns were very scarce after ten o'clock. For lunch the boys roasted some tropic-birds,--very good eating too. Were I taking "homing" birds to Pitcairn they would be my choice. Found a dozen or more blue shearwaters, mostly just in from the beach edge of the woods, but some in very heart of bush. Have not observed them climbing trees to take flight as the neglected does. They always make for the open when disturbed. Although the beginning noise of their call somewhat resembles the neglected, they have not the length or the "kea-kea-kea" at the end of it.

For the night I went to the place nearest where the

rail was found. Set some traps out rather promiscuously and lay down for the night not far from guano pile of red-foot booby. My decision regarding the sooty tern (17) is that they are not resting on this island at night, but rather go to sea early in the evening. They are undoubtedly hanging around here in preparation for nesting; but they are not alighting either during the day or night.

April 19

Awakened by the boobies flying about, I turned out and took my revenge by collecting ten adult and one juvenile specimen. Then obtained ten sooty terns from scattering pairs flying overhead. Found two more small shearwaters last evening. They are rather scarce here, and strangely found only in low shrubs of the interior. Heard and saw several neglected and blue shearwaters about. No sound or sign of rail. They are either very scarce or very wary here. Few noddy terns about. Got some more lesser noddies, which are to be found in a few colonies in woods of west end. One frigate-bird this morning had a very spooky sounding "Whoo-hoo-hoo-hoo",--a cross between a hoot-owl and the Wilson snipe. White terns here are both blue-footed and white-footed, so a good series is needed and it is hard to get them clean. No rail this morning up to nine-thirty.

Went into well and had a bath and scrubbed clothes and dog. Where he picked up fleas I don't know, unless at

Pitcairn. He certainly had a few. Very hot this morning with little or no breeze. I found aphides on the purslane (?) herb (the one used so much throughout these atolls for green feed) and have cyanided some. Also succeeded in catching two syrphid flies, and one other insect of interest. There is a miller here, larger moths and flies.

Cooked up a noonday meal of rice pudding with two neglected shearwater eggs. No sign of boat at one o'clock, so I set off to get boobies. Heard a shot at one-thirty, seaward towards ship. At this time of the day the squawking of the tropic-birds is the main part of the program. A few sooty terns about; and two curlew fly down the coast line calling. I have entered the patch of semi-open woods nearest the spot where the dead rail was found, but this does not look like rail country at all, while the denser woods with a thick carpet of hip-high ferns looks promising but yields nothing. Perhaps they roam about here of evenings, mornings or nights. If I sleep ashore tonight this is the spot.

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The ^rtopic-birds take little heed as to their landing place. They seem to locate their nest and simply descend upon it with wings fluttering above their back. They take wing very readily from the ground without any running. Very hot this midday. Found a few lesser noddy and also obtained a few white terns in good shape during trip. Carried boobies back to boat landing, stopping to shoot three small shearwaters (Ducie) and found one other on ground.

Three o'clock and no boat, with the ship well off the reef. I cannot make out any reason for their not coming ashore this morning, or at least by this time. If they intend coming at all they haven't many more hours of daylight.

At four o'clock the boat arrived with the most exciting tale of the journey. They capsized coming in about one o'clock, when I thought that anchor of the 'Sam Jones' looked awfully large. The ship, as is her wont, immediately put off to sea, not pausing to watch the passage of the reef. Consequently the boys were clinging onto the submerged whale-boat fully three hours, a current having taken them to sea. Losses have not been catalogued. They would get on the keel and a swell would turn them over. They would get inside and the next swell would turn them over. Beck got a picture of them as they were picked up. The accident and no probability of finding rail decided us to leave the island, so the sails were set at about six P. M.

Worked late on terns this evening. We were indeed fortunate to find the poor specimen we pickled. During all the time I was on the island, including two nights, I never heard a sound that could have been the rail. They must be either very rare or extremely wary. The island is sandy and tracks of tattlers and curlews, shearwaters, crabs and rats could be plainly seen in the mornings. Yet not once did I see the track of a rail. Searched in vain for the eggs of blue shearwater. Small Ducie bird well incubated where found.

Neglected shearwaters had eggs in several instances. Collected few of them.

April 20

Spent entire day skinning birds, winding up with three shearwaters within an hour; but that is a spurt and not a steady pace. Had little trouble keeping steadily within half an hour per bird. This is the kind of practice one needs to develop a little regular speed. Off the island about twenty miles today.

April 21

Louis and I set to work to print labels. Mr. Beck happened to have some typewriter Bond heavy enough to serve the purpose. I was stockman and draftsman, the Captain's parallels working splendidly; the Captain was cutter, using a scalpel and bill board; Louis was press manufacturer and chief type composer and pressman. I did the folding, and now there remains the threading and tying to be done, save for twenty-five the stewardess did before we had both sides printed. A block of wood with flanges and a plant blotter base made a very efficient press block. Louis and I each handled two sticks, and Saturday afternoon we pressed the cabin boy into marking the line in end of label, his job as printer's devil giving him too much time for mischief. Turned out one thousand labels in two days.

April 22

A slow drizzle started soon after four o'clock and at five it was raining sufficiently to afford a bath; so I rolled out of my sleeping bag (I have enjoyed its comfort two nights now; since taking it ashore at Henderson Island it has been rolled and stowed away). I had but restless nights in my cabin bunk, so have deserted it for the fresh air on the top side.

In the evening I read from Captain Cook's "Voyages", Everyman series. The third voyage is in the venerable explorer's own words, and certainly is far superior to the edited first and second "Voyage". Afloat on the very seas and landing on the islands he discovered, one can best appreciate the character of the man who braved uncharted waters and unknown savages for science.

(14) Neglected shearwaters about this evening.

Following the morning showers we had fair weather and fair wind which should take us very near Timoe tomorrow. We are now entering upon that extremely dangerous and risky task of exploring the Tuamotu Archipelago, called Low or Dangerous by early explorers; but I believe native names should be preserved, and in French circles the native is always used. We have eighty islands to visit, Mr. Beck having touched at ten briefly on the 'Hinano'; but even there we must stop for more thorough work. I look with unlimited zeal to this trip, for I am to have that rare privilege of seeing the best examples of atolls in the world. My one lament is that my preparations

have been so limited; lack of knowledge means lack of appreciation.

April 23

This evening we are well within the Low or Dangerous Archipelago (Tuamotu). In fact, we are some few miles to the northeast of Timoe, north of Pitcairn and some sixty miles southwest of Minerva reefs. Having just read Captain Cook's "Voyages" I can doubly appreciate the boldness of the man and his crew who sailed these seas before they were charted. In fact, I'm somewhat wrought up today about the death of the old sea rover, which seems to have been so unnecessary. We are overhauling charts and pilot book this evening. Our chart is entitled:

Pacific Ocean

Tuamotu Archipelago

From a survey by the U. S. Explorers' Expedition in 1839.

"Washington D. C. published July, 1872, at the Hydrographic Office under the authority of the Secretary of the Navy." It bears the stamp:

Hydrographic Office
Division of Issue
Aug. 20, 1920.
Corrected to this Date.

Number 77

"Editions: 14th Aug. '17, 15th Oct. '19."

Shows Gambier Island very inadequately by omission

of that portion of the reef extending from the low islets on the north in a southwesterly direction; no sign of an islet, Tokoroua, on a point of reef two miles off the southwest point of the islet Tara-vai; and no warning of the one-fathom shoal due south and distant three miles from the southernmost island of the group Kamaka... These islets and reefs and shoals are well charted in a French chart:

"Carte

du Groupe des Iles Manga-reva.

(Archipel Pomotou)

Levée et Dressée

par M. Vincendon-Dumoulin, Ingenieur

Hydrographe de la Marine

Expédition au Pôle Austral

et dans l'Océanie

Commandée par M. Dumont D'Urville

Cap. de Vaisseau

Août 1838

Edition de Février 1893.

This is, of course on a vastly larger scale. It is our opinion on board that some sort of marks should represent these dangerous reefs and shoals even on the chart of the entire Archipelago. At least mention of them should be made in the Pilot Book, which remarks on page 142, under the paragraph heading of "Barrier reef": "On the northeastern side of the barrier reef there are many low detached islets covered with bush and a few coconut trees. On the opposite side, the barrier reef dips from 5 to 7 fathoms below the surface, affording an entrance to the lagoon within ..."

Opposite "northeastern" is "southwestern", where truly enough, an entrance is possible over the submerged portion of the reef which is as deep as stated. On the south-east is another and better passage, but between them is the very dangerous shoal of one fathom (Fr. two meters), which, however, is not extensive.

Of Oeno I have a few corrections to make to the Pilot Book, p. 140, line 29: There is no hut on the island, nothing but a long banquet board rudely erected by the Pitcairn Islanders for their feast upon sea birds, eggs and fish. Line 35: landing is not very dangerous in calm weather or even with a light northerly breeze, provided the steersman pays strict attention to his business and evades the patches where the waves break. Lines 39-41: We found a good passageway about four hundred yards westward of the sandy islets, opposite which islets now stands the post of an anchor from the 'Sam Jones' wrecked there about two years ago. This passage was over a wide stretch of submerged reef with knolls sufficiently elevated to drag the waves; but between them, channels of two or more fathoms with sandy bottom and out-flowing currents which carried the boys and the boat back to sea when they carelessly got above one of the knolls and were consequently rolled over. Personally I would have little fear of accident if all islands were as easy to reach as Oeno. Ducie and Henderson were both more difficult of approach, and even Pitcairn at Bounty Bay carried more thrill than Oeno. This was

a long and tiresome row, but not very dangerous.

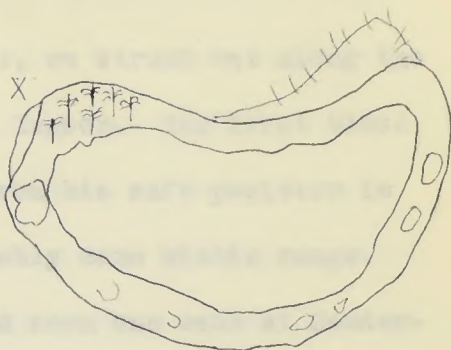
Timoe or Crescent Island (Latitude $23^{\circ} 20'$ S., Longitude $134^{\circ} 29'$ W. Gr.) is the southeasternmost island of the Tuamotu Archipelago proper. It was discovered by the missionary ship 'Duff' in 1797, along with Gambier while that ship was making the Marquesas Isles from the Friendly Group where a portion of the missionaries had been left. From the description given in the Pilot Book it is "a strip of coral about 100 yards wide, about 2 feet above water, inclosing a lagoon into which there is no passage. Upon this strip of coral are several small islands (the highest being about 6 feet above the sea) covered with three (trees?) nearly 20 feet high. Landing appeared impossible on account of heavy surf." Tomorrow we shall see whether or not landing is impossible to these Polynesian sailors who land wherever it is possible.

April 24

We are approaching Timoe from northeast by north. A long strip of white sandy beach with the bush in long patches above. Mr. Beck says he sees an obscura. A good grove of coconut palms on the northwest end of the atoll. Above the lagoon we see a halo of prismatic colors, a phenomenon common above shallow lagoons, so the Captain says. Is it due to evaporating moisture or a reflection from the lagoon surface? The sun is directly astern as it must be in

all rainbows.

A good enough landing place appears off the northwest opposite the coconut grove. Our mainsail boom lift gave way last night and we are delaying now until it is fixed. Also certain repairs are necessary on the whale boat. We arrived here at nine-thirty, but will lay-to until after breakfast. The mountainous islands



of Gambier can be dimly seen through the haze, bearing WNW. A heavy swell with wind-swept spray surges upon the reef around the west point of Timoe. This northwest end seems to be free of heavy breakers, either because of the cross-swells or else due to the conformation of the reef at this point. The rigging is fixed and we steam into land at noon. Have decided to take a new note-book lest this one get lost.

The passage, however, was a perfectly easy one and not even thrilling. The boys rowed in very close to the reef and then casually rowed broadside to the waves as they looked for the best place to make the shoot and while awaiting a sufficiently large swell to put us over the verge. There wasn't much to it when the time came. Jimmy pulled the boat around bow towards the shore, and the boys pulled hard and fast and we rode in on the crest of a swell which combed on either side

of us, but not where we were. About forty meters of shallow coral bottom and then dry land,--and coconuts! What a treat they were, sweet and refreshing!

Having finished that repast, we struck out along the concave side of the crescent-shaped lagoon. The first blood was a white heron which took wing from his safe position in the coconut clearing and then foolishly came within range. Got him in very clean shape. We had seen one each at Henderson and Oeno, but this is the first reef heron taken on the voyage. They are plentiful enough as a rule at Ravaivai, but we did not get any this trip. At Rapa Teo says they do sometimes occur,--one or two, but not frequently. At Pitcairn the boys said they did not occur. We saw none at Ducie. Later on I saw a blue one, but he was wild and escaped. Farther along I obtained another white one, without a dark feather and in beautiful fresh plumage. A tattler was the next victim. I saw one or two single birds, a pair or two, and one flock of five or six along the lagoon and ocean shores, and one very surprisingly on the limb of a dead pandanus tree in the middle of the island.

While we were at the village (composed of two shacks, one with a metal roof and water can) a curlew was heard and whistling attracted him in our direction; but an oversize shell stuck in the gun and he escaped. Later I heard and called another and dropped him into the edge of the sea water. He was a very fat bird. Falling upon sharp coral "gutted" him

so as to spoil the skin; but he will be splendid eating.

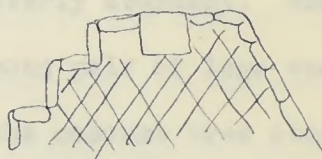
The entire concave side of this crescent island is land continuous with but two or three low places where high storm water sweeps across from the sea. The coconut grove is not very extensive,--perhaps half a mile long. Young trees are beginning to grow where planted beyond. Clearings have been made wherever much bush prevailed along the strip, especially at the farther horn, where the land is considerably wider than elsewhere and the vegetation much more motu-like. The land is composed of very coarse coral blocks, especially along the seaward side; a small strip of white gravel beach below it. There is a uniform stretch of shallow coral shelf of about forty meters width along the sea front. The reef is practically continuous without the usual small channels traversing it.

White terns were found scatteringly all along the islet and at the further end, where more representative native bush prevailed, they were quite plentiful. Obtained half a dozen, all blue-footed. The noddies collected were mostly young birds in juvenile plumage. They were only observed singly or in pairs. Saw a few lesser noddy, but could not obtain any. They were seen fishing above the lagoon and a few were flying over the trees. One blue-faced booby and one frigate were observed, but I could not get them.

The afternoon was well spent by the time I reached the farther horn of the crescent, so I returned as fast as I

could walk. Saw one pair of blue shearwaters coming up wind along the island and obtained both birds. A little later I got one of the small Ducie shearwaters, and at the boat landing while my gun was cased for the passage I saw another of the latter. Mr. Beck reports three or four obscura off the island, but I saw nothing of them ashore and cannot help but think they come here from Mangareva, which is but a few miles (twenty) away and where Mt. Duff looks precipitate enough for even obscura.

On the beach, which is very nearly three meters high, are heaped innumerable small cairns of coral rocks and one of considerable size, with a slope to seaward and steps opposite faced with the flat coral rocks. On top is an oblong hole, also faced with flat rocks, and at one end was a similar one low down. Some one has been here very recently making copra and planting and clearing. They have also been searching for the small yellow pearls which it seems they find in small yellowish pearl oysters. Heaps of the shells can be seen all along the lagoon shore. They are very delicate and crumble along the rim very easily. Along the ocean beach we found considerable sponge which very greatly resembles the commercial variety. Why should not these lagoons be ideal sponge gardens? If shell has no market value, why not introduce sponges and let the natives learn that industry?



Pearls, shells and copra is all they can think of in this part of the world.

One very noticeable feature of this atoll is the deep blueness of the lagoon at a very few meters from the shore. Very few shallows appear out in the lagoon. Some run a hundred meters or so from the innermost concave portion, but not far. The lagoon beach has stretches of cemented conglomerate, but is mostly composed of rather uniformly small coral gravel, and in a few places of sand, piled a meter or so above the water level. Pandanus trees are very abundant, as are also the green-leaved, yellow-flowered shrub and Tohunu so common on atolls. Hermit crabs not overly abundant. The coconut crab is here. He has the second pair of legs enormously developed, no doubt to reach around the coconut tree stem. The boys are exceptionally fond of them. Ants are very thick and active, several being on the birds ere I could reach them.

Three red-tailed tropic-birds flew noisily over us, but hoping to find them nesting I refrained from shooting. While returning I saw a yellow-billed or crested tern, Thalasseus bergii, but he flew across the island and off towards the sea so I could not get him. The first one observed on the trip.

The brisk walk of six miles or so and the fresh coconuts certainly make a fellow feel fine. We made a good clearance of the reef coming off, after having to wait awhile for Curtis to arrive from the opposite bush where he was diligently

collecting plants. I only wish he were going to be with us longer than this voyage, for he certainly has taken hold of that work well. When we were all ready the three sailors disappeared. Two of them had been here most of the afternoon and had not put a coconut in the boat. So we had this to do at this late hour. No one having any matches ashore, Teo made the boys a light for their cigarettes in the true Polynesian fashion with a grooved stick and a sharpened one. I have preserved the sticks and will send them in with the birds, just as they are. Apparently it is a strenuous job, for I could see his muscles straining as he warmed up the groove. A small pile of wood powder accumulates at the base of the groove, and when this commences to smoke the strokes are increased in speed and vigor until a steady curl of smoke announces that the embers are burning. Cigarettes light readily from the glowing "charcoal". Some woods are much preferred to others for this purpose.

work we should carry a folding canvas camp which could be
erected over the tent and land and set up in the lagoon.
This way water in an atoll could be visited easily enough.

Found three nesting tropic-birds today and visited
some honey suckers. Four yellow-bellied or covered terns I saw
across lagoon, but they were far too wild for me to get within

BOOK XXVI

... later, and passed over the edge of the lagoon, but he
believed was Voyage of the 'France' ... we could get ...
but could not obtain from ... which makes three

Voyage of the 'France'

from

Timoe Atoll

Returned to ... to ...
for the ... The Mangareva Islands

The Mangareva Islands

Voyage to Marutea

April 25-May 14, 1922.

April 25

Came ashore the first thing this morning. Curtis
went with me to the further (east) point to collect plants
there. I went on in an attempt to get farther around the
atoll. Found east or windward side well cut across by chan-
nels, one being fully forty meters wide and waist deep at low
tide. Two more I got across on the coral, but the next was
too wide to jump and deeper than I cared to wade. For this

work we should carry a folding canvas canoe which could be carried over the reef and land and set up in the lagoon. Then every motu on an atoll could be visited easily enough.

Found three nesting tropic-birds today and obtained some lesser noddies. Four yellow-bill or crested terns I came across twice, but they were far too wild for me to get within range. Later, one passed over the edge of the lagoon, but he drifted out over the deep water before we could get him. Saw but could not obtain another white heron, which makes three white to one blue observed.

Returned to coconut grove and had but a short wait for the boat. Saw another neglected shearwater, but he came breast on and then went off over the lagoon. Saw one blue shearwater as we got into boat; also an obscura towards the ship. Lay-to off this island during the night. High trade blowing. Sails reefed, but comparatively warm.

April 26

At daylight we swung before the trade and proceeded towards Mangareva (Gambier), where we arrived just before noon. The lagoon here is so large (fifteen miles across) and the windward side so open that the sea is quite noticeable in here where we are now anchored at quarantine. The officials wonder what a French ship should go into quarantine for.

The islets of this group do not look very inviting either for birds or plants. Noddies, white and crested, are the only birds thus far noted, and they are not very plentiful. The

land is, for tropical islands, rather barren like Rapa and the Marquesas in general external appearance. A very small tide-level shelf affords footing for a drawn out village where coconut palms, breadfruit, orange and other trees hide the houses and leave a few red roofs and two cupolas on the church standing out above the dark foliage. As for the church, it is reported to be the largest in all Oceanica. An old dilapidated one, monument to the short-lived enthusiasm of missionary enterprises, stands an eyesore in a prominent red-banked shoulder of Mt. Duff at about four hundred feet elevation. The roof has fallen in, or been taken off, and only the rock walls are standing. A graveyard about it is in a good sanitary position as regards the village. The pilot approaches in a canoe, fighting bravely against the heavy trade wind. The gendarme is coming off in a sailing cutter. Tacking rather poorly against a head wind, he will not get out here for an hour or more.

Mangareva--Tiaku	}	All shearwaters.
Tahiti--Karaka		

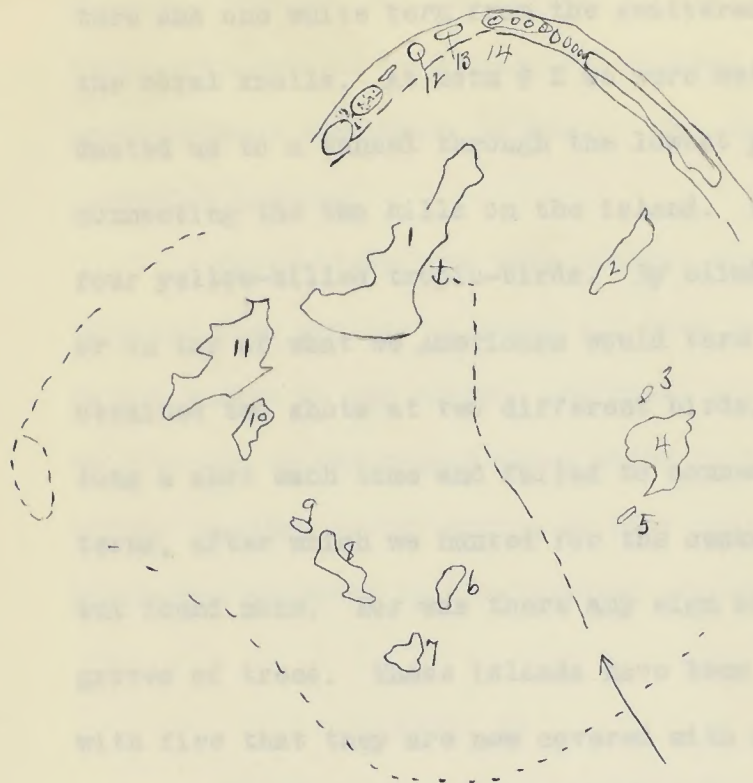
We got out representative birds, but according to the policeman-pilot there are no land birds here, not even the previously reported warbler. The cuckoo, he says, is here, but "no plenty". No rails, warblers, flycatchers, kingfishers, swallows, swifts or doves dwell here, according to him.

Landed shortly after one, and proceeding to left followed a rocky pathway around a patch of woods above the level cultivated farm of some natives. Saw nothing but white noddy terns and some tropic-birds. Also saw a wasp. Save for the

squeaking of rubbing tree branches in the wind the talus slope below Mt. Duff on the southeast is very quiet. About the cliffs above, noddies are croaking, and when I shot, about a dozen of them flew out excitedly. A few white terns are above the tree tops and a tropic-bird sails about above the mountain. Holes are very scarce in this cliff, and no shearwaters are observed about it. Alas! I fear the pilot was right and there are no land birds here. What has happened to the warbler?

The natives said there were no wild chickens here, but I see sign well up in these woods. The plant life is very similar to the Austral Islands and Rapa. Curtis is busy collecting in these woods, where he will be able to spend another day very profitably. A cloudy and dismal day. Oranges here are sour, but even a sour orange tastes good after so many days (forty) at sea without an abundant supply of fruits. There is a frigate-bird soaring into the wind out above the water. We are, of course, on the main island of the group near the village, on which we have anchored only to find that there is no water to be had within five miles, or on the other side of the island. This is almost as bad news as no birds. The pilot said the wedge-tailed and the neglected shearwaters were here, as well as the little obscura. He also claimed that the Ducie and blue shearwaters were here. Of course they may be out on the motu of the reef, or as he says on the other islands. I have called at length for warblers and cuckoo with no success. Not even the white terns will come within range. It promises fair to be a birdless day. Thought it best today to still hunt for

warblers, cuckoo and rail in these woods, but fear the worst regarding them.



April 27

Aukina Island, Gambier Group: Charlie and I in the Fan Fan this morning attempted to make the reef motu east of here. We are having some trouble tacking and avoiding the coral knolls which seem to fill the lagoon. Noddies and white terns are fishing in the lagoon, and frequently a noddy chases

the white terns. We pulled in to the shore on one tack and put in some ballast, after which we made the motu eastward (Number two) in one long tack. We picked up one yellow-billed tern and one white tern from the scattered birds fishing about the coral knolls. At motu # 2 we were met by a native who conducted us to a tunnel through the lowest part of the low ridge connecting the two hills on the island. Here were three or four yellow-billed tropic-birds. By climbing above the tunnel, or on top of what we Americans would term a natural bridge, I obtained two shots at two different birds, but had taken too long a shot each time and failed to connect. Shot some white terns, after which we hunted for the cuckoo reported to be here, but found none. Nor was there any sign of warblers in the scarce groves of trees. These islands have been so continually swept with fire that they are now covered with nothing but dry-ridge ferns and the tall pampas grass, the stem of which is used for making straw hats.

As we approached the coral knolls off Mangareva Island we found white, noddy and yellow-billed terns fishing in considerable abundance. They were mostly the former with a few of the latter two, and again the noddies chasing the little white terns. Three yellow-bills came up wind at a long range, but I dropped one and the others of course came back to him. We swung into their lee and had good shooting which soon netted us nine birds of that species. Two we shot off the reef signs, and then sailed dangerously close to the coral knoll to pick

them up. It was really good sport sailing around there with Charlie at the tiller and me shooting and picking up. These birds are evidently in winter (?) plumage, not the breeding plumage. The one tatler I picked up over at Aukino was extraordinarily fat and in a beautiful flecked summer plumage, with sexual organs commencing to swell. Mr. Beck obtained one in a similar plumage.

The natives have been without sugar here for some time and seem anxious to trade all they have for some. Cane is not raised to any extent. In fact, all the islands seem to be given up to the pampas grass which follows in the wake of fires. Walking around Aukina we came upon a large school-house once attended by four hundred children and now in ruins.

April 28

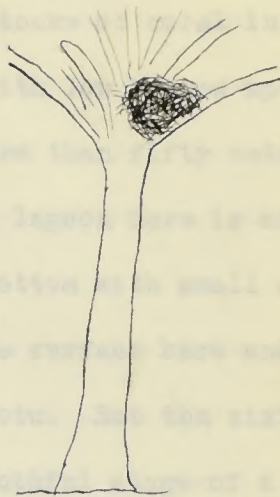
We had a little turtle steak for "coffee" this morning. Curtis, Charlie and I are off in the Fan Fan for the reef motu. We arrived at about eleven on the farthest westward of the string, or # 13 on my sketch, page five.

After lunch I walked along the lagoon side of # 13 westward. At the farther end a reef heron flushed from a coconut tree. There in the lower frond stems I saw a cluster of sticks, so shinnied up the tree and brought down two small blue eggs in my hat held in my teeth. How small their eggs are compared to sea birds of less bodily weight! The nest was composed of fine twigs piled up in considerable quantity so as to

fill up the lower point of the angle made by the fronds and the tree.

There was no lining in the nest, the top of it being a very compact, slightly bowl-shaped surface in which the eggs rested.

In flushing, the bird placed behind the tree from me so as to escape. Saw but one white tern and a couple of tattlers and a white reef heron, but got no shots at any



of them. The dog caught a rat near the native hut. The seaward side of this motu is piled high with large boulders of coral, while the lagoon side is typically sandy gravel beach and conglomerate.

Coming out as we passed the points of land projecting from this north end of Mangareva there were several noddies, Anous stolidus pileatus, observed fishing. A few white terns, L. albus royanus, and some yellow-billed terns, Thalasseus bergii, were also seen fishing above the shallows in the lagoon. Three or four frigate-birds, Fregata minor palmerstoni, have been observed during the day above the lagoon. Also as we tacked upon starting from the harbor anchorage we saw a considerable flock of terns, mostly noddies (Anous stolidus pileatus) off to the southeast fishing. Once again I saw a noddy persistently chasing a little white tern. The taint of piracy runs in the Sternidae I fear. We are now approaching motu # 14.

Motu # 14 gave us nothing but a tattler. Two blue herons were also there. Beyond this motu, which is composed of a rather coarse gravel with few large blocks of coral in it, are three very small round gravel islets with low bushes upon them. Here are two more. They are not more than fifty meters in diameter and very nearly circular. The lagoon here is about two or more fathoms deep and has a sandy bottom with small coral rocks protruding to within one meter of the surface here and there. A few pandanus trees in the last motu. But the sixth is yet to be planted, for it is in that youthful stage of a new born islet of gravel without vegetation. A very high tide would sweep across it. The ninth has more pandanus. The tenth is barren and a curlew is walking about it feeding upon--what? He flies before we are within range. The black-topped fin of a shark was a temptation, and also some noddies passing. Lost count of the small islets after the tenth, where we came upon a flock of about twenty yellow-billed terns (Thalasseus bergii). Shot six or eight of them and later went ashore on a small islet and tried creeping up on another bunch, but failed. The boat came in and we got below the two birds and killed nine more. A very few white terns and noddies about. An early morning excursion near the harbor would get more of them.

Islet or Motu # 12 is called Pouaoumou; # 13 is Vaiatekeona. The long series of ten or more small motu and sand bars are termed Tolegegie; then the long one, at the north end of which we struck the last flock of yellow-billed terns, is called Taraourouroa; four small islets are charted along the

south end of this motu and are doubtless included in the above name. One a mile farther on is unnamed, but one about another mile along to the southward is called Taouna; one mile and a half beyond which is the Tekava, or bird islet of the reef, whereupon many birds dwell so the natives inform us. Our journey today covered fourteen and one-half miles of sailing, on the chart, with four stops.

The reef and its islets at Mangareva is decidedly interesting in that it is submerged for more than twenty miles of the thirty-five of its extent. Fifteen miles of reef is at and above the surface, i. e. the motu are above the surface, and in places are composed of enormous boulders of coral in a great mass to seaward, but grading down towards the lagoon where fine gravel and sand occur. This stretch of surface reef is around the northeast portion of the group of islands. The most pronounced islet is northeast of Aukina, including Taraourou-roa and four islets south of it. The islets, Pouaoumou and Vaia-tekeona, are situated north of the northeast end of Mangareva and bear northwest by southeast as the long islet does. Between them, bearing one point west of north, is the stretch of small sand spits and young motu. From the two islets, # 12 and # 13, the reef extends in a southwest direction nearly five miles to a small islet which bears a few trees. From this evidence, that portion of a reef bearing northwest and southeast is best situated for island building if on the northeast of the island. Except for the small knoll due south of Kamaka islet,

the submerged portion of the reef is about ten to eighteen meters below sea level, affording good passage for ships.

I have been particularly impressed by the levelness of the successive strata of volcanic rocks composing the two peaks of Mt. Duff, the south-southwest face of which is very precipitous for more than half the distance from the top. At about six or seven hundred feet is a level ridge connecting the two peaks; below it are three very distinct shelves, upon the lowest of which is grown a considerable grove of coconuts, breadfruit, oranges, bananas and other cultivated plants. Red volcanic soil characterizes these shoulders or shelves. I am inclined to jump at the idea that we have here the topmost edges of the rim of an ancient volcano still sticking above the sea; but I have no definite evidence of the volcano except the sheerness of the south-southwest face of Mt. Duff and the dip of the ledges exposed along the northwest side of Au-kina, which seem to hold the proper angle of lava flows. Lava must of necessity have its source at some point above the bed where it rests; hence we are prone to judge all mountains as volcanoes if they present just the slightest resemblance to a crater. Mangareva and Au-kina might be the walls of one crater, the rest of the islands in the group being indicators of another.

Sink Tahiti four thousand feet, and we would have an interesting example of just such a place as Mangareva. Commencing at the present valley of the Papenoo, a long, narrow, steep-walled, rocky islet would extend in a southeasterly

direction and swing to the south end southwestward, to end abruptly at Lake Vaihira; beyond this gap, Tetufera would form a small pyramid-shaped islet eighteen hundred feet high, with a thin spur running westward towards the Punaruu. There Tahiti peak would be a small islet less than five hundred feet high; the Diademe would be a pointed rock twenty-seven feet high; Aorai and Orohena would protrude abruptly and magnificently out of the lagoon two thousand eight hundred and three thousand two hundred feet high, with shoulders sloping northward into the lagoon some six or seven miles from the reef. That group of mountain peak islets would be seven miles in extent, and sixteen miles to the southeast of them Mona Ronui (Tautiria) would be a small rocky islet three hundred feet high. There would be five main groups of islets in this sunken Tahiti with one distant rock. At Mangareva we have five groups of islets, and Timoe is only twenty miles distant. How interested Darwin would have been in that comparison, for it certainly adds considerable evidence to his theory of the sunken continent.

It is also very interesting to note in the chart, after sailing over the lagoon and reflecting upon the same thing all day, that a narrow strip of shoals contoured by five meters extends from ^{Aukena} Au-kina to Mangareva, and also from Aka-marou towards ^{Aukena} Au-kina. Coral knolls also indicate the proper boundary of the northeast portion of the ^{Aukena} Au-kina-Mangareva basin. But this island was not the regular cone-shaped crater that Tahiti must have been, as is indicated by the concave-sided, triangular reef.

✓ Index to the Islands of the Pacific, Wm. T. Brigham, A. M.

April 29

Slow drizzling rain soon after midnight, which became heavy downpour just before dawn. Relented slightly after daylight. Maxwell Company's boat, manned by two native boys, came off about eight and picked up Curtis and myself to sail to the isle of Tara-vai. We had heavy rain and gusty wind especially while below Mt. Duff on the outward journey. We searched the wooded portion of the isle for warblers and cuckoo, but rain continuing made hunting doubly useless. Heard nothing. Returned to chicken and breadfruit dinner, a warm meal being very acceptable on such a day.

Shortly afterwards the old man returned from fishing, for which occasion our crew delayed. Then we set sail. Heaved anchor, hoisted the sails, put the rudder in place; but it was too late; we were grinding coral with our keel by then. Heavy gusts of wind drove us farther over the coral with every wave that raised our keel clear. The result was that our sailor got into the lagoon and with him pushing and our "skipper" (who couldn't skip the reefs) poling, we managed to work out towards the edge of the reef. After half an hour the "skipper" skipped over the anchor and stubbed his toe, which reminded him, as I had long desired to do, that warping would be better than poling. So he sent the "crew" ahead with the anchor to the edge of the reef. It was simple enough after that. We were able to get clear; place the rudder in position; hoist the sails, and then heave anchor and take to the wind. What did they do then but

pull right up under Mt. Duff instead of even holding a course for the point we had to round. The result was that we got more gusts and sputterings of wind with calms, or lulls. Then the yard-line broke and the staysail line gave way. Both required time for fixing. Around Duff we met with a head-wind in unreliable and variable puffs. Long tacks from land to channel gained a bare two hundred yards.

Opposite the Church-mole Curtis and I and the dog took to land, leaving the boys poling the boat along the shore. Noha was rather badly treated by a large black dog, but every time I pulled him back and beat off the big fellow, Noha was game to try it again. He was well beaten but not licked. Chicken, fish, breadfruit, sweet potatoes and metu tonight.

April 30

The girls here are inquiring from the sailors why the "man with whiskers" does not go ashore at nights, the same be-whiskered gentleman being yours truly who hasn't shaved since leaving Rapa, and doesn't intend to waste any razor blades this side of Tahiti. Granted, however, that the bush about my jaws is more scraggly and sparse than vegetation on the Gambier Islands. The sailors explain to them by the only excuse acceptable, saying that I am a "missionary". Everyone else in the world is supposed to indulge in all the licenses of sailors.

May 1

Not much chance here to go a-Maying. Few flowers of

any attraction save those cultivated about the village, and besides, one needs must have a May Day queen to make the jaunt interesting.

Went in the sailboat out to the Kouaku, or most south-east reef islet, where I was informed many birds are to be found. Obtained a female frigate (Fregata minor palmerstoni), a few noddies (Anous stolidus pileatus), lesser noddies (Megalopterus melanogenys), and white terns (L. albus royanus). Was unable to get an effective shot at the two tattlers (Heteractitis incanus) seen; and only saw a curlew (Phaeopus tahitiensis) at a distance. No reef herons observed here. Returning, plan to stop at island # 4. We picked up a little blue ternlet (P. cerulea) off the rocks of island # 5, the only one observed about here. Rocks very numerous around # 3, 4, 5, about like the Diademe summit would appear in my submerged Tahiti. Some are dangerously at sea level. Large swells and stiff breeze from the southwest all day.

We made the passes well, with the boat pilot knowing where to go and Bijoe to make the boat go where desired. Anchored at the wharf. I started for the mountain where I saw one or two tropic-birds; but a native talked considerably about another trail so I followed him. The trail led around the north-west side of the island near the shore and out the rocky peninsula towards island # 5. We came upon two yellow-billed terns (Thalasseus bergii) perched upon rocks well off the shore. They flew before we were within range, but one flew a little closer so I tried to drop him but failed. It is very interesting to

see them invariably "tumble" whenever a shot is fired. The flocks we were at the other day out along the reef never failed to perform a "tumble" at every shot. Along the rocks of the peninsula we flushed one tattler. He was standing on the rocks too near at first and would not fly as I approached. He took wing while I was on slippery footing and of course I missed him.

At the point of the peninsula one noddy tern came toward us but not near enough to shoot. Observed one or two white terns about the hillside. It might have been terns I thought to be tropic-birds upon arriving. Several small patches of puro trees failed to produce either cuckoo or warbler. It is not the season for the former to be found in abundance, though Mr. Beck and the engineer have both heard one at Mangareva. The latter is no doubt extinct, and probably has been for many years as no natives here know aught concerning it. It is interesting to get amongst a tribe which uses the "ng". The little blue ternlet here is called "nganga", while in Tahiti it is contracted to "a'a".

At last after a wait, as is usual, of more than half an hour, our pilot and the ever tardy Bijoe have arrived. Our pilot has a wife on this island, and Bijoe seems to have fared as well as the pilot; hence our delay. There is no doubt that these women are better looking in facial features than any Polynesians we have yet encountered. The crew claim it is due to an infusion of Spanish blood, but one cannot detect any Castilian features in them. I consider them a sort of softened or toned down Polynesian.

The rock at the end of the peninsula of # 4 is a volcanic conglomerate, the boulders of which are very similar to the various grades of volcanic rocks seen about this group of islands in situ. There appeared to be a beach or two of fine sand to the east of the wharf, so I ordered Bijoe to get us a box of it. If there is anything the sailors will do it certainly is not what they are told to do. Curtis is the only one of our crew that can be relied upon. The rest do as they please. They seem to think that this expedition is entirely for the purpose of their visiting these islands to have a good time at the expense of the Museum. The Polynesian has no conception of values. He is the very prince of wastefulness. Many is the dish that has been left on our table; but never once has anything been fixed over at the next meal. What we can't eat in the cabin goes to the fore-castle; their refuse goes to dogs, pigs and chickens, and what is left the sharks enjoy. There is no doubt that they sacrifice to "Mao" as a deity.

On island # 30 were a reef heron and a tattler. If I see the customary flocks of terns fishing I will try to pick up a few as we go in. "Pararaki" is the Rapa name of the little gray ternlet.

Returning to the ship we picked up one more little blue ternlet from a flock of about ten fishing and being chased by a noddy. In the hold comes the startling discovery that the little blue ternlet is cerulea instead of the one we have been getting thus far on the trip. Why the change here? The Austral Islands are in this same latitude. Oeno was

inhabited by a few cinerea. This is indeed an interesting discovery.

Bijoe informed me today that the coral rock cairns over on Timoe are the tombs of the ancient Mangarevans. It being taboo to bury anyone on these islands, all bodies were taken over there and entombed.

The rough plan of the Gambier Group, page five of this volume, has the islands numbered for reference. The numbers correspond to the names on the French Chart named in the preceding volume as follows:

North Isle.

1. Manga-Reva.

East Groups.

2. Au-kena.

3. Mekiro.

4. Aka-Marou.

5. Maka-pou.

South Group.

6. Manoui.

7. Kamaka.

8. Makaroa.

9. Motou-teiko.

West Group.

10. Aga-kaovitai.

11. Tara-vai.

12. Motouo-ari.

On bird labels we put these names followed by
 "Tuamotu Archipelago."

May 2

Out again with the Maxwell skiff, our dory trailing, to islands # 6, 7, 8. Passed Manoui which is very rocky and steep. Noddies (Anous stolidus pileatus) and white terns (L. albus royanus) in abundance about it. Saw one little blue ternlet (P. cerulea) and a tatler (Heteractitis incanus). The island bears a few coconut palms and pandanus trees, but, being stacked with goats, is eaten bare of other vegetation. The goats are no doubt limited in number by the lack of food. They belong to M. Levy of Tahiti. We didn't attempt a landing because no definite signs of shearwaters were visible.

We anchored off Kamaka and attempted to land on the lee shore where the rocks are decidedly steep. The sandy beach observed off the north shore was inaccessible on account of very high breakers combing over the shallow reef off there. We failed to effect a landing. Three terns observed,--noddy, white, and one or two of the little blue ternlet. Could not scare anything out from holes in cliff by shooting. We are now off for Makaroa to try our luck there.

Here we were able to make a landing. Had to anchor the skiff in the lee of the mountain near its east end. Thence Bijoe rowed Curtis and me along towards the lower west end of the island, where we found not a beach but a shelf of sloping

coral which afforded some sort of a landing. I was a bit leery at first, but Bijoe tired of dilly-dallying, whirled the boat around bow to land, and we went in on a swell. He jumped out and held the boat while we got out safely enough. We were for holding the boat and pushing him off, but he pushed it himself until near the edge of the shelf, then shoved it off and swung himself out on the stern as it passed him.

I immediately went up the hill, but could not even get a few terns to send back with him. He brought our stuff off in another load, Curtis receiving it. The dog not finding me at the landing jumped back into the boat and caused a great deal of trouble before Bijoe could get him ashore again. Then he saw me and joined me up the hill where he found goat smell rather entertaining. Ascended the ridge towards the highest peak, working around to the north face wherever holes looked accessible. Was very elated at the first side excursion (two hundred feet elevation) to find in one shallow cave the little Puffinus obscura (# 3224). The bird was sitting upon a nest in the remote recess of the shelf-cave, and it was only by the aid of the long gun that I finally succeeded in poking her out where I could reach her. There was a considerable depression in the soft detritus at that end of the hole, and quite a quantity of dead grass composing the well lined nest. Was utterly unable to reach by hand, or obtain by poking, any egg from the nest, although I poked out most of the grass lining.

Proceeding higher I happened to glance behind me and

saw a small brown sandpiper on the red soil of the shelf I was on. He flew before I could insert the auxiliary, so I was forced to shoot him with a large shell while still too near. He dropped over the cliff, but by good fortune a "chimney" afforded the means of descending thirty feet to the ledge he had fallen upon. It also gave access to several holes, but no birds were found in them. Grass was found in several holes as if they once were inhabited.

A heavy shower threatening when I returned to the ridge, I hastened back to the cave at the landing. We then had dinner upon salmon, beans and George Washington coffee. The cabin boy, as is his wont, neglected to put biscuits in our grub box.

After lunch I again ascended the mountain, and on the trip the dog caught what is either a very small rat or else a large mouse. Went around on the face of the cliff below the successful hole of the first trip and was rewarded by finding a well grown young bird in a very small hole in the farthestmost recess of a fairly large cavern. In it I now sit well shaded, while the dog has ample room to stretch out behind me. It is six or seven meters across the open face and two or three deep and fully two high. The inhabited hole is more than one meter deep, thirty centimeters wide at the mouth, and twenty centimeters high. After catching the youngster I realized that I should have the traps along. The dog has quit me and returned to camp. I returned for traps and then came back. The traps

should get one bird at least in every nest, which will help out, for I do not expect to find very many inhabited holes accessible.

The island is a mountain peak and decidedly peaked. It is composed for the most part of a very rigid volcanic conglomerate and is honey-combed by caves large and small. I think the birds scratch considerable detritus out of smaller holes and even such places as this, but they do not appear to do any mining in the rock itself as does pacificus at Bora Bora. I've a notion to sleep in this cave to listen to this bird tonight.

Went on up to summit and there left coat and gun while I explored down the northwest cliffs. There were some very interesting caverns and old sign of nest, but only one contained a bird (# 3222) and an egg (362). I took the bird but left the egg to induce the mate to remain on the nest tonight. Did not have traps with me. Reascended the hill and returned down ridge to camp, shooting three blue ternlets (P. cerulea) and another sandpiper. This one was obtained with the auxiliary.

At camp I found a sign on the basket:

Fragile
Handle with care
Egg inside

Carefully opening the basket I found the egg, one of the P. obscura, and the bird carefully plugged and wrapped. Curtis had found them not one hundred meters from camp. I shot one

more blue ternlet from the cliff above our cave. Curtis returned just at dark, having experienced a thrilling slide above the cliffs when both his hand holds loosened. Fortunately he caught on a small ledge.

Rock here is for the most part a coarse volcanic conglomerate with ledges and dikes of lavas in situ. The island is very linear and # 9, Motouteiko, is a direct indicator of the former mountain ridge extending towards # 10, Aga-kaovitae; while the other end points directly towards one slope of Kamaka. The relationship is perfectly evident. The little blue ternlets were coming in down wind just before dark in scattered pairs and three's.

May 3

Heard one or two P. obscura last night, undoubtedly the "Rao" of all previous notes and the bird which was heard about the cliffs above our camp in the Punaruu; on my Vaihiria trips; Aorai expeditions; and several times over in Moorea. What a heap of satisfaction it is to at last find them accessible! Eggs, young birds and nests now are known to me. We went up to Curtis' nest and set the remaining traps, but apparently the place was not visited during the night. It was another small hole entering the face of a low cliff above a wide shelf. It was about one meter long or deep; thirty centimeters high and perhaps fifty centimeters across the mouth. The interior was full of pulverized pandanus leaves, as several

smaller cavities in the neighborhood were also filled; and apparently all was the work of rats which are very numerous on this island. Pandanus burrs were direct evidence of their work in filling these cavities. The birds had but taken possession of the nicely bedded hole, and at the farthest extremity had scratched out a small basin of a nest in the rubbish which needed no other lining and had none.

We made shift to break our fast by frying the salmon in butter until it was crisp. How lost is the European without the staff of life! I am off to ramble joyfully about cliffs. Traps failed to catch a single bird last night. No sign of visitors in hole where old bird was found. But in the hole where the downy young was obtained tracks went in and out several times right over one of my traps. Had half a notion to leave traps one more night, but have since decided to take them in and not bother to revisit here unless Mr. Beck deems it best. Obtained another sandpiper this morning while ascending the rocky ridge. I first noticed him fluttering above me a few meters, piping in a soft, high-pitched voice. He alighted finally on the rocks and came running directly toward me and too close to shoot. He took wing and next alighted below me in such a position that I was able to back away far enough to shoot him with the auxiliary. This little fellow is about the most curious bird I have yet come across. All three of those taken have this same tendency to come close to see what we are.

Proceeded over the summit which is 350 feet high,

loosened rocks splashing into the ocean on either side. From this elevated position one can follow the light green of the submerged reef very readily from the northwest towards the point south of Kamaka where the waves break upon one meter rocks. From the ESE to the south not even light green can be seen from this distance. Again comes that soft piping call, and there to windward of me flutters the little brown ball of feathers. He alights on the open rocks amidst the tall grass below me while I change the load from # 6 for frigates to # 10 and the auxiliary. So well adapted is his speckled brown to the dirt and lichen-covered rocks that I could not see him until he flushed. He immediately alighted again and I tried the auxiliary, but it had no effect so I was obliged to take him out of the air as soon as he got decently away from me. I almost lost him over the cliff. That makes four for this island.

Went on down the further side of peak and found that an egg in a nest is better than a trap, for the mate to the bird taken last evening was upon the nest. Collected both bird and egg. This hole is but twenty centimeters wide and twelve centimeters high at the mouth and not an arm's length. The nest was not scooped out any, and the lining consisted of barely a handful of dry grass. The bird was terribly tenacious of life and nearly wore me out in the struggle to kill him. I held him by the wings as I had done his mate and let him call at length that "Ah-ow", the first syllable a guttural throat noise at about high "C", the last a nasal twang at "F" above; frequently

repeated.

Shot three frigate-birds this morning as they soared overhead, half a dozen being observed above the island early in the morning. Each and every one was blown much farther than I calculated and fell far over the ridge. A young male I was able to retrieve, and may and may not get the other two going back.

No sail recognizable yet, in spite of my orders to Bijoe to come at seven this morning. What an unreliable bunch of sailors we have! Instead of going back to the ship they went over to Aka-Marou, where very probably they still are. Complaints only bring silence aboard, so I am tired of reporting. The sailors think this is a pleasure party for them, act accordingly, and get by with it. There is, however, a head wind against them, and it is barely possible that a sail which headed very close to the near end of Aga-Kaonitai and seems now to be tacking this way is the skiff. The wind shifted around to the southeast during the morning and was accompanied by large choppy swells. The boys had taken the starboard tack, and so the change of wind swung directly ahead of them when they attempted to get back from Aga-Kaouitai. Obtained another sand-piper on the opposite end of island where Curtis joined me. We returned to camp and had a cup of coffee before the boat arrived.

Had an interesting time getting away, making two trips of it, as we had landed. A very rough sea all the way to Mt. Duff. This lagoon is so open that very little break occurs in

the sea swells. The bay has been very noticeably filled with large ray. Some of them appeared to ^{be} fully two meters in length and broader than that. Was unable to see whether or not the pectoral fins were confluent before the head, nor did the natives know anything about a sting in the tail, so have not the slightest idea what family of rays they belong to. There were several of them, however, and invariably in pairs. I wonder if they feed upon the oysters in the bottom of these lagoons. The native scraping paint off the ship had them pull in nearer the dock because he was fearful of sharks at the former mooring.

May 4

A little late in starting this morning owing to necessity of sewing up trousers. "Fafarua" is the native name of the ray found in this lagoon, which is evidently a stinging ray, since it is described as having a long whip-like tail armed with a sharp bone spear with barbed edges. The natives harpoon them with a line on the harpoon. They are then pulled around until the ray is worn out.

Shot little white tern (L. albus royanus), but it was soiled. The dog which holds down the barrels while shooting finally broke off. I think it had been strained before while cliff climbing on the mountain for shearwaters. The skiff lay to the wind off Motou-teiko, # 9, while Bijoe took me over in the dory. Did not ask Curtis to risk going ashore for plants, although I think he would have willingly gone. The gun being broken anyway, I went empty handed myself; and, fearing trouble,

left notebook, jacket and everything in the skiff, except an old oil-cloth and the egg basket. We have a much more calm sea today, and so were able to land. I tossed basket ashore and jumped from stern of boat, making a firm landing.

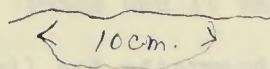
The first cavity I peered into possessed a downy young not quite so well feathered as the other one collected on Makaroa. The next find was the skeleton of a downy Upoa (P. nativitatis) just below a nest composed of a few coarse herb stems and grass in a small cavity along the face of the cliff. Many feathers still intact, which will enable identification I think. As we approached the island a considerable number of noddies flew out from the cliffs (Anous stolidus pileatus). Nests were observed in various places; some composed of dry twigs and dead herbs and grass in mat-like clusters on the thick shrub branches; others were on the bare earth beneath low rocks; other nests of sticks on rocks, or on earth mounds at base of rocks; still others on open topped clumps of grass. I collected all the eggs which appeared to be fresh, and a few of the downy nestlings. (Eggs all rotten.)

The little sandpiper was present throughout the day, curiously approaching to within a few meters of me. One came out upon the rocks above me once so closely that I reached out to catch him. At one time I saw three, all within five meters of me. I watched carefully for any signs of nest, but found nothing. The natives verify the supposition that that bird no longer exists on any island where cats have been introduced. But wherever there are no cats and never have been any, the

birds are found. It is just as well that I did not take the gun ashore because that little bird is so fearfully tame that in our eagerness for a series we are likely to take all that show themselves to us; and I think most of them come around to say "Hello!" at least.

I found fourteen shearwaters, at least five of which were in burrows, in the brush or grass-covered detritus on ledges. The burrows were invariably shaped as below, and were about ten centimeters wide, five to eight centimeters high for a distance never exceeding one meter, and usually about sixty centimeters long; always curved at least once to right or left from entrance, and more often if rocks obstructed progress. A room a little more than fifteen centimeters in diameter and about ten centimeters deep always ended the burrow. The nest was always lined with dead grass or stalky herbs. In one burrow I found a young downy which had been well fed once at least, and one parent bird at home. One downy very much smaller was alone. The rest of downy young were with parent birds, except one dead one found in open cavity. Here the birds found plenty of nesting sites of the low style of hole beneath rocks. One bird had its nest around the side of the entrance to a fairly large cave, where shade was afforded by the rocks. A pair of birds were found in one nest beneath a large flat rock. One bird was found under a very small rock, its wing-tips protruding. Here was a shrub about one foot high with well leafed branches affording shade. Two burrows entered the top of talus

detritus at right angles to the cliff and then followed along the rock about an arm's length to the nest.



A tatler was also heard on the rocks below. Called the boat, and after throwing bag of birds and basket of eggs into the boat made a safe get-away.

Makama: It was getting so late that we did not bother Bijoe to take us ashore. We stipulated, however, that they remain close in until they saw us safely on shore. Then I bravely took the oars and we struck out for the sandy beach. The swells were rolling over in patches at long intervals. We were fairly within the patches when, upon looking back, I saw a swell swelling and swelling and swelling! It seemed to have overcome the powers of gravity and reared up directly behind us one, two, three meters high. I think it was higher still, but in order not to exaggerate I stopped at three; but it didn't stop! It came up astern and just the least bit to port. I straightened around as much as possible, but none too much. And then the crash of falling water, the rush of a surging surf, and a very scared couple of guys in a dingy boat being tossed shoreward at a reckless rate. Curtis told me there were rocks ahead and almost below our bow. Then a swale in the waves and we rested upon one, but the lowest ebb was still sufficient to balance us there. I moved her ahead on the next small swell

until the stern rested upon the rock, which was a bare pinnacle. Again a few moments of tense waiting while another trough held us at its mercy. Thank God it was merciful! Then we got off with the next swell and afterwards avoided the many submerged rocks betwixt there and the sandy beach where we found a good landing free from danger.

Curtis cooked salmon and tea and made camp while I went forth to shoot blue ternlets (P. cerulea). Most of them were flying too high for effective shooting. But I succeeded in getting two. Two noddies and a third blue tern landed in the top of a pandanus tree above camp. Also got a female frigate. Just before dark I saw one or two P. obscura flying along the hill. Did not get a shot. As we ate dinner we heard them calling.

May 5

Heard but a few shearwaters during early evening and early morning. All the obscura. Holes in the cliffs are not very plentiful on this island. Went out in pareu this morning at daylight, hoping to get some blue ternlets before they left the island, or as they left. All seen were too high to shoot. Two noddies (Anous stolidus pileatus), of which there is an abundance here, dropped into the sea and failed to wash ashore.

After breakfast climbed a cliff about which I had seen a yellow-billed tropic-bird (P. lepturus) flying, but could find nothing of the nest. Three little sandpipers met me above the

cliff, where a grassy slope spotted with boulders leads uphill to the puro thicket. Bagged two of them, one on the wing with # 10 shot, and the other from the horizontal branch of a pandanus tree upon which he had alighted.

Followed over each of the three ridges of the triangular pyramid mountain 575 feet high. Obtained two more sandpipers. One as I descended the south ridge I saw running around amongst the rocks and grass as if feeding. Shot him at long range. The other was on the ENE ridge, or rather on the grassy east slope of it. We had been taking refreshments beneath a grove of coconuts and just as soon as we started out of the grove into the open grassy hillside I heard the little piping peep of the sandpiper. Looking up, I saw him approaching fully fifty meters away, which is certainly the height of curiosity. Obtained one or two blue ternlets, a white tern, and some noddies during the day. Saw three or four yellow-billed tropicbirds but could not bag any.

All three sides of the top of this island are well wooded with hibiscus and another common tree with pendant heart-shaped leaves. A few other trees mixed in with them, some candlenut and one other I do not know. The goats have all underbrush cleaned out thoroughly. The hills, too, are rather barren.

As we descended the hill we could see a sail going in behind the islet Mekiro towards Aka-Marou. As we came off in the boat we saw it emerge from between the two islands. We are now on the line connecting Aka-Marou and Tara-vai. The boat

having been attracted by double shooting, a distress flag is heading our way. Their visiting Aka-Marou is a good illustration of kanaki indifference to orders and work. They know they can get by with it so they do it.

We are just about holding our own, save for turning to pick up a white tern and to watch two enormous rays trailing a school of small fish; from which I surmise that they eat the same. When they flapped their fins they were fully as far apart as our oar blades,--five meters. The body looked larger than the boat, so we did not get too close. A frigate-bird came down to scoop up a fish or two but I didn't let him enjoy the privilege. I consider Makama the most difficult island to land upon that we have yet encountered because of the danger of submerged rocks just off the sandy beach, which in itself is enticing enough. We did succeed in avoiding them coming off, but had the most favorable weather and a fairly high tide. We are gaining a trifle on the boat which we have decided to race in, more for the better hunting off the reefs than for mere sport.

The absence of the yellow-billed terns from the three outlying islands visited this mid-week is particularly noticeable. They apparently stay within the reef-infested areas of the lagoon, though some were seen at Taravai; but since coral knolls fill the lagoon off the shores of that island it is much more a lagoon island than Manoui, Kamaka, Maharoa and Motouteiko. We are now pulling into the shadow of Mt. Duff, while the boat is becalmed back where we saw the ray.

May 6

It seems that Charlie went out with the pilot in the Maxwell skiff. They went to Aka-Morou for coconuts because the cabin boy had not filled their demi-john. Charlie had asked about it and was assured by Bijoe that it was full. It seems the pilot left most of the lunch at that island. They rowed in to the ship about an hour after us. A few noddies were about as Curtis and I rowed in over a perfectly calm lagoon. White terns and one blue tern were spoiled on account of pressure.

Curtis, Charlie and I went out this morning in the good little Fan Fan to visit the reef motu. Rather calm, so we have rowed to the end of the island. A light breeze now takes us gently along. We touched just beyond the end of the Long Motu where we left off a week ago yesterday, and I followed along the island in spite of rough, loose coral blocks on sea coast and bushy shore of lagoon and brushy interior; while Charlie sailed or madly rowed the boat along. At last traveling became too difficult, so I waved the boat in and we rowed along near the shore. A channel separated that motu from the next, along which we rowed a way before heading for Au-kena where we filled four cans and a case with the fine sand found on the beach there. It was seven when we finally reached the ship after a long day of rowing and seeing only four or five terns.

May 7

Spent the day with Pierson in the "Paleozoic Era" and enjoyed it as much as I ever did any novel. It was somewhat of

a romantic age anyway, looking back across the whole era. Had a good chicken dinner aboard, since the Captain was not eating ashore this Sunday. A very tranquil day with the one important bird note being a series of cuckoo calls from the village tree tops during the early morning. Mr. Rutledge has seen the bird in the trees about their place just this week. Mr. Beck has tried in vain to call the bird within range. Personally have not heard one while out hunting.

May 8

Still calm and tranquil, though not quite so chilly. The sunrises the past three days have been marvelous paintings. Rose tints predominate, with softer hues in the trade wind clouds and reflections of indigo from the cobalt lagoon.

With Charlie and Curtis in the Fan Fan to Manoui, where we effected a landing, with a little jump onto the vertical rocks. Spent the day here. First came upon a very young downy P. obscura dead. A little later found an adult bird of same species dead. Could not detect the cause of death. White terns were very plentiful, but I did not bother to take any. Saw one or two young birds on pandanus trees. Noddy terns very abundant. Half a dozen little blue ternlets started the morning's bombardment. They were either too near or else above bad cliffs most of the time, but I obtained one good specimen.

While picking up this bird I came upon two sandpipers. They were as tame and curious as ever. Two shots with the

auxiliary at too distant a range, however, got them excited so that I was obliged to shoot them eventually with the large shell. Only once did two appear on the same rock. I found them on the southeast slope of a spur which once was well brushed over above a grassy slope. Now the goats inhabiting the island have stripped it bare of all brush and grass and herbage.

I was stuffing cotton into the mouth of a sandpiper when I saw a little bird about the same size going up the hill away from me through the dead sticks of the old hillside brush. At first I thought it another piper, but it didn't act like them. I was totally dumbfounded to see that it was a rail. Took no chances but shot him with large shell. It appears to be very much like the Austral Island and Rapa bird, but may possibly prove to be different. The iris is a brilliant cardinal red when first killed; orbital ring red; legs reddish orange. This is indeed a surprise. Of all islands to find a rail upon the one which is most barren! But the goats have either not been here very long, or else have been killed off fairly well. The island is at present fearfully overstocked with them.

Found a few P. obscura in holes about the island under rock ledges. Most of them, however, in burrows which were easily discovered owing to denuding of grass. Several well grown and one young downy I left, since we have a good series of them. At one place below some pandanus trees I came to a considerable number of holes in the earthy slope below a rock ledge. They smelled very rabbit-like and the holes were large and long and

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deep. But some small ones revealed a few more obscura, as did also some of the distinctively rabbit holes. The larger holes, however, produced still another surprise by giving up well feathered young of P. pacificus. Four of them I found by feeling in the numerous burrows until the stick was pecked at and then going after the birds. Don't know just how many obscura were obtained, but five eggs and a good heavy hunting jacket resulted from this burrowed slope. Saw two small black and white rabbits. The goat herd was here just before me. They trample in many shearwater burrows and seem to actually paw them out in several instances.

Returning to ship I shot at, but did not obtain, some female frigate birds. It was late so I hastened down, only stopping at coconut trees for refreshments. Shot a hen below them. Some native must have turned them loose, for I heard no others. Tossed birds into bow of boat and on the next swell swung aboard and shoved her off. Dead calm or just the least bit worse; a head breeze too light to tack with.

May 9

Out again in the Fan Fan with the white sheep of our crew (colors are reversed in the South Seas). Around the point of Duff we met a southeast breeze, which is indeed welcome. I have three oar blisters on my hands. Shot one of two or three lesser noddy terns seen fishing about shoals with noddy and white terns. Failed to get any of the others. Have seen one

blue ternlet this morning. Last evening just before dusk we saw a flock of about ten but we could not get to them. An outboard motor would, I think, be a very useful accessory to our equipment. It would be a little more expensive perhaps, but certainly the time saved and the birds obtained would more than offset that. These three calm days would have been spent on the islands visited rather than rowing to and from them. An extra man's services could be dispensed with, which would pay for gas and oil and up-keep. In the lagoons of these Tuamotu Atolls there will no doubt be many days when sailing will not be practical. Besides, a little kicker to go into the wind would also save many hours of a man's time. My time may not be as important as other men's, but I consider it too valuable to be spent at a pair of oars.

Descriptions of the nesting burrows of the shearwaters collected yesterday could not be written in the field as they should have been, nor could they even be written while returning to the ship. I may be mistaken, but I cannot make myself a bird collector merely. What the birds are and where they are found is interesting; but what they eat, what eats them, where and how they live, the nests they make, the calls they give, and other things of that nature seem to me to be quite as important as the specimens themselves. Any contrivance which enables one to spend more of his time with pen and paper is certainly worth a little extra expense. At sea an outboard motor should be worth its expense for the additional

number of birds it would enable one to collect. If the motor covered three times the territory it should get three times as many birds. Surely shooting from it would be about as easy as from a rowboat. Certainly one would have a much better opportunity of reaching and keeping up with a flock of fishing birds.

The terracing of the foothills of Mt. Duff is evidently caused by the difference in hardness of the various layers of volcanic rocks composing the mountain. The most striking feature of these layers is their perfect levelness. This extends to the very tips of the peaks. The peak of Makaroa Island is also formed of similar level layers. We are now out in the center of the lagoon between the four groups of islands. Au-kena and Aka-marou present on this face similar level ledges of rock. Manoui and Kamaka likewise are level ledged, but weathering hides most of the upper rocks, and dikes cut them in various planes,--some very vertical. These dikes are mostly of columnar basalt with the columns horizontal, and are usually about two feet wide, though some are but a few inches across.

Weakly cemented conglomerates and loose rocks make the summits of Kamaka and Manoui, rather pyramid-like in slope, and the slope of the rest of loose earth and gravel. Taravai resembles the long strip of Mangareva in being little precipitous. It is formed of serrated peaks but not crags, with soil sloping up to most of them, but with sloping exposures of rock. Ravines cut the side hills of the elongated ridge. I have not been around to the west of those two islands except at the northwest end

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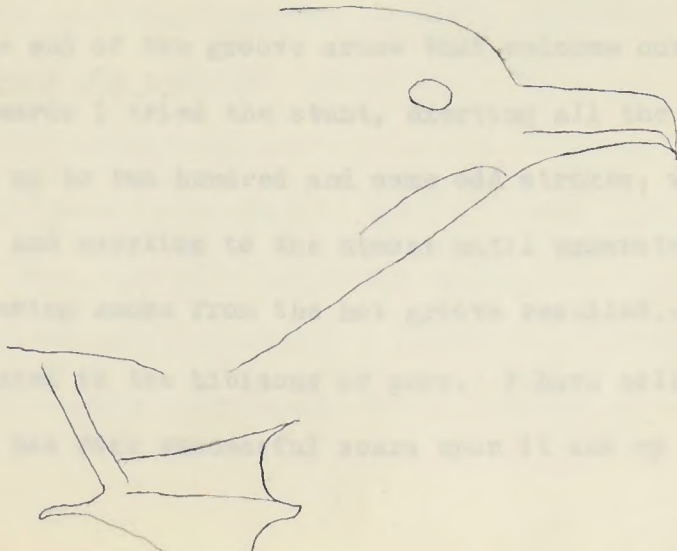
of the latter, from which place several drowned valleys could be observed. That is to be expected if that was the gentle outer slope of this mountain group.

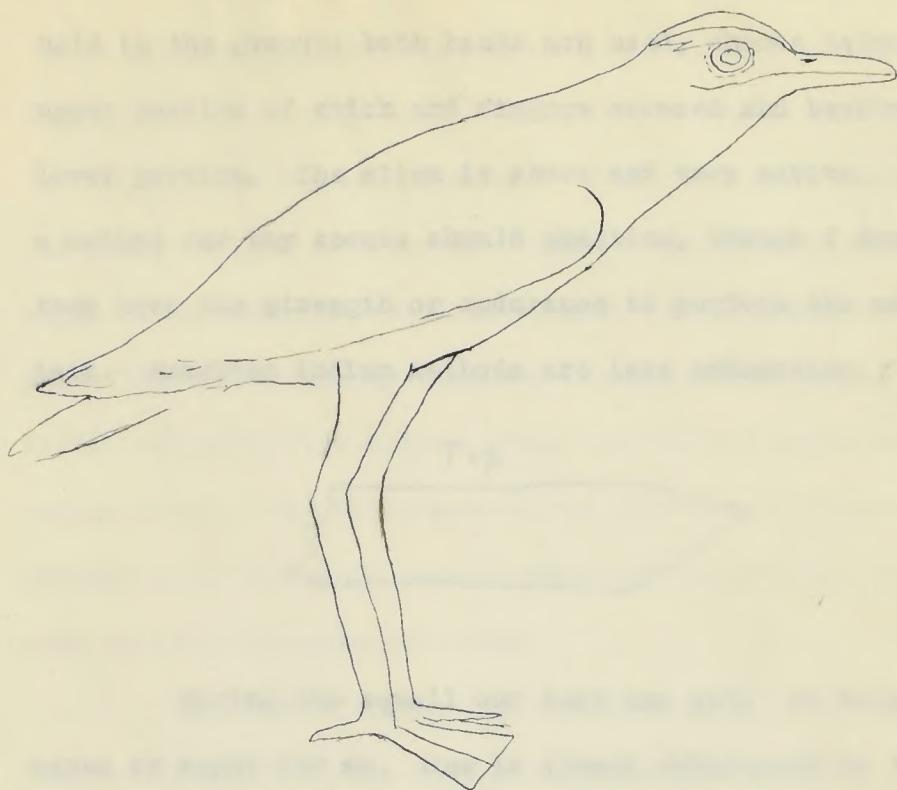
Last evening as we rowed in towards the ship (we have been out until seven for three nights in succession) we had a few splendid examples of the height attained by the coral knolls. It was not quite low water, the tide here at present varying about three feet ebb-flow, and being about two thirds out. We were just able to float across most of the knolls encountered. Some, however, were just awash during the troughs between the slight swells reaching in there. Sandy bottom prevails from the point off Mt. Duff to the wharves, but it is very frequently interrupted by these coral knolls. Several varieties of seaweeds cover the coral rocks. We have not noticed the variety of fish found in the lagoon at Papeete, but edible fish are very plentiful and certainly taste good at this stage of our journey. We haven't had too much fresh food, and canned meat is a poor substitute.

In sailing and rowing, especially the rowing, we have been forced to notice the prevalence of a very strong current setting across the southern portion of this lagoon. Last evening it seemed to set SSW. Three of us rowed strenuously for an hour and did not make a mile against it. It was at least one mile an hour. A single blue ternlet comes flitting up the wind but keeps safely out of range. This current is due, in part at least, to the oversplash of the waves along

the barrier reef ENE to WNW. Current and wind carried us far to the southwest to such an extent that we decided it impractical to attempt beating against it. From where we were, to leeward of Manoui, we could see the waves dashing high against the landing rocks, so we set out the sail and scudded before the wind towards Taravai.

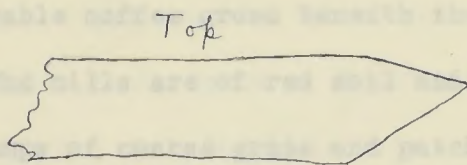
The Chief's daughter gives us "Kotaki" as the local name of the white tern. She says the rail is to be heard (and let us hope to be obtained!) on the mountains of this island. We walk the trail over the mountain, and upon conversing with another native are informed that we have no time left today to get across to Aga-kaovital after the shearwaters, which are at the extreme island. Will make it in the boat tomorrow with our guide, who welcomed us cordially today with a feed of pork, fei, and breadfruit. Apparently the two Puffinus and perhaps the little albigularis petrel are to be found there, which will indeed be a relief from jumping onto the rocks in the other group of islands. Have decided to spend balance of day looking over this island for possibility of rail.





We dodge into this brother-in-law's hut for shelter from a squall. There are the implements for lighting a fire. Our host gives us an exhibition of fire making. I counted his strokes, fully three per second up to about two hundred and fifty, after which he moved too rapidly for my counting for about fifty strokes. Then from the accumulated charcoal at the end of the groove arose that welcome curl of smoke. Afterwards I tried the stunt, exerting all the pressure I dared up to two hundred and some odd strokes, when I increased speed and exertion to the utmost until exhausted; but only scattering smoke from the hot groove resulted,--no fire. The wood used is the hibiscus or puro. I have collected the stick which has four successful scars upon it and my unsuccessful

one labeled "Q". The longer bevel of the pointed stick is held in the groove; both hands are used, thumbs below the upper portion of stick and fingers crossed and bearing upon lower portion. The stick is short and very active. Here is a method our boy scouts should practice, though I doubt if they have the strength or endurance to perform the arduous task. American Indian methods are less exhausting.



During the squall our host has gathered four long canes of sugar for me. One is always embarrassed by the lavish hospitality of these people unless one is stocked with trinkets or tobacco.

There being no road around or over the island we returned as we had come to the landing village. There I parted from the native and ascended the hillside to the most promising fern brakes to listen for rail. Have been here half an hour and have heard nothing of them. Nor does my best calling obtain any results. About the rocky points along the summit a few noddy terns are flying and occasionally the call of a young nestling is heard. The only other bird present is the white tern, "Kotaki", which was flying about the village tree tops in the early evening. A tatler calls from the beach. Several squalls have passed today, leaving the evening sky

clouded. Perhaps it is well we did not try landing on Manoui.

This village is a neat little affair as viewed from above. It is located on a very narrow strip of soil between the lagoon and the abrupt hills. There are just enough coconut palms to give a tropical effect. Breadfruit, orange and mango trees seem to predominate, with two clusters of wide spreading, horizontally branched trees offsetting the breadfruit. Considerable coffee grows beneath the shade of the taller trees. The hills are of red soil and a friable tuff covered with clumps of coarse grass and patches of fern brake, with evidence of frequent fires.

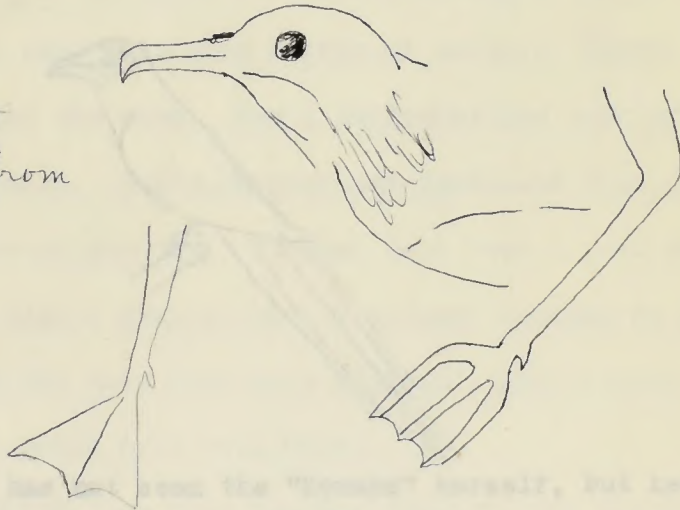
No sound of rail, and darkness is approaching. The lagoon off here is well filled with coral. A shelf extends three or four hundred meters from the shore, where a sandy bottomed, shallow channel separates the similar shelf around the very small, rocky islet off the coast five hundred meters or so. Evidence of drowned valleys is striking all about this island, or ravines rather than valleys, which now seem to plunge into the lagoon with many promontories between them. Black dikes of lava extend out into the lagoon from the shore off several ridges. Partially submerged rocks extend from the small islet towards the mainland.

The breeze seems to have slightly abated this evening. Clouds look ominous. Crickets are chirping in great numbers, being the second noise, only surpassed by the roar of the waves upon the distant rocks.

After dinner the Chief tells us of a little black bird like the tattler only smaller, with red eyes, which lives near water. He calls it "Kororo-iva" (rail). He says there used to be plenty, but the dogs ate them except at the islands to the southward. There, unfortunately, the goats are rapidly destroying the underbrush which affords them proper shelter and, no doubt, food in the way of insects and bugs. Here where they had good cover (though once the ferns were burnt off the dogs and cats had a good chance at them) white man's introductions have proved too much for them.

The tin can drum is beating, so I suppose we are obliged to take in the village amusements, though it is hard to tell whether to or not.

Drawn to get
information from
natives.



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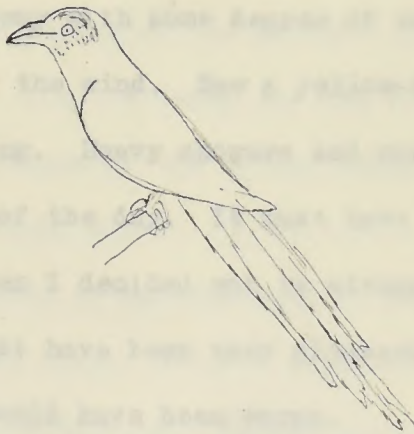
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of the petrel which kicks the water while flying, and therefore abides in these waters. He describes it as Fregetta grallaria. "Tiaku", according to this fellow, is Fr. albigularis. We must spend more time here and search more thoroughly for these birds. There is no doubt that Pt. neglecta dwells here, for the natives are very familiar with its call. The Ducie shearwater, however, seems to be a stranger to them. Again there seems to be no native name for the little sandpiper. The Chief's daughter, who talks good French, says that the "Kakavika" (the cuckoo) does not lay eggs here, but passes out through with nesting; most abundant in November. But now she says they did find the eggs in November, more than fifty years ago. Nests in trees. This, of course, may be tradition.



She has not seen the "Komaku" herself, but her father, the Chief, has. He gave us the name and says he saw them about thirty or forty years ago.



They know nothing of the eggs or nests of the tatler or curlew, which information includes the plover, usually considered as "Toria" with the tatler.

The tin pan drum has beaten incessantly while I have held the crowd here to give me this information; so now I must desist and let them go, or go with them.

May 10

Thank God we did not land on Manoui, for the night brought on a heavy blow and rain galore. I doubt if the Fan Fan can ride the waves, so we are not running around to Aga-kaouitai in her; but will make the journey overland and by canoe, hoping that the wind will somewhat abate before noon and let us get away with some degree of safety. Charlie is off to look over the wind. Saw a yellow-billed tern off shore early this morning. Heavy showers and continued wind promises to be the order of the day. It must have been a real hunch I had yesterday when I decided not to attempt landing on Manoui. The rain would not have been very pleasant, and sitting waiting for a boat would have been worse.

The noddy tern here becomes "Ngoio"; the little blue tern is "Nganga", (to be sure of the spelling of the name I had my guide write it down); the lesser noddy has the Tuamotu name of "Kikiriri"; the yellow-bill tern here is called "Tarara".

Left Curtis to continue the plant collecting on Taravai, and with Charlie in the Fan Fan and my guide, his wife, and two

children went around the rocky points to his brother-in-law's, where we arrived just in time to shelter from a heavy shower. The journey was not devoid of thrills. The woman sat at the helm; her husband was beside her with a broad bladed canoe paddle to lend his aid in case of necessity. Charlie, the young lad and myself were on the three oars, and the young girl in the bow to "parou ofai". These people of course understand Tahitian, but only are accustomed to the use of the "K" and "Ng". They talk much more rapidly than the Tahitians.

Last night the hula hula lasted late,--well towards midnight. It seems that the Rutledges have offered five hundred francs for the best exhibition of a hula hula; hence the drill every night in all the villages. The music consists of an oil can in a large pan as a snare-drum and a box for the base. The stick action of the drummer is fairly good and their time is perfect. In the dance the men far surpass the women. The whole performance of the latter seems to be muscular action of the heavy, fleshy hips.

The island of Aga-kaunitai is fringed with a shelf of coral two hundred meters or more from the shore, and practically connecting it with Taravai. We ran along the shore of the latter after rounding the point with current and wind both fair. Three sails, two paddles, and the Fan Fan riding high proved to be good sails. The guide, the two boys and Charlie went with me to Aga-kaunitai, where we had to float over the edge of the fringing reef on a swell. Once within the outer edge we found water quite sufficient to carry us ashore. Gusts of wind so

strong here that unless an oar was well feathered it was blown back from the end of the stroke. The reef WSW of here is sufficiently high to break the present sea. The west edge of this island has a beach of fine soft earth slowly encroaching upon the shallow lagoon. With coral building up beneath the water and rain washing down the soil, it is little wonder that barrier reefs are well filled, especially when in close proximity to the land. Vertical dikes are surprisingly numerous on these two islands,--almost enough of them to lead one to think they are overturned strata.

We ascend the hill and follow along the ridge; descend and cross a narrow flood-swept isthmus to the farthest point of the island, on the summit of which we now rest for wind. We are barely a hundred feet high by estimation. Saw two blue reef herons as we descended to the isthmus, but got no shot at them. The wind is steadily increasing, which makes walking extremely precarious over the slippery red clay of the ridge top. Climbing, too, will be extremely dangerous with a wind against which one must brace considerably. But with the boys to help, I hope to obtain a few birds for the two days' work. Have offered five francs each for petrels.

"Tokorua" seems to be the name of the portion of the reef to WSW, or it may be for the reef generally. The sea from here seems to be well specked with foam, but the waves do not seem overly rough. Again I must restate that I am very thankful to my guardian angel for keeping me off the island of Manoui where landing today would be simply impossible. It was well

that I told Mr. Beck that if I decided not to land there I would go to Taravai for the night and keep the boat unless there were birds to send in.

"Pungaverevere" is the name of the spider collected here. "Papoti" is the name of the cockroach collected on Kamaka. "Eori" is the cricket.

We scramble around amongst the broken up boulders of the rocky point, searching in vain for inhabited burrows. Nests are lined with coarse grass, pandanus leaves and other rubbish, and of a size consistent with the larger species of Puffinus. Feathers are black tipped and sooty, indicating that the inhabitants had been P. pacificus or nativitatis. The egg shells, too, were of birds that size. Other sign indicated that several weeks had elapsed in most cases since the birds left. One or two nests looked almost freshly tracked,--so much so that in desperation I dug out several of them only to find an empty room at the end. Several of the nests were beneath the large loose boulders where ample room was found without burrowing; others were partially burrowed beneath sheltering rocks and ledges; while still others were pure burrows into the accumulated soil. I found no nests of obscura, although I think I can say honestly that I saw at least twenty-five old nests.

Sadly disappointed I returned to the boat and we rowed across to the other island, or Taravai, where we took on some three hundred oranges, for which I bargained some soap, sugar and tobacco. Had a strenuous time rowing back into the wind

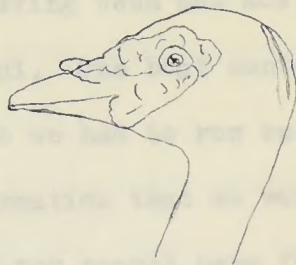
and tide. The breeze was so stiff that more than once an oar was blown out of the rower's hands. The native at the helm (the women had walked back) cut in as near the rocks as would still permit rowing with the lee oars. Tide was high enough to prevent touching the keel at any point.

The Chief is once again obliged to feed us, which duty these people most thoroughly enjoy. A "popoe" is being made of ripe breadfruit. A long trough having been washed, receives the soft fruit. The mass is then thoroughly stirred by the hand of the daughter of the Chieftain, who is quite an attractive, womanly girl. After the "popoe" is well stirred it is dropped into cupped breadfruit leaves and wrapped up for cooking in the "umu" dirt oven, or in this instance a five gallon oil tin resting on an old crowbar and an old wagon tire (straightened) laid across two rocks. If the wind abates this afternoon sufficiently to let us have half a chance against it we shall return to the ship. If not I see no reason why we should not remain here. One feels somewhat embarrassed, but these people do so thoroughly enjoy being hospitable that it is even more embarrassing to refuse their hospitality. But anything that makes them laugh seems to be repayment. We are somewhat under obligations to them already, but it certainly was a blessing to have some sort of haven for this blow.

The little rock off this shore is my next objective. We may possibly be able to make it this afternoon in a canoe. If not I will stop long enough in the morning to look it over

thoroughly, for they say that there the petrels live (as Mr. Beck had a hunch). The Chief told me yesterday that the petrel "Tiaku" (F. albigularis) does not kick the water in its flight. I was quite disappointed today to find no signs of either petrel, for grass there was aplenty and conditions seemed very favorable for them. I spent most of my time runnaging about amongst clumps of grass in search of these two birds, following everything that looked at all like a trail, but without the least success.

It is very amusing here to watch the ducks these people have about the dooryard. One kind resembles our domesticated Mallard breeds, the drake being a true green-head. The two ducks stand facing him and quacking in short rapid notes while raising and lowering the head with bill pointed downward as if bowing repeatedly. The other type of ducks is a Chinese breed, the drake an enormous fellow about as large as the Canadian goose. When the Mallards are conversing, the four or five ducks of this breed assemble before their lord and master and greet him in a very animated manner. But they do not bow to any mere drake, but stretch their necks straight out before them in a slightly elevated position. The feathers on the old drake's neck and head rise up on edge as he squeakingly tries to quack. Their call is but a strong stage whisper of the typical family noise.



The "poke" (Tahitian "po'e") being well cooked, is once more spread out in the long trough, and a sturdy young fellow with both hands upon the handle of the stone "poke" pounder thoroughly beats the mass into a thick doughy consistency. Then the trough and contents are set in the cook-house and the family congregates about it, and after adding a goodly quantity of "miti haare" the family meal commences. Considerable sucking and smacking of lips throughout the meal.

Now comes a vahine in great excitement to tell us that the Maxwell boat has been out to the South Group of islands looking for us. Sure enough, the boat is now observed returning to Mt. Duff. Should we risk the storm with our frail Fan Fan to keep them from further worry? I have sent for Charlie to discuss the proposition. Will at least work the little island before leaving. The Maxwell boat now appears to be headed this way, which will soon relieve that portion of the crew of anxiety. A storm like this is enough to bother a person all right.

Two boats came up after having been out most of the day searching for me on and about Manoui. One boat containing Teo and Jimmy anchored off the reef, so we had to row out and speak to them. Sent them back with information that we would attempt returning tomorrow after finishing our search here for birds. Rather unfortunate not to have any birds to send back, but that is to be expected in such weather. Shearwaters failing, what birds are to be obtained during rain storms? We made one trip over the slippery, wet red clay when the wind frequently blew us off our balance, and then to meet with nothing but disap-

pointment was very trying indeed.

The three boobies are well known birds to my guide who has traveled as far as Honolulu. He mentioned their presence at Timoe occasionally; I saw the blue-faced and red-footed ones there. He firmly asserts that none of the three are permanent residents here. We have found none. He has also observed the albatross astern from ships, but none in this particular vicinity. No name for the latter. Boobies are called "Uau" (*Sula piscator*), "Karena" (*S. leucogastra plotus*), and "Kena" (*S. dactylatra personata*). The frigate continues as "Otaha" (*Fregata minor palmerstoni*).

May 11

Owing to the rain last night the village amusement was at the guest house where we abide. Charlie played the clown he usually is; Curtis and I tried to sing; and there were a few songs from the natives. I am quite attached to the "K" and "Ng" as here used. It certainly does not injure the language at all. Nor does it sound much harsher than the Tahitian.

There are wasps here and the breeding season has brought them into the houses. They are, however, rather scarce,--much more so than at Tahiti where the myna is supposed to hold them in check.

Rowed out to the little island off this port to search for "Kotai" (*F. grallaria*). The top of the island, which is well grassed, reveals but one disappointment in the

way of a nest smuggled neatly in the midst of a close group of clumps of bunch grass, the common grass of these islands which grows about sixty centimeters high. The racemes of seeds are borne on the end of a coarse stalk above a cluster of blades. The nest is in a natural depression and is lined at least two centimeters deep with the dead grass. The bit of egg-shell found shows considerable age, as does also the down and one white feather in the nest lining. The young boy, lizard-like, is scurrying along the face of the rock peering into crevices and rummaging through the clumps of grass which find a precarious foothold on small shelves. The south face of this island seems to be a dike of basalt, and continues towards the main island with one stretch of exposed rock and a line of shoal. The guide has been all around and over these rocks, finding two previously occupied holes beneath ledges, and one grass nest similar to the one I found. An hour or more of thorough search revealed nothing more. The birds apparently have been gone some weeks. The natives claim that "Kotai" (F. grallaria) is the bird which nests there. We have certainly had bad luck on these three islands, but they have been well surveyed. Motouo-ari is the rocky islet off Taravai.

As we rowed back to Taravai a flock of noddies (Anous stolidus pileatus) were observed off towards Mt. Duff fishing, and a few scattered white terns just off the shallows off the fringing reef. A heavy shower delayed us long enough to get another meal before we left. We have now imposed upon these kind people for eight rations of chicken dinner, six coffee

and six teas or lunches. For these meals and five hundred oranges and four bunches of bananas we gave them four kegs of sugar, worth here fifteen francs per; three bars of soap at fifteen francs per; fifty francs' worth of native tobacco at prices prevailing here; also a five gallon tin of kerosene and a small bag of biscuits; for which they accompanied us to the ship, traveling in their canoe. One girl went with us until we were obliged to beach and let her get out with the canoe party who were beached waiting to get around the point. We had the Fan Fan too heavily loaded, which made things awkward; but after getting rid of her (we had tried rowing along shore with three oars but found current too strong) we set sail and in about two hours and a half reached the ship, thoroughly wet and cold. One man had to keep bailing out the rain water and seas we shipped, the mast threatening to tear out its braces and blow away all the time. It was well we had a good sailor at the helm. Decided to set sail from here tomorrow.

May 12

They have no distinguishing name for the nativitatis and pacificus. Bulweria bulweri is here called "Nokonei". "Mokoe" is the frigate (Fregata minor palmerstoni). "Kotuku" is the reef heron (Demigretta sacra sacra). "Keue" is the golden plover (Pluvialis dominicus fulvus). "Tavake uaka" is the red-tailed tropic (Phaethon rubricaudus). These names were obtained from the Chief's daughter while looking over the specimens.

We heaved anchor at ten o'clock, and with the Taravai party aboard (the Chief's son-in-law, Simeon, as pilot) proceeded to leave this group of islands. As we pass out to the northwest, Taravai presents the proper aspect for the side of a crater; steep-to towards the lagoon, while the ledges seaward dip at the typical lava slope. This can also be detected across the pass on Mangareva. Tongues of land extend seaward from the higher hills in true shape, with good examples of drowned valleys between them.

A flock of noddy terns was fishing above a shoal near the pass. We sailed through a school of twenty-two manta. From the rigging I could distinguish the extension of the lateral fins around in front of their heads. Just before entering that school we had seen one jump entirely out of the water and flop over upon its back. I judge these to be three to four meters wide, with a mouth well over fifty centimeters in width. The wind is well towards the north. We set our sail and took the course to Maria before passing over the submerged portion of the barrier reef. The result was a considerable scrape along the heel when a large trough let us touch bottom. Vessels entering or leaving should follow the pass as marked and sounded until fully five miles from the islands. The submerged reef has not been properly sounded and where we struck our chart carried no fathom numbers.

It must be remembered here that all the birds from
number to were collected from this group of islands.

This will avoid any trouble from the comparative obscurity of such names as Motou-tako, which is one of the islands. An additional name for the group should have been added, but "Gambier Group" is a French administrative name for this and several nearby Tuamotu atolls. In the egg blanks I have made it "Mangareva Group".

We came out upon a fairly rough sea which put everyone not on specific duty to bed, and made the stewardess and cabin boy seasick. The Captain reported some large white-bellied shearwaters, probably the neglected. Mr. Beck says there was a small Aestrelata around. I remained below filling out egg data blanks and sleeping. In the evening at about eighty-three, just after I had crawled into my sleeping bag, a small bird (either the Aestrelata Mr. Beck observed, the least shearwater, or else a petrel) flew over me and struck the mainsail; then caught wing and fluttered around it.

May 13

The wind continues north-northeast, accompanied by high, rainy looking clouds. Two or three light squalls during the night. The sea has somewhat subsided. When we sent the local skiff (which had been out seeing that we were safe) back to the ship from Taravai, it seems the kanakas conceived the erroneous idea that we were afraid to sail in such a storm. How surprised they were to see us come in with the little Fan Fan loaded to the gunwales next day, which was far more stormy

than Wednesday. Here they are very scared of sudden skiffs of wind from the mountains. With Charlie Olsen at the helm I'd be willing to sail in any boat in any sea. These kanaka are the most conceited people I ever met, which is only to be expected from people who have no broadening literature. How they would cling to the rigging on a New England fisherman, and how much they have yet to learn from the Scandinavians!

One small Aestrelata observed this first hour of the morning. If that were the bird that visited us last night I am many times more regretful that it did not fall to the deck. Spent a very restless night, turning about in vain efforts to get to sleep. Insomnia has been my worst enemy on this journey.

Arrived at Maria at three P. M. The boys just pulled in a fish called "cau", about eighty centimeters long and a very good eating deep sea fish. The people at Mangareva warned us not to eat the lagoon fish here for they are poisonous. We will live sumptuously upon this fellow tomorrow. Frigate-birds are very common here, appearing in flocks above the island in several places. White terns are fairly common. Red-footed boobies greeted us a few hours ago and have been observed since. Mr. Beck and I thought we heard very plainly the noise of blue-faced boobies.

This is a very typical atoll with its outer reef where the waves break; a shelf submerged except at the lowest of tides; a shingle beach apparently of coarse coral; then a narrow strip of wooded motu and the inner lagoon. On this southern side no

coconut trees are visible. A few pandanus stand out above the common vegetation; tohunu trees are abundant.

There being no need of laying-to over Sunday when we might just as well be sailing, we are continuing on to Marutea where we should arrive early Monday morning. There we will probably have work for ten days, since several land birds are reported to exist there. Doves, parakeets, warblers and rails were said to be there, and we expect the ground pigeon everywhere, but as yet have not found it. Shearwaters may also be there.

May 14

Had another irritable night and bad cramps beside. Spent the day in bed in spite of our approach to Maurutea. While beating along the shore a large fish was hooked. Two sailors could not hold him at first. Then we saw a splash and a sinister dorsal fin, after which the fish came in very easily; a second splash and again the dorsal fin of a shark. After that the fish came in without the least effort and the sailors hoisted aboard the head which had been decapitated at the gills. It was fully twenty centimeters in diameter, yet the shark had made a perfectly clean cut of it. This is no place to capsize a boat. Several people ashore are no doubt wondering what ails us for not putting out a boat on the Sabbath. We lay-to off the lee shore, the natives ashore putting out a light that we might know the location of the land throughout the night.

This island is apparently very long and has various islets upon it. Landing over the reef, but we hope to get the little dory at least into the lagoon unless a native canoe can be obtained. This island apparently has never been touched by the various expeditions. No mention of it in our notes, so in all probability the birds obtained will be new records at least, and very likely new species.

Upon this eve of our Tuamotu work one cannot help reflecting about the enormous length of time it will take to completely survey the group. Islands like this which have three or more land birds will occupy ten days or two weeks of our time. Others may not require more than two or three days at the very most. Given an average of a week, which is very low, it will require one year and six months to finish collecting on this Archipelago. What with the Marquesas and Society Islands to finish, with perhaps half a year at each place, we will be in these French islands until the end of 1924. The line and intervening island and Cook group will occupy about one year. Samoa may be reached before the first five years is up. It is well one has no particular ties binding one elsewhere. Scientific research makes all lands intensely interesting. Five, ten, fifteen years of one's youth may well be spent gathering data and specimens for others and future study for one's self. My only prayer is that health may not fail me. I do not like the way my stomach has acted upon this trip, but lay it mostly to lack of variety in our diet.

In these days that can be avoided. The Tuamotu atolls will be the worst part of the entire expedition in that respect. By interspersing cruises through them with work in mountainous groups like the Society and Marquesas a great deal of the monotony will be dispensed with. It is only too unfortunate that we cannot get more of these outlying atolls surveyed this cruise. But our time is rapidly drawing to a close. The next six weeks will slip by before we can get around to many of the atolls. The crew is quite anxious to return to Tahiti; but for my part one portion of the South Seas is just as interesting as another, although a little mail would be interesting.

I had hoped to be able to read a bit today and reflect upon the Gambier Islands in a summarizing manner, but a bad and decidedly irritable stomach prevented me from anything but light reading. Now at nine o'clock in the evening I begin to feel fresh enough to work all the night. A very significant thing about the Mangareva Islands is the lop-sidedness of the coral formations. The four-sevenths of the reef being submerged is the most noticeable physical fact. The next is the abruptness of the southern group of four islets. They are not surrounded by anything that could be called extensive fringing reefs. In fact I am inclined to blame the shallows off Kamaka to worn down rocks from the cliffs rather than coral filled lagoon. Taravai, Aka-marou, and Au-kena, on the other hand, are well fringed with reefs, as is also Mangareva.

About these islets extends the exposed portion of the

barrier reef in its widely open horseshoe form. Just what is the cause of this peculiar circumstance I am puzzled about. It may be due to an unevenness of sinking, the southern portion lowering more rapidly than the growth of corals. The lack of fringing reefs about the south islets may be due to the lack of protection or shelter of the submerged barrier reef, letting in high seas and heavy currents which are not satisfactory to the growth of lagoon filling corals like those about the other groups of islets.

There is one thing a little disconcerting about these steep-to islets. Why are not new fringing reefs forming upon them? Is it that they do not get the full force of the open sea? Is that absolutely essential to their growth? How strange that no intermediate kinds fill this niche! There are some corals which afford material for sandy beaches in the coves above sloping shelves of cemented conglomerate; and the submerged rocks are coated somewhat with corals. Is it possible that submergence has been so very recent geologically that no noticeable fringe has been developed? Does this also apply to the Marquesas Islands? Are Rapa, Bass and Pitcairn too far south for coral growths (their beach lines and harbors do not seem to indicate that), or are they, too, sinking so rapidly that the corals cannot keep up with them? There are the Neilson, Portland and Minerva reefs down this way which seem to indicate a very similar condition. They, too, are submerged several fathoms below the surface. Is it that submergence is too rapid? The submergence theory does seem to explain conditions better than the other beliefs regarding the

formation of these islands. Of course exceptions like Henderson, Makatea, Rurutu, Rimatara are a little disconcerting to any idea of general and continued subsidence. In fact they contradict that "continued" idea. But does not recent investigation in geology indicate that coast lines fluctuate up and down? No doubt some elevation takes place amidst the general subsidence. It is indeed strange if such a vast stretch of the earth's crust as that from Ducie Island to India should subside equally throughout. Rather the marvel of it is that irregularities are not far more frequent. Our paleogeological maps of North America indicate irregularities of crustal movement far more astonishing than these few islands amongst so many hundreds which do not exactly conform to rule. I am inclined to Darwin's explanation; now what I want to know is when did the subsidence occur? How recent or how remote was it? At what geological age did the separations from the mainland occur? The stratigraphic evidence is buried, but is there not other evidence?

What of plants, land snails, scale insects, and other forms of life not capable of being transported across vast stretches of open sea? Unfortunately our important line, birds, throws no light upon the subject. Had birds been existing on that sunken continent one would expect a series of quaint varieties more strange and odd than New Zealand and Australian types. Birds here are to be explained as emigrants after submergence. Plants might tell the story, yet in many cases they have been introduced. There is little doubt that the Polynesians brought

most of their staple foods and industrial plants with them from the lands westward. As for sea birds carrying plant seeds, I have little faith in that idea. They eat no plants and there is no mud upon their feet. Migrant shore birds may carry indigestible seeds and so stock many islands with the plants they feed upon. Rails, sandpipers, doves, pigeons and other vegetarians might have carried seeds in migrations of an early date, and later both plant and bird have settled down to become indigenous. Such would be the inference from an island like Henderson which has a much more varied foliage than any atoll I have yet visited. Few atolls are able to carry the vegetation that formerly grew upon a mountain. Yet Henderson vegetation very greatly recalls the flora of mountainous isles. These are the problems of keenest interest to me in regard to these islands. The birds that dwell upon them are the first consideration; where and how they live is the next; other forms of life crowd in for their share after this.

BOOK XXVII

Voyage of the 'France'

from

Marutea

to

Maria

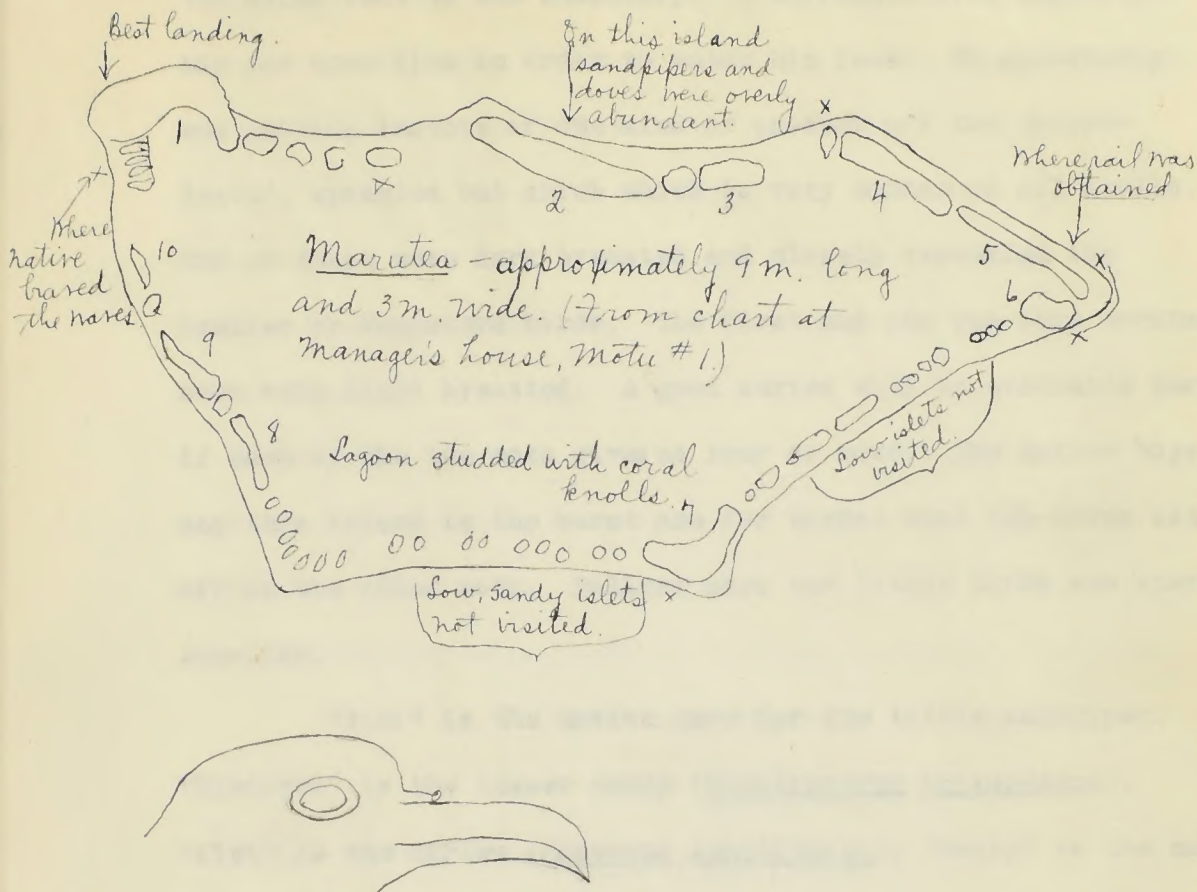
May 15-June 3, 1922.

May 15

Put the boat out this morning and went ashore, not quite so easily, as that is a landing over a coral reef. The two natives working here under an American named Pollner (ex-brewer and consequently out of employment now in the States) were standing alongside the narrow boat passage. We pulled in close and then waited our opportunity, but current swept us away from the proper place twice. At last we made the plunge and were caught by a foaming wave and hurled briskly shoreward.

The lower part of the prow struck very heavily on a rock, but no damage was done.

I waded ashore and met Pollner, a fine chap in his forties who naturally took us for the long overdue and greatly anticipated trading schooner. The neglect of owners for these outlying islands and their keepers is something scandalous. It is four months since a ship last touched here, and then only to leave a little mail. He is almost foodless and quite shoeless, but cheerful and contented. We will leave him some reading. He took me out hunting along the plantation road where he had frequently seen small brownish birds which came very close and flew only short distances. We did not find any. At the copra shed and beside some copra spread for drying he said we would find the curlew, which he firmly asserts eats copra. Sure enough! We saw four of them very near the drying copra. I stood behind a tree and called until two came well within range. Then I shot at but didn't seem to hurt the further one. Took the nearest out of the air next shot. Reloaded while both of us whistled for the others to return. Dropped two from above the coconut palms. One fell into boughs of tree. I gave it to the native who went after it later. At the end of the coconut grove we flushed and obtained a sandpiper. Rest of morning brought no other game. Saw some terns (Thalasseus bergii, Anous stolidus pileatus, Megalopterus melanogenys), a reef heron and frigate-birds.



The boys put off to sea at eleven with but one sandpiper and two curlews owing to my failure to kill any sea birds. Had they brought their lunch I would have held them until evening, but did not like to impose upon Pollner for five meals. After a chicken dinner we again went out after the little brown birds which he claims dwell in the cleared coconut plantation. We again found nothing, but in the small unplanted strip of land at the end of this motu # 1 we found three more sandpipers. Two I had to shoot with the large shells because of their wildness;

the other fell to the auxiliary. I refrained from shooting him for some time in order to watch him feed. He apparently was getting insects of one kind or another off the coarse-leaved, sprawled out shrub which is very common on all atolls. Two of these were dark breasted and closely resembled the Gambier or Mangareva birds. The first and the one this morning were very light breasted. A good series will be available here if each of the ten motu gives us four or more. The native boys say this island is the worst one for birds; that the doves are off on the other motu. Pollner says the little birds are sparrow-like.

"Titi" is the native name for the little sandpiper.

"Kikiridi" is the lesser noddy (Megalopterus melanogenys).

"Kiwi" is the curlew (Phaeopus tahitiensis); "Gnoio" is the noddy (Anous stolidus pileatus); "Otaha" is the frigate (Fregata minor palmerstoni); "Uau" is

"Rokikokiko" is the warbler, very scarce here according to the native. No parakeets here according to natives and keeper.

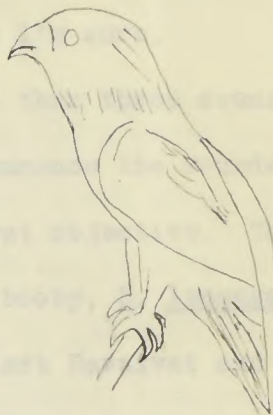
Mosquitoes are terribly bad here tonight. Flies not overly bad. I noticed several moths and butterflies here. Also lizards are present. Rats very scarce according to keeper.

A strange incident occurred here just a few days ago. Pollner was talking with his little Moorea girl about a little pup they have here. She then told him of an American "popaa" who obtained a pup at Moorea and was carrying it in a small box to Papeete. That was two days ago and we were on our way

hither from Mangareva. The American "popaa" was E. H. Q. and the pup his dog Noha. Strange and very interesting, but nothing spiritualistic that I can see. Yet, 'tis odd.

Islets of Marutea as numbered:

1. Vaimuu.
2. Motu Kaveka, Motutahiri.
3. Motu Metuero.
4. Huriri-otio.
5. Teava-motu village, Oneroa.
6. Tikatu.



Intervening are: Torohitu, Pitopito, Tikiato, Vete vete, Tiakaka, Takopoto.

7. Vainono.
8. Vahokariepoe.
- 9.
10. Motuopopo.

May 16

A sleepless night, due in part to a cup of coffee. What a drawback to be unable to drink the commonest beverage of mankind!

A high sea this morning so the old landing was decided upon. We reached it just as the boys came up to the reef. The higher waves were piling up in a very threatening manner, and with an off-shore breeze blowing foam and spray back from their combing crest their size was highly magnified.

The boys having had their needed lesson against carelessness at Oeno watched carefully for the proper time, and with good luck came in before a beautiful comber which left them high and dry. As Curtis says, it certainly is a marvelous experience; and very interesting from the shore I'm sure.

Out in a sailing canoe with less than three square yards of canvas very frailly rigged to commence the rounds of the islets. Motu Kaveka, # 2, is our first objective. The first bird worthy of space is the common booby, S. leucogastra plotus. "Karina" not observed since we left Ravaivai and not taken since Scilly atoll. The bird observed did not come close enough to shoot. Beyond the end of Vaimuu, # 1, are several low islets of coral rock and bare sand, with strips of lagoon between them. We are about half a mile off the first one bearing trees and shrubs. Before visiting these lesser islets I plan collecting on the ten largest; then if no warblers are located I will visit as many of these islets as time will permit. May possibly be able to work # 3 as well as # 2 today.

Noddy terns and blue-faced boobies observed above and on the little islet opposite. Off the near end of Kaveka is the typical stretch of coral conglomerate shelf and on it a very conspicuous large boulder, evidently thrown up by the waves. The wind being northeast we will hardly fetch the near shore of the islet without a bit of paddling. I am to get off at nearest point available and will then hunt along to farther end where they will await me with the canoe. Yellow-bill terns

observed along shallow shelf inside the reef in a place which seems very favorable to them. The native who came with us on his own invitation (Pollner advising me to bring the other) says the yellow-bill tern does not nest here. I have the boys paddling into face of wind.

Upon landing I heard some tatlers and started for them; but was soon side-tracked by the sandpipers which came up to me from every direction. I would shoot and pick up until I had half a dozen; while papering them one or two more would come within range. They were on shrub branches, bush tops, pandanus and rocks, and flying, all piping in their strange, gentle voice. I continued killing and papering so long as I had ample auxiliary cartridges. Saved a few for doves.

These birds were also very tame and not only allowed me to approach very closely, but even came up into nearby trees of their own accord. Finally I struck out along the islet searching only for doves. Obtained some dozen or so. Two curlews, flushed by my shooting, flew above me too close for shooting while I changed from # 10 to # 6 and got both of them, and also another dove flying by. It was the best morning of hunting I have ever had. Some fifty birds in the bag and hardly eleven o'clock yet! Have finished islets # 2 and # 3, which is very encouraging, for there are many of them about this lagoon. Refreshments of coconuts and lunch. Three more sandpipers to complete our half hundred, and we are off for the ship to skin birds.

But I have decided it best to remain ashore and collect. Will come back out this evening and even attempt reaching the farthest islets. Heard some sooty terns today and the native says they are nesting farther along the motu. We are now back flush with the near end of islet # 2, the big rock. I got so excited with the sandpipers so thick about me that I forgot to go over to take a close look at it. It is no larger than similar boulders at Scilly. I simply cannot get over the abundance of the sandpipers here. I never saw land birds of any kind so plentiful before except migratory flocks. They were simply everywhere, and being curious also made them appear overly numerous. There is a tendency towards albinism in them, which may well account for some of the white speckled species named from single specimens in early days, or from drawings. I am watching for unusual birds now. Today's collection being a straight run should show their general color. Hereafter I'll pick out odd plumage phases.

The doves are not cooing, though I thought my calling had something to do with my good bag. They seem to be very quiet and are not seen flying except rarely. One thing I like about the little twenty gauge is the ease with which it can be handled with one hand. I am watching in all trees here for their nests. It cuts me to the quick to think that in all these months we have not found one fruit dove nest. It is not from lack of search. I have blamed it upon tall trees, but here there are no tall ones, so I have not that excuse. I should find the nest of

this sandpiper here where they are so plentiful too; but had no success today.

Thrills and chills await us ere we finish the Tuamotu Archipelago. We decided to help the boys off with the boat, and it was well. The lazy things had piled a lot of wood up on the beach, which now delayed them half an hour or more. Pollner and I, back on the beach, saw a great sea coming in from the storm which clouded the southern sky. We yelled for the boys to hasten, but it did no good. They dallied too long and the sea came just as they were ready to shove off. Waves fifteen to twenty feet high struck the reef and the flood from them carried the boat far back to its former anchor. Ere they again reached the reef another series of seas came up and once again swept them inland. Then I went to their assistance and the two natives ashore followed me. We held the boat through two more enormous seas. How frightful appeared the gaping maw of the reef as the comber broke! Long treacherous cavities or crevasses with sharp edged, jagged flanks extended down through that chute out which the boat was being pushed. Large holes (I let one leg into one, but had good hold of the boat and only scraped my shin a couple of inches---that was enough) made standing and working there dangerous; while the large, black, sharp-spined sea urchins made things uncomfortable, to say the least. Several times the barefooted natives winced, but there again I was more fortunate than careful.

At last the back wash from the preceding wave caught

the boat and carried her down that chute with terrific speed. The die was cast. The boys scrambled aboard and grasped their oars and commenced pulling with all their might. And just in time to mount the next swell a moment before it broke. My native canoe boy had helped so well that necessity forced him to go with the boat. The other chap (a dullard if ever there lived one) hesitated and was lost. He did not make the boat, nor did he regain the shore. The back wash shot him along seaward into the great gulf below. But these Tuamotu boys are good swimmers, so under the combing wave he went like a fish. Then for five minutes or less he remained there just where the waves broke. Perhaps he could not return to shore safely. The boat having set out to sea, I waved them back to the danger point to pick him up. Pausing there dangerously near the critical line of the combers they awaited him. Apparently he was not doing well, for the other island native jumped out and helped him alongside the boat, which then was rowed to safety where the two men were pulled aboard. This was indeed an experience. I stood there upon the verge of the reef where the waves struck but to my waist, and was helpless but wise enough not to try to assist him. Little chance would the human body have of withstanding the pounding against that jagged coral, and only long experience and proper decision could prevent such a catastrophe.

This landing over reefs is no child's play. Without exaggeration one can fairly say it is dangerous. We have two gross errors in our personnel aboard the 'France'. The first

one is in trying to make a sailor of a young Harvard graduate, a man who will do his duty in spite of all risk and danger; the second is in not paying a little extra to obtain an experienced "boat captain" or boatswain. A few there are to be had at Papeete who know just how to handle these surf boats, but they know a little of values and will not sail as ordinary seamen. Above all it is no job for inexperienced white men.

May 17

We had but returned to the house, after seeing that the ship was approaching the boat, when the storm hanging about the southern sky broke with light rain. The clouds were noticeable because of their peculiarity early in the afternoon. The brisk northerly breeze of the morning died down just as we returned in the canoe. Then followed a lull of two hours before the storm broke. During the night the fury of the wind sounded cyclonic, but not much damage was done so it could have been but a gale.

This morning upon hearing the whistle of the cuckoo I went out with the gun, but got nothing although I walked the half mile along the lane to the sea. After breakfast I took the gun along with Pollner to look at copra. No curlews, but hearing the plover call I answered and drew three birds in our direction. The first two shots netted but one, which proved to be an accompanying tattler, so I continued calling until one of the other birds circled back and I got him. It proved to be a

unique specimen with black speckled abdomen.

Paddled out to nearest motu at about, or between # 1 and # 10. Found there white and noddy terns and a few sandpipers; no doves. One sandpiper alighted upon the leaf of a tree here. His first attempt flattened the leaf down upon its companions and afforded him a good level resting place. The ship is standing-to at a little distance, with foresail down; the mainsail is reefed and only the staysail to offset it.

In the lagoon here the coral knolls are of a striking nature. They are almost as level surfaced as a table, and resemble that piece of furniture in the overlapping of the thin top, which is just a few inches below the present low tide level of the water. Over the top of this table the brilliant bluish green parrot-fish are to be seen at breakfast. They are called parrot-fish because of the beak-like jaws with which they scrape the living polyps off the coral skeletons.

I stop to write this and the canoe drifts over upon a table at which the mollusk is abundant.

To anchor I shove the pointed end of
my paddle into the jaws of that vise,



and here we rest. There is no doubt that these mollusks grow about as rapidly or more so than the surrounding corals and coralines, for they are to be found in all sizes and their surrounding is always sufficient to their needs. I got the paddle loose by breaking the tips of the shell that held it so firmly. Woe unto him who puts finger or toe in there!

Passed up the next small islet, seeing naught but a pair of sandpipers upon it. Stopped at the next to endeavor to outwit a white reef heron; I failed. Three or four sandpipers here. Went on to next two where a sandpiper came out fifty meters from the lagoon shore and fluttered about the canoe, almost alighting upon the outrigger. Shot him after landing. Shot one of two frigate-birds observed above this islet; both females. At the shot I heard the scared scream or scold of the cuckoo. White and noddy terns about as usual. Obtained one dove after returning to pick up frigate. She was perched quietly upon the dead branch of a tree. They are neither noisy, scary nor curious. Have had no luck calling them today. No more sandpipers seen yet. They are about as thick here as on the home motu.

I went on and into the next few motu and finally reached # 9. From there I proceeded afoot to # 8, the only result being a couple more sandpipers, a dove or two, some terns and sight of a cuckoo, making the third heard today. I got a hurried shot at him but failed to make a kill. Lesser noddies passed occasionally today but were always observed too far away for shooting. It was rather late in the afternoon, so I hastened back to the canoe. In fact I was hastening thither when the cuckoo scolded me. Also flushed a blue heron en route.

There was just enough wind blowing to bother my canoeing. I exerted myself to the utmost at the paddle but could make

no decent speed. Finally I pulled for the nearest point of the motu adjacent to # 1, and after beaching the canoe struck out on foot for the house. Had some wading to do but made it in good time. Curtis came out to meet me. At the house the two local natives utterly refused to go after the canoe, in spite of the oranges I had just given them and all the stuff they got while aboard the ship last night. We men went on out the lane (the boat had come ashore on the north opposite the lane of coconuts and flagpole) and helped launch it. Kept Curtis back to help me with the sailing canoe tomorrow in lieu of these men,--a very handy arrangement, for there may be good collecting in the plant line out there. Pollner just tells me to be on the lookout for turtles and eggs at the further end of the atoll.

When we returned to the house Curtis started after the canoe, but we noticed it half way across the lagoon, while two other natives were walking back along shore. Pollner's little house girl was missing. I surmised that she had gone after the canoe; and surely enough, she had! This little Moorean native Pollner has with him is certainly a wonderful companion. Few women in the world could be better adapted to his needs. The hardest thing for me to fathom in the South Seas was the "popaa" with a native "comrade". But out here I can understand why it is not only feasible but the very best possible arrangement. What white woman would live on an atoll a thousand miles from Papeete with no other company

than her spouse? How restless the few who dared try would become! Were I an unattached man intending to spend several years on one of these outlying islands I would find such a native girl as Pollner's comrade to keep house for me. As to the moral issue: is it after all so bad? It certainly does not injure the girl's reputation. There being no such thing as virtue, it does not help a girl any. If they were only scientific enough to doctor against venereal diseases there would be little to say against the very free love of the South Seas. I would not for a moment condone free love in civilized communities, but where free love has always been in style does it really injure the people morally? Morals are rather comparative things anyway; the good are merely better than the bad. ...

Just before I left the canoe I yelled, "Let's go!" to attract the boys. Four yellow-billed terns flushed at the call. I killed two, but only one was clean enough to save, the other getting the breast feathers smirched when I was killing him. These birds are not so very numerous here,--nowhere near as many as we saw off Mangareva reef. The natives say they do not nest here. Somewhere through these Tuamotu we should find them nesting. The lunata has not been observed upon this trip. I am also anticipating their nesting place. How these two terns must travel around and yet we have never observed them very far away from land. Have seen nothing of boobies since the canoe voyage yesterday morning. At one

place today there were four or five frigates well above me. Tatlers were heard practically all day along the rocks between and around the motu. They were in flocks of three or four and very wild. I did not get a shot at any. We are very anxious to get them just now to see whether or not their organs are swelling. Pollner tells me that the natives here shave themselves with freshly broken glass,--a common habit they say in these Tuamotu.

May 18

We have a head wind for Vainono, # 7, but it may prove to be just the right wind to run us over to the further point of the island, where we may be able to work # 4, # 5, and # 6. Pollner fears that we have too much wind for the sailing canoe, but we'll try it at least. It wouldn't be so awfully bad to capsize, for the small sharks in here have never bothered the pearl shell divers. There is nothing else for us to do, so we might as well try to get out to the point, although I should like very much to get a good batch of birds to the ship today.

Daylight floods us instantly,--hardly fifteen minutes transition from real darkness to full light. We rigged out the sailing canoe and secured everything in it as best we could. We then paddled across through the reef tables to the northeast, where we beached and put up the sail. Then we boldly struck out to tack into the wind. Once our outrigger came out of the water but we weathered that spell. I had not calculated properly on

our headway and tried to get to windward of a table. We succeeded and then the leeway took us upon the reef. Footing was rather treacherous,--it was not quite so level topped as some are. We succeeded in working the canoe back along the edge of the table until just the bow touched. I got in and Curtis shoved off. Again we headed into the winds, but a series of choppy waves changed our opinion about the lagoon sea. We turned shoreward and let her run before the wind. Dropped the sail before striking the intricate table reefs off the landing and drifted in. Had all we could do to keep off the reefs as it was, especially at the fish trap gap where we had to come up to windward. Pollner now tells me it is possible to land from the sea at both Vainono and Tikatu, so I think we must either bring the Fan Fan ashore or else tackle landing around there from the sea. Unless the two ton copra boat is launched here there is no equipment to cross the lagoon.

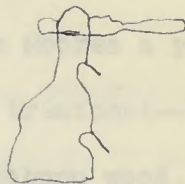
Went aboard after flagging the ship. Mr. Beck decided that landing the Fan Fan and carrying it to lagoon more feasible than trying landing at other end of atoll. So after lunch we launched her and Bijoe and I took her in. Mr. Beck went in with the other boys in surf boat. It was my first experience steering. Rudders are more dangerous than good, so I steered with the extra oar and we made a very good landing indeed. Went after cart and on it had no trouble in transporting the boat over the lane to the lagoon, where she now rests upon the beach with all sail set ready for the first fight with the

lagoon reefs. I must steer her myself as Charlie is needed aboard ship and Bijoe on the landing boat.

Did I say "Fight"? Well, fight it was indeed! A squall lurked in the offing, if that means to windward across the lagoon. So we waited a while for it to pass over. Finally decided to go in spite of all squalls. Getting outside the labyrinthian table reefs was a very difficult task, but finally we managed to back her out into the wind; then, while Curtis held as best he could with the oars, I ran up the spanker; took my seat astern; set the sail, and off we went on the port tack. Had to bring her about and tack back and forth very frequently until we got somewhat beyond the cove of the home motu. Then came a few long tacks which got us well to windward. Whenever we saw the waves breaking ahead as over a table we tacked back. White-caps all over the lagoon were somewhat disconcerting. On a long port tack from the northeast point of Vaimuu, # 1, I had Curtis unfurl the staysail,--a foolish thing! What with his weight forward and high and the flapping staysail, we very nearly capsized and our chest of sand as ballast shifted dangerously. It kept Curtis busy reshifting and refurling the staysail after we saw it did no good and much harm. After this we made some more long tacks. The sun was about fifteen degrees high when I could have fetched islet # 10 easily enough. But I recollected the reefs about there were bad, so we aimed to make the near end of islet Kavika, # 2, and land. This necessitated one port tack after we returned from # 10 on the

starboard tack.

It was getting dark, being cloudy about sunset time, so I let the Fan Fan out before the wind a little more and we sped on towards the near end of motu # 2, where some young cocomut trees offered us easily lighted fuel for the essentials of a comfortable (?) night. We were speeding along well out in deep blue water and were watching the waves. The sail seriously handicaps the helmsman's view to leeward. Suddenly beneath the sail appeared a small table reef standing up in that deep blue water. Hard aport the helm! Our speed brings us around. The bow is clear; the stern--bang! The rudder is ripped from her moorings, but the boat did not strike the rock, and our speed held us up in the wind until Curtis' emergency oars pulled us safely away. The rudder pins (wire spikes) had given enough to let her loose without serious damage. Hastily I hammered them straight with the heavy tiller and replaced the rudder. Then we came on towards the near end of motu # 2.



About two hundred yards from shore the table reefs stood with crooked channels about five meters wide through them. We had taken down the sail and taken in the rudder and were upon our oars and luck. Curtis amidships held two oars, while I astern had but one. Dragging it on the starboard was effective enough to pull the boat



around in that direction. To port Curtis dragged that oar and we both pulled on the opposite ones. Rather serious combers occurred just within the reefs. Was it inherited character from an ancient Viking's child wrecked on the coast of the Isle of Man, or just pure fool's luck that steered the ship through those dangers just before dusk? As we sped towards a coarse gravel beach I heaved the anchor, which after dragging at length held and brought our bow about to face the waves. She's a heavy old boat for two not very strong men, but Archimedes had strength unknown to Hercules, and the oars as levers set the boat atop the shingle beach.

With the anchor firmly secured to windward we left her to the night storms and carried our stuff along the beach to the welcome vicinity of the coconut trees. It was too windy for our lantern--the same old thing I had in Moorea a year ago, and victim of many a tumble and other rough treatment--but we got a good fire going with palm leaves and tohunu wood. Fried salmon, stewed tomatoes and coffee went not at all amiss. Just finished eating when rain came down in torrents. We curled up under some old canvas (foolishly forgot the tent silk and rain-coats) and hunched up on our haunches like a pair of Pillicanthropis awaited the passing of the squall. During the lull that followed I rushed back to see that the boat was safe. The staysail was out and flapping. I furled it securely and lashed it well, then returned to camp where we made out a sort of bed.

Stripped off the wet clothes and crawled into dry ones,

laughed at the day gone past and went to bed. Slept like a log in spite of drizzling rain, until the waning moon came up. Lit the lantern and recorded one of the narrowest escapes I ever hope to experience.

May 19

Awakened at daylight by the piping of sandpipers,-- a couple apparently surprised to find us upon their private domain. They were around camp well before sunrise; in fact, clouds prevented that event. A good hot fire of tohunu wood started with the crossed-fibrous sheath from the base of the fronds of the coconut (a splendid kindling) and palm boughs. A real breakfast on salmon, asparagus, jam, biscuits and coffee. A day like this one can stand that stimulant. Packed up and launched and loaded the Fan Fan.

A squall passing over, we left her at anchor; I swam out and dropped the anchor over a rock far enough to hold the boat off shore and rocks. We sit beneath our old canvas awaiting the passing of the squall. As we were loading, two frigate-birds soared along the motu to windward. This is no squall but a storm, a black, clouded, ominous looking blow accompanied by showers of rain. Since our narrow escape yesterday I have no heart to set forth under present conditions, so we have made a shelter and camped until the storm breaks or abates.

After about two hours we noticed the Fan Fan listing to port, so stripping down we waded out and brought her into the shore and again beached her. The lagoon is practically

afoam with white-caps. We were wise not to attempt sailing into this storm. Our leeway would have been more than our headway, and it would have been difficult to see the dangerous coral tables out in the lagoon; so we stuck to the land. I went out in the evening and picked up four sandpipers. They are not very numerous here.

Wind continued all day so we did not attempt launching. In the evening we hung the lantern where it could be seen from the sea, leaving it there for an hour or two.

May 20

During the night considerable rain fell but not in heavy showers. In the morning a light breeze was blowing. I went hunting, obtaining a curlew, white tern and seven sandpipers (of which there were not many here). Saw two white and one blue reef heron, but could not creep up on them. Also saw tattlers but did not get any.

Breakfast finished, we loaded the boat and struck out, tacking towards Vainono. Out in the fairly quiescent lagoon we came upon several of the coral tables and thanked our lucky stars we had not tackled the storm the day before. Finally we were becalmed and had to row in through a drizzling cold rain. This storm prevented a fair survey of the island which is very broad and fertile, the soil being covered with black loam and spongy moss. Two little sandpipers were all that I obtained. As we passed some small islets off the end of this one a score of frigate-birds flew up and over

us, but all too high to kill. As I returned to the boat I saw one neglected shearwater. Calling brought him over me but too high to reach.

We took to the boat and rowed a mile to warm up before raising the sail to take advantage of the fair wind which took us into port about three-thirty. The boys were in with the boat, Pollner having flagged them this morning when he first saw our sail and again this afternoon. The 'Moana' passed along the southwest of the island this morning. It stopped a few minutes alongside our ship and then went on to Papeete. Our letters left at Mangareva on her, I hope.

Pollner had hot water and dry clothes ready for us. As I did not have more birds than Mr. Beck could easily care for I remained ashore, sending a note on board for more provisions for next week. Having indulged in coffee, which is very tempting when served with coconut milk, I have had a bilious attack the past few days, ending with very severe cramps this evening. Half a dose of Epsom salts (which I avoid like poison since drinking freely once of a mineral spring at Mammoth, Yellowstone) settled the question decidedly.

May 21

Enjoyed a real day of rest and Pollner's kind hospitality. We went out once and caught an octopus in the walled fish trap. It was interesting to see the brownish colored, bulging form resembling very closely in outline, and especially in color, the surrounding coral. It had two bulging eyes, and

us, but all too high to kill. As I returned to the boat I saw one neglected shearer. Calling brought him over me but too high to reach.

We took to the boat and towed a mile to where before raising the sail to take advantage of the fair wind which took us into port about three-thirty. The boys were in with the boat, Poliner having flagged them this morning when he first saw our sail and again this afternoon. The 'Hornet' passed along the southeast of the island this morning. It stopped a few minutes alongside our ship and then went on to Papete. Our letters left at Mangareva on her, I hope.

Poliner had hot water and dry clothes ready for us. As I did not have more than Mr. Beck could easily care for I remained ashore, sending a note on board for more provisions for next week. Having indulged in coffee, which is very tempting when served with coconut milk, I have had a bilious attack the past few days, ending with very severe cramps this evening. Half a dose of Epsom salts (which I avoid like poison since drinking freely once of a mineral spring at Mammoth, Yellowstone) settled the question decidedly.

May 21

Enjoyed a rest day of rest and Poliner's kind hospitality. We went out once and caught an octopus in the walled fish trap. It was interesting to see the brownish colored, bulging form resembling very closely in outline, and especially in color, the surrounding coral. It had two bulging eyes, and

its tentacles were embedded in the interstices of the coral. I stood watching him while Pollner rushed back for the spear. Soon after he left, the octopus (a very small fellow with tentacles less than two feet long) left that location, swimming across the grayish green pool. The instant he left the rocks his color changed to a grayish green, making him barely discernible in the water. Pollner arrived and speared him. With the first touch of the spear his color changed to a dark reddish brown, the exact color of the rocks beneath. I let him entwine his tentacles about my arm to feel the power of the sucking discs. A large one might prove rather interesting. Here they are never found much larger than this. They make good dog food and are not bad eating on the table when cooked in the "Umu Tahiti".

In the evening we went out to try for lobsters, but our lanterns afforded insufficient light and the water was somewhat too high. They are found along that shelf within the outer edge of the reef and the beach of sand and gravel.

May 22

We prepared to sail the lagoon again this morning and started out at eight, or as soon as the boys arrived with our supplies. Mr. Beck and the Captain came ashore with them. Bijoe and Teiho accompanied us in a canoe to Motu Kaveka, where Bijoe and I got out, sending canoe and boat along to end of islet. We shot as many sandpipers as I felt I could spare auxiliary cartridges, and all the doves we found. The sand-

pipers were again very plentiful, and always three or more were within range; seldom two near enough together for a double shot. The doves we found mostly in pairs and quietly perched in the lower branches of the larger trees, except the pandanus. In one broad-leaved tree near an abundance of white berries we obtained three birds after shooting one in the adjoining tree. I shot at a noddy tern with a large shell. The shot scared a dove from the upper limbs of a tree to the lower ones. Obtained the dove and found in the upper limbs what is undoubtedly a dove's nest. No egg in it and I did not observe the bird upon it. Were it the nest of the sandpiper (of whose nesting habits I know naught) many more should be found. It appears so similar to other dove nests and so unlike any other bird's nest here that I am convinced it belongs to the dove scared by the shot. I felt her for eggs but could not feel any large ones. The nest was a neat cluster of delicate brush twigs smaller than thin pine needles, arranged rather loosely between the branching boughs. Bijoe cut off the branch to carry it aboard ship. The doves were found in proportion to the abundance of the white berry, which I surmise is their staple food, although they appear to eat the green Tohunu berries also. If so, even Ducie Island would support the life of a dove. But a few birds - perhaps six - were seen flying during the two hours on the island. Only one pair seemed to be attracted by our cooing. All the rest were obtained after seeing them perched in trees, and by walking boldly up to the proper range, getting position

behind them and using auxiliary cartridges. They have no fear whatever, and allow one to get within one or two meters before they seem to think of flight. I should have had my camera brought ashore.

The sandpipers, too, are overly tame, so much so that we tried to reach out and capture them. The boys had no success with sticks and stones today. I saw no unusual specimens.

Observed one pecking at a yellow blossom and others feeding about the low shrubs and herbs. On this island were three terns, noddies in considerable numbers, lesser noddies rather scarce, and white terns in abundance. Obtained a few of each.

We ate lunch at the end of the island. The boys then returned with about thirty-five birds, while Curtis and I set sail on the port tack to the farther end of the lagoon. On a long uneventful course we reached the gap between the small islets adjoining Motu Tikatu and the long one half way towards Vainono. There we were forced to change our tack by one of those coral table-like reefs standing up out of the dark blue lagoon with the top just below the water. Several passed during the day had a considerable quantity of coral blocks washed up on them, and some had gravel banks accumulating in their center, - the beginnings of coral islets.

After a short tack we returned to find that we were still obliged to use an oar to clear the reef to windward. Ran into green water and tacked back again; had to put out an oar to pass that same reef to windward; took down and furled the staysail;

made a tack and again had to row past. Ran into shore shallows; furled the sail and commenced to row with both oars into the wind. While rowing, a frigate came within range, and although he was a youngster I shot him. Another flew over him in a harassing manner but did not remain until we arrived. In camp this evening I observed an old female harassing a younger bird until he ejected a fish - all this in the air - whereupon the old bird would swoop down and catch the falling morsel about ten or twenty meters below the other bird. This was repeated several times.

Shortly after killing the frigate above mentioned a common booby, S. leucogastra plotus, flew over us. We were both intent upon watching the islets astern because of the trouble holding the boat to windward; but I was able to get in a successful long shot. This is the second bird of this species observed within this lagoon.

At camp this evening (we made a clean run to the end of the lagoon when next we set sail) I saw three or four red-footed boobies. Here at Tikatu terns are plentiful; noddies and white very abundant; lesser more common than elsewhere; yellow-billed numerous off the end of islet adjoining and the sooty in flocks of as many as thirty headed towards Motu Huriri. Upon landing we unloaded and secured the boat on the sandy beach well above the high water mark, and then set up the balloon silk shelter. I put on my boots and started off to hunt. Whistling for the dog (who was playing with the multitudes of hermit crabs lining the beach) I was startled by the excited whistle of the cuckoo as he left a pandanus near our shelter and flew back into the

timber. I followed up but heard nothing more from him. Heard the same call I first heard in the vicinity of Lake Vaihiria, Tahiti, - a low-toned, doleful whistle. While I pondered upon it, it was repeated from the thick low brush near by. Ah ha! the rail! So I parked in an opening and conversed in rail noises at length. Darkness stopped me. Had heard at least three different birds but none of them ventured near the edge of the clearing.

May 23

Several heavy showers during the night, one of which came from the west and got under one end of our shelter; during another our floor canvas extended beyond the eaves and so conducted all the drippings into the depression that my body occupied. Otherwise a comfortable night.

Went back into the bush and sat around in the clearings at daylight this morning, looking for rail. Heard but one and saw none. Crossed the motu to ocean beach, a high wall of large, coarse coral blocks. The tide was so temptingly low that I walked across the dry reef shelf to the mounds of living coral at the verge. A pinkish coralline encrusts most of the upper portion of the reef and down as far as even this low tide permitted one to see. It was very interesting to see the long crevasses between the living mounds of coral, and to watch the puffs of water ejected by compression through almost closed pockets. Followed around the beach to end of the island. We camped on Teava motu, Tiahu being across a small channel from

us. Along the ridge of coral blocks above the reef shelf and well back from the beach line I came upon a cairn, crudely built of the neighboring stones. It was rectangular in shape but not true to form, being about 1.5 centimeters high, 2 meters wide and three meters long. A depression about the size of a small grave set me to excavating, but upon reaching beach level I found nothing. Returning to camp a cuckoo flushed but kept safely in amongst the pandanus branches. Returned for breakfast with no game.

After eating we packed up a lunch and rowed over to Tiahu. Off the seaward shore of this islet is a flock of about two hundred sooty terns flying about erratically. I thought for a while that they were nesting here, but from the actions of this flock I will be surprised to find them nesting anywhere. They strike me as being in a courtship or honeymoon flight. Here are more cairns of still more irregular shapes,--just heaps of loose boulders, though plainly enough man erected, with sunken cavities which might have been former vaults. This coarse shingle is very extensive along this southeast end of the island. The reef is three hundred meters or more from the timber line. A little vegetation is creeping out over the boulders. Along the high beach were some more cairns, one set of which appeared to be more recent than all others and had stones on end like head stones at about the proper interval for graves.

Passed again across the island without sign of sandpiper, dove or rail. So returned to Teava by boat and ate

dinner. I threw a lot of hermit crabs into the lagoon, the centrifugal force of the throw loosening them from their shells. A couple of sharks, gray-green in color with black tipped dorsal fins, passed along picking them up. Later I saw an octopus, so watched him swim a while, then fished him out with a stick. Of all uncanny feelings those suctional discs on one's arm are the limit!

After lunch I again essayed to catch rail. Came into bush and sat down, giving their trill and then continued Vaihiria calls. Soon got an answer but the bird refused to come near the edge of the brush from which he called. I walked around it and sat down in a pandanus tree. Again I called. After five minutes or so I saw something black move through the tangled bush and pause. Dead rail! (# 3444.) Evidently very similar to the Manoui (Mangareva) and Rapa bird. No more conversation here, so must move on. Started to follow along the island to farthest west end, but finding that the whole motu was composed of coarse blocks I decided few rail were to be found there, so returned to the region near camp. There I held prolonged conversations with at least a couple of rail. But the more I talked the farther into the dense bush they withdrew. At dusk I returned to camp, well pleased to have at least the one bird,--that's better than ten days at Moorea and Vaihiria.

May 24

No success with rail this morning, so skinned the other bird and then we struck out. Rowing soon grew tiresome so we

tackled tacking into the wind. Made such good time on the starboard tack that we kept delaying and sailing. At last by one of us rowing we made good headway until at the end of the brush where I got off to hunt. Went on to end of islet shooting a white tern and a curlew; the latter I left where I cut some coconuts. We then had a steady tack on the starboard until we rounded motu Kavika. Nowhere along here did I see any signs of the sooty terns' nesting site. Small flocks were about, from which I shot several birds which delayed us so long that we could barely make the land by dark. Made a move off to east end of Vaimuu and beached as it was impossible to see reefs towards the setting sun.

The boat had left just before dark as we arrived at the house. A hot bath and a good feed was very welcome. What a saving of time (and time is money on an expedition as expensive as this one) it would have been to have had an outboard motor for this boat! On the fifteenth we could have hunted twice as long. The following day I could have surveyed much more thoroughly twice as many islands and have been back at the boat in decent time. The seventeenth and succeeding three days we could have saved at least two full days. This three day trip would have been accomplished in two days, with more time spent hunting and less rowing and sailing. Three days saved! The expense of the ship for that length of time would have bought the best of the outboard motors. At Mangareva we would have saved as many days again.

How strange that on these largest islets not one dove or sandpiper was observed! Evidently they are confined to Motu Kaveka where we obtained so many in a few hours, very few having been noticed on other islands. This may be due in part to lack of food, the white berry being most abundant where the doves were found. The lack of sandpipers on the larger islets may be explained by wild house cats. Pollner says there are some here.

May 25

According to our usual luck, a high wind has arisen during the night directly from the islets we have yet to visit. Yesterday we had a head wind most of the time, with about twice as long a tack on the starboard.

Weight of frigate-bird 1.440 kilograms. The boat did not come ashore until one o'clock and then brought no provisions; so I went aboard after some and to talk over conditions. Mr. Beck decided the unvisited islets should be explored, so we took some provisions ashore and at three or shortly after Curtis and I struck out on the port tack. The wind was dead ahead. We made the south shore and then rowed into the wind until approaching darkness drove us ashore. We were forced to land upon one of the small islets in the vicinity of # 10, which I had visited on Wednesday, the seventeenth. We exerted ourselves to the utmost in a vain attempt to make a larger islet. The one we are on has nothing in the line of birds save a pair of white terns. Made camp where pandanus leaves were available for mattressing, a relief from coarse coral. Everything too wet to burn, so made

out on a cold supper, which wasn't bad, thanks to G. W. coffee!
Turned in to dry and warm blankets.

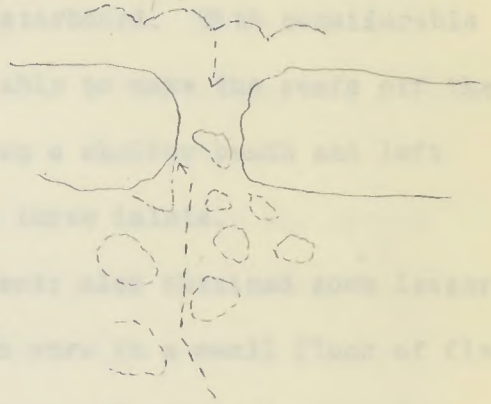
We have had our share of storms here at Marutea, and so far it has been my experience that bird hunting and plant collecting are dry weather jobs, unless one is fully equipped for continual storms. Lack of blotters will not permit us to collect plants that are wet. A few rainy days means mildewed specimens. Rutledge obtained some bichloride of mercury to paint his plants to prevent their mildewing, but we have not the time for that. I wonder if it works. As for birds during these rainy spells, one could be putting up a few terns perhaps, but we did not expect a second storm so soon and are consequently unprepared. In fact, I very foolishly left my tools, arsenic and cornmeal at the main island. Our equipment for working this Tuamotu is insufficient in boats. The Fan Fan is a fair-wind sail-boat and a calm row-boat. Having no keel to speak of, she simply refuses to make headway against a strong wind; and riding so high out of the water rowing into a stiff breeze is more than Curtis and I (neither being overly strong) can do. It is my opinion, however, that an outboard motor would successfully overcome even the stiff breeze we have today and would have landed us this afternoon at an island large enough to pay for a night's stop at least. If we are to survey every motu on all the Tuamotu atolls we have no time to spend trying to fight heavy breezes with oars. A row-boat at first thought seems much more inexpensive than a little motor, but when an expensive ship's time depends upon the

speed of the row-boat it becomes a rather expensive affair. The few days' time we would have gained at this one island would have paid the initial costs of an outboard motor.

May 26

The wind brought a heavy rain during the night,--not a squall but a long continued downpour, which continued on this morning with less rain but little abatement in the wind. Late in the morning we essayed to navigate the turbulent waters.

Last evening we had beached after a rather tortuous passage through some reefs on which the lagoon waves broke with a vengeance. We met a heavy current coming between the two islands from the sea, where enormous swells were breaking upon



the reef in great masses of spray. An eddy behind a sandspit carried us to the best landing, where we beached the boat with considerable effort.

This morning the current was flowing outward and the waves, still higher, were breaking like little furies upon the reef tables of the passage. With Curtis pulling two oars and myself facing ahead pushing one oar and steering we did succeed after half an hour of clearing the reefs. It was only the stimulant of impending doom that strengthened us sufficiently to make that much headway against the wind. At least an hour and a half

of rowing had kept us away from the reefs but had taken us nowhere except back down the shore two islets where we were forced to land.

May 27

Awakening about midnight I did not get off to sleep until shortly before daylight, and consequently overslept a little. But we got under way close to seven-thirty. The wind having died down considerably, we were able to make half a mile or so in less than an hour of rowing straight into it. Then we hoisted sail and made some long port tacks and one short starboard. With considerable rowing on the leeward side we were able to make the reefs off the third islet west of Tiaku. Landed on a shelter beach and left Curtis with the boat while I hunted three islets.

White and noddy terns present; also obtained some lesser noddy and some tattlers. The tattlers were in a small flock of five, two killed being in full summer plumage. Seems to be high time they were migrating. Saw three or four sandpipers on these islets and one dove. Heard nothing of rail. Saw no signs of shearwaters, although the islet Tiaku bears a shearwater name. (Thursday as we left shore I saw a blue shearwater, Bass Rocks species.) The dog was very busy with his nose and prowled about at considerable length amongst the brush and rubbish piles. Saw but one frigate-bird and one white reef heron. These islets have been cleared but are pretty well overgrown again.

Pollner informs me that this atoll was swept rather bare by the hurricane of 1906. Certainly it needs a great deal of replanting. It is unusual in comparison to the few other atolls

I have seen only in the numerous table reefs or coral knolls (though they are not knoll-shaped) in the lagoon. Many of them are about level with lowest low tide. On some, considerable blocks of coral have been broken off the edges of the shelf and piled upon the table. In a few, white gravel was seen. Channels connected to the ocean are very frequent and occasionally wide and rather too deep for comfortable wading. The shallow part of the lagoon nearest the motu is an intricate mass of coral tables which make landing with a boat rather dangerous. This lagoon is about nine miles long, but the low islets are little shelter and during heavy breezes a very choppy sea arises, when outside the ocean is not unusually troubled.

We had the wind on the starboard beam for the return journey and made splendid headway throughout the course, not once having to turn out for knolls, although some were passed closely enough. The sailors were awaiting us, so it took less than an hour to get the Fan Fan across the plantation and at the reef. Bijoe and I took her off with Curtis, Pollner and one of the Tuamotuans holding us in the notch. Made a clean and safe get-away, in spite of Bijoe's excited fumbling with the oars. The sea was not so overly high. The big boat remained to get a few coconuts, generous Pollner showering us with gifts to the last minute. It is good to meet hospitable people, but people who dwell so much in solitude cannot help being agreeable and overly kind to their few visitors. Mountaineers, desert rats, island overseers,--all are forced by circumstances to be

hospitable. In cities we see too much of our fellowmen and so fail to appreciate their companionship.

Today I saw some slabs of coral conglomerate very greatly hardened and resembling marble in appearance but not crystalline. A very hard limestone it was, however, much harder than the floor of the shelf extending from the reef to beach. The time required for calcareous sand and gravel to become agglutinated must be very short indeed, for frequently the beach will appear to be sandy, when only a thin superficial layer of sand covers the cemented stone beneath. The pounding of the lagoon surf seems to be somewhat effective in this work, while no doubt the hot tropical sun has its share of the task to perform. Where still heavier surfs strike, these hard slabs are found. The ones seen today were loose and resting upon the shelf which was dry, permitting me to pass dry-footed from one islet to another.

The Captain tells me that the coral knolls within this lagoon are nothing unusual and are to be expected in most lagoons. I always expected them, but near the shore. These stand up out of the dark blue water like flat surfaced mushrooms with irregular outlines. It will be interesting to check the conditions of the various lagoons navigated during this trip. Scilly was deep throughout and Mopelia also, in so far as I saw it. They did not have table-reefs along the shores like this one either.

A very striking feature of the reef surrounding Marutea is the number of blow-holes occurring on it. The sea surges into

the crevasses, which are often closed near their land end, with an open hole at the end. Up through this hole spray is forced by the air trapped beneath and compressed by the swell. Some I observed shooting spray more than twenty feet high. In nearly every case the blow-hole is surrounded by a mound of coral coated with corallines, similar in every respect to the formation at the verge of the reef. Naturally the spray keeps the living polypi and algae well aerated and sufficiently moist to offset the exposure of low tides, just as the breaking waves protect the verge of the reef.

May 28

In "College Zoology", Robert W. Hegner, Ph. D., The MacMillan Company, 1916: "John Murray believes that the island enclosed by the reef does not necessarily sink, but may be worn down by erosion." Unfortunately I have no detailed explanation of Murray's beliefs, but from all references it seems to "attempt to account for barriers and atolls without subsidence." ("Text-book of Geology", Pirsson and Schuchert, Part I, p. 188.) Grant to Murray and Agassiz their raised platforms; then we would expect a wall of coral from the lowest depth of coral growth two hundred and forty feet to the surface and below that the platform, which being formed by "lime deposits" would not be steep banked but sloping at the angle of deposit and rest of such materials beneath sea water influenced by currents and storms. Grant them for barrier reefs such volcanic islands as the Society Group (overlooking the four atolls of it); grant them

the present elevation: how will they explain the drowned valleys of Moorea, Cook's Bay, Papetoi, Vaiere, Putoa (Afareaitu), Aharoa, Ahutai, Vaianahe? The first two bays have the drainage from the 1sthr Opunho and Pahopaho valleys; why have they not been filled with sediment in a uniform manner? Even if the channel currents are capable of removing all detritus from the lagoons as rapidly as it is washed down from the mountains (which it does not seem to have accomplished about Tahiti where the fringe of habitable land was so formed) there will always be a grade level or peneplained land center to such an island, for under the protection of the outer barrier and the inner fringe of coral, wave action is reduced to a minimum.

Raiatea and Tahoa have more drowned valleys than Moorea, and Bora Bora with but one pass through the reef certainly should tend to fill its lagoon with sediment, for there the currents are greatly hampered by lack of passes. Maurua or Maupiti seems even more difficult to reconcile to any but the subsidence theory, for there the one pass is far removed at the open end of its horse-shoe shaped barrier reef.

In the matter of atolls, what prevents those without deep passes from filling entirely, and what explains the greater depth of the inner lagoons of others with passes than the passes themselves? Solvent power of the water alone could dig them deeper than the pass, yet they generally are much deeper. As for the solvent power of ocean water, it certainly would be strained to capacity in these lagoons. But the lagoons are not being cleared out in that manner, for, with the exception of the

coral-sand bottom, there is a protective coating of living corals, tunicates, sponges, mollusks, and corallines every bit as effective as that on the outer reef. These, too, are building up and certainly are not being dissolved down. The only place I have seen definite evidence of the solvent process is on tide flats where exposure to sunshine prevents the growth of protective coatings. Between the outer reef and the fringe of the lagoon such action occurs; and where the mechanical upbuilding does not offset it we find tidal flats or shelves submerged most of the time, but almost bared by the ebb of spring and neap tides. This is always lower than the verge of the outer reef where the dashing of spray saves the corals and corallines from the death blows of sunshine.

As for the lagoon,--no better examples can be found than Marutea and Oeno, where the tendency towards ultimate filling is already indicated. Oeno at first glance is somewhat of a puzzle; certainly it is a non-conformist. There are no reef islets, but evidently has been one on the west. At present there is a wooded islet in the west center of the lagoon and a sandy islet in the north center. This is very likely due to the submerged northern portion of the reef which admits rather heavy seas. These washed the sand into the present locations of the islets. The former islet is evidenced by remnants of the conglomerate shelf which frequently forms the base of atoll "motu". At Marutea the very numerous coral-tables (Darwin calls them "knolls" under the nautical definition of the work; but to land-

lubbers "knoll" connotes "a little round hill, a mound", so I prefer the term table-reef which gives a figurative idea of them) are certainly not being dissolved away. They are growing laterally more rapidly just beneath the low tide level, but species of slower growth are bolstering up the central pedestal and bracing the top board. The surface of the top is coated with coralline upon which the brilliant blue parrot-beaked fish seem to feed. Protruding corners of this top shelf or board are frequently broken off by storms, some being washed upon the table top, while no doubt many drop around the table legs and help fill up the lagoon. Scilly and Mopelia, to the best of my observations, had lagoons practically free of such obstructions. In the shallow regions, however, were half-dome mounds of living corals rising out of sandy bottoms.

Saw a small white-breasted shearwater this morning shortly after daylight,--very likely P. obscura, but identification was impossible in the early light.

At three P. M. we approach Maria. Seven frigate-birds are out to meet us and they are picking up something astern. They are mostly young birds. A white-breasted shearwater off in the distance is about the size of neglected.

Towards evening other neglected shearwaters were observed. We are eating today, as yesterday, the pig purchased at Marutea. Fresh meat certainly tastes delicious, but it holds out but a brief day or so. Obtained six gallons of lard from the fat, which will perhaps see us through the rest of this trip. A

kanaka cook certainly can use, or waste, a lot of grease.

May 29

A young common booby came up astern and landed amongst some rubbish thrown overboard early this morning. We are very slow in getting up to the island. I am equipped to remain ashore over nights, which should be done at every island for rail and shearwaters. Can see several frigate-birds about the island. Large boulders are strewn along this northern shore, which is not so heavily timbered as the eastern and southern.

It was well past nine before we decided upon a landing place. Curtis and Bijoe are on the hospital list, the latter with several ugly boils on arms and legs. He has been bothered with them most of the journey. Curtis is laid up with some severe coral cuts about his ankle and instep. So our boat crew consisted of Teiho and Jeminy with Charlie on one oar. We found a good notch for landing in spite of the lowness of the tide. As we left the boat two yellow-billed terns came by. I obtained them both but missed a little blue ternlet. Noddies and white terns abundant as usual. Redfooted boobies and frigates about in fair numbers; esquadrilles of the latter are soaring in battle array above us. Our first land greeting was by a pair of sandpipers. They appear to be similar to those at Marutea and Mangareva, but I collected eight to be certain. They are not overly abundant since my visits to Motu Kaveka, S. Marutea, but compared with other places they are at least rather plentiful.

I wagered a dinner with the Captain that I'd find a rail here; so I'm searching thoroughly through rail territory. Shot a white-bodied redfoot booby. The shot flushed a new bird to our expedition,--a dark body with white throat and parts of the head. I wasn't going to let that bird escape, so shot it a little too close. The major portion of the body, abdomen, back, tail and wings is a purplish black; upper wing coverts brilliantly bronzed; cap, bluish gray; eyes brown; bill black; legs, purplish black. At last the ground pigeon, Gallicolumba sp., has been found. That adds new life to the whole trip, for here is a new bird to hunt and observe. I found them in the white-berried shrubs which are very dense and about knee high, or a little better. A second one flushed but did not get far enough away for the large shell. Following it up, I again flushed it and fired with the auxiliary at close range. The bird dropped upon its back. When picked up it was apparently uninjured. We have kept it alive to add to our aviary, which includes the Henderson Island parakeet and a Marutea dove already. The Tuamotuans at Marutea gave the Captain one for some tobacco. One sailor told us as we left that they had five other living birds. They had said nothing to us about them.

Twice today I heard the cuckoo, but could not see him in the tree branches above me. While calling him the second time I heard a flutter of wings behind me but could see nothing until I started to leave, when a ground dove flitted from one to another tree branch. The first auxiliary failed to injure

it. Startled, it flew about the tree and came back to a nearer branch, from which the next auxiliary, after a delayed change of cartridges, killed it. At camp the boys had a neglected shearwater and broken egg. I had seen a few flying about, but had only obtained one of the blue or Bass Rocks birds. Also shot another redfoot booby. In the excitement of the pigeons I had forgotten the one I killed before. Knocked a second out of the air with gun barrel, and a third from a tree branch with a rock. Killed a male frigate.

For lunch we had the so-called "lobsters", a prawn of these sea waters, baked over hot coals. Natives also had a red-tailed tropic-bird; also had one for a specimen. I have come into the dense pandanus jungle and listened half an hour for rail. No sound or sign! The ground is very damp and brush is plentiful. I plunge through the jungle towards the lagoon; then again wade through the knee-to-hip shrubs in searching for ground pigeons. Had gone considerable distance before one flushed. It gained the shelter of a tree before I could fire. I followed in the direction it had flown to try flushing it a second time. Had about given up when the dog raised it. Flying a few meters, it perched upon a low branch of a small tree. I had to walk around so as to avoid shooting it in the breast. It remained so quiet while I moved that I decided to close in and use the auxiliary. I shot it through the wings from about ten meters. The dog pounced upon it until I reached him. The next one flushed and flew straight from me. I either failed to hurt it or else

merely winged it. The dog could not find it where I saw it plunge into the low bushes. It did not rise one meter above the bushes during its flight. Most of the others flew about two meters above the shrubs.

The next bird was a startling surprise, for it fluttered from a branch of a small tree very near my head to another branch not two meters distant. It remained very quiet, looking at me curiously as I backed away sufficiently to avoid injuring it. This one was in the broad leaved, white flowered, nut fruited tree common on these atolls. The white feathers of its throat were stained by some fruit.

I proceeded on through the bush until I reached a small channel cutting across the land from lagoon to reef. Here the sandpipers again became numerous. They are present nearly everywhere save in the dense woods, but are most abundant where stretches of bare gravel are to be found. Here also I killed a grayish feathered, red-footed booby. Later obtained a clean specimen of the white body phase plumage, and a young bird in a very dark phase. The prevailing phase is the gray body with white tail. Have not come upon any nesting birds yet.

Here, also, I killed a curlew; and later while returning along the lagoon beach a flock of five birds came up from behind me. I was able to get only two of them, although I winged four of the five. Calling while reloading brought back the surviving three, and one alighted within range. Is it not high time that they were on their way to Alaska if they arrive

there in June?

Saw a dove twice here but did not get a shot at him. Following his direction, I came upon one perched on a low limb of the same broad leaved, white flowered, nut fruited tree. While creeping up on him for an auxiliary shot I saw that he was pecking at the ripe fruit. Winged him and then had a job chasing him up for a second shot. They certainly are at home running along the ground. This one was also stained about the throat, and freshly too. The color of the stain corresponds to the color of this ripe fruit. While after this bird I thought I heard a rail whistle. Returned to the spot but could get no reply to my calls.

Rather late in the evening a squadron of thirteen frigate-birds were seen. There was just the proper wind blowing today for perfect soaring. Saw but one neglected shearwater about dusk. No unusual noises in the late evening.

May 30

Broad daylight prevailed when I awoke after a sound sleep, in spite of heavy showers during the night. Left a note saying I had started to walk around the atoll, which will entail some wading of small channels. At the channel where I turned back last evening I found a pair of blue-faced boobies. Obtained both of them with but one severe bite on fingers. Left them hanging in a tree near place of capture. They were standing in domestic peace and affectionate proximity in a small clearing on bare sand, preening their feathers after the night's rains. Fish are

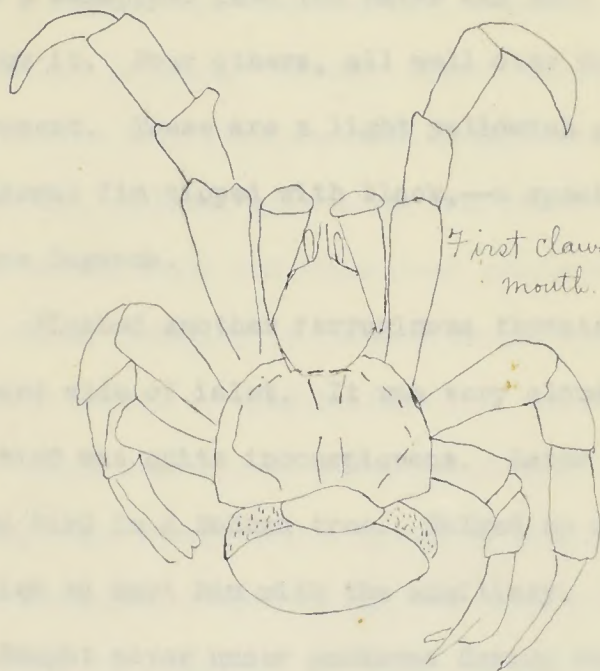
abundant about here, so they do not have to go to sea at dawn. Many red-footed boobies were flying about, mostly the common gray, white-tailed types. While I was killing the two boobies no less than four sandpipers were within five meters of me. One came as near as one meter.

Across the channel I entered a pandanus forest of good tall trees six to eight meters, with clear leaf-covered floor. On the pandanus leaves stood a ground pigeon, which differs from the six previously obtained in that no white appears upon it. Throat, breast and abdomen are a light, ferruginous brown; legs purplish. It was very gentle and remained perfectly motionless until I inserted the auxiliary and then permitted me to get within two meters of it. I paused, whereupon the bird came up to within one meter - an easy victim for a cat at that range. When I tried to get closer it slowly and steadily departed, walking as naturally as any gallinaceous fowl over the pandanus leaves. Have found no more in the heart of the forest. Heard one cuckoo at two different places, or else two birds. Could not see him. Of all birds this is the most difficult to locate, his brown speckled plumage being the most effective camouflage imaginable.

Here are vast numbers of crabs, usually called the "coco-nut crabs". Here they appear to live chiefly upon pandanus burs, which also afford food for the hermit crabs, also very abundant here. (See sketch on following page.)

Here are ten sandpipers within three meters of me. I suck my hand and they come as close as one meter. The color here is very uniform, and no albino feathers noticeable as at Marutea.

On the Tohunu tree branches low over head. some stand piping at us. All ten are now upon the ground ahead of me. Twelve now, and all in a space not more than two square meters in extent. They have a variety of calls from one resembling a young chicken, only softer, to a hilarious trilling note usually made while flying. The piping is the most characteristic and commonest call.



First claws held back under mouth. Left larger.

I just passed a rookery of frigate-birds where young and eggs occurred in numbers. Counted forty-five birds in the flock overhead, with many on nests at the time. Did no collecting until Beck has a chance to photograph them. Blue-faced boobies have been observed nesting all along the lagoon beach

south of lagoon. Red-footed boobies flying about but not overly numerous. Saw one yellow-billed tern today. Obtained only lesser noddy seen on this island. Saw two solitary golden plover, one of which I was able to call within shooting range twice. Missed both shots. I obtained one of two tattlers heard, calling him within auxiliary range. These migratory birds are much easier called at this season than at any other time of the year. Along the beach I threw a sandpiper into the water and shot the shark which tried to devour it. Four others, all well over four feet in length, were present. These are a light yellowish green color with the first dorsal fin tipped with black,--a species very common throughout these lagoons.

Flushed another ferruginous throated pigeon in low brush on seaward side of islet. It was very cloudy at the time and the flying bird was quite inconspicuous. Later I came upon a white-throated bird in a Tohunu tree. Walked up until within range, but failed to hurt him with the auxiliary. Saw no more for some time. Sought cover under pandanus during heavy shower. The third ferruginous throated bird seen flushed from bare ground amongst Tohunu trees, alighting on nearby branch. Auxiliary did not injure her (I am convinced these are the females), but # 10 shot brought her out of the air as she flew away.

All but two of the sandpipers have followed the dog away from me. I followed through a stretch of rather open woods - Tohunu pandanus, sage-like and broad-leaved trees with patches of shrub including the white berries. In this the next two

pigeons, first a male and then another female, flushed from the ground. Both alighted on low Tohunu tree branches and both permitted me to approach as near as I wished. More than half a dozen sandpipers have been following all through here and are now piping around the dog and me. Here, also, have struck a group of noddy terns. White terns have been about as common all along the island. Nothing out of ordinary.

I had to wade two channels from sea to lagoon, once being obliged to change shoes. Beyond the second of them vegetation existed only in clumps and consisted of the hardier pioneer species,--Tohunu, sage-like, and occasional pandanus, with a low spreading shrub and occasional grass tufts. This portion of the island, however, is barren, loose blocks of coral with little fine gravel or sand amongst it. It is along the southwest and shows evidence of being frequently washed over. Here occur many huge blocks, five by ten by two meters and over. They are weathered considerably, but look to me to have been torn up from the verge of the reef. What a tremendous sea it must have been to tear loose and transport those many ton boulders so far!

Of chief interest along here were the nesting frigates. I counted flocks of from thirty to fifty in several instances. They have their nests on the low shrubs. I did not bother any lest we decide to photograph them. Blue-faced boobies were not so frequently met with along here, though some of them were nesting in favorable spots. Here, also, were found a few nesting

red-tailed tropic-birds. As I was fording the last channel a little blue ternlet flew past me. Lesser noddies were more abundant there than elsewhere. Seeing the upper portion of a rainbow I decided that it must be about three o'clock (John Burroughs claims rainbows are not observed between nine A. M. and three P. M.), so hastened back to camp. There were a few sandpipers along this stretch. Saw one or two reef herons during the day, but was not able to get any. Saw but three neglected shearwaters and only had long shots at two of them.

At the boat this evening I saw a blue shearwater. At camp I found everything as I had left it. Ate lunch and changed shoes, for my off boot is wide open from toe to instep. Charlie arrived while I ate, saying the boat was down at first channel, where I had left the two blue-faced boobies this morning. We carried birds down there. I helped launch the boat. It seems they were washed back ashore twice yesterday evening. Made a clean get-away this time. The boys had spent the day fishing and cutting wood and had the boat well filled with both. I returned to camp through the woods along the seashore. Heard a cuckoo and obtained one male pigeon. He flushed from shrubbery in small park and alighted on tree branch nearby. I blew a female all to pieces after the third ford where I had loaded for two curlew I had heard and subsequently forgot about the change. So during my entire trip around the island I saw but seven pigeon - two only escaped. I do not think them very plentiful, yet I am fully aware of the fact that I see only those I chance to flush. There may be many more than I imagine

in woods and brush. Had the claws of a coconut crab for dinner.

May 31

My bed on Tohunu leaves is not very comfortable, hence a tendency to sleep uneasily until early morning when soundness makes up for lost sleep and usually intrudes upon daylight. Strung the lantern to topmost boughs of the tall dead Tohunu tree above my camp after reading. I could see this tree yesterday from all angles, so have little doubt the ship could make out the beacon. The watch always feel more comfortable if they can see a light on the land.

This morning I wandered back and forth across the motu from camp to the landing channel without seeing any sign of a pigeon. Heard a cuckoo give his sharp shrill whistle of departure. Followed in the direction he took; it is but seldom one can get a shot at them flying, so closely do they follow the dense branches. I called for half an hour with him occasionally answering from the tree branches overhead. They are the most difficult birds to detect of all the South Sea inhabitants. But later on, across the channel, in the pandanus woods where I obtained the first female pigeon (page 46) I sat down to give a little jungle speech. Seeing a cuckoo feather on the root beside me I commenced my discourse with three sharp whistles, with the lower lip held tightly against the teeth and upper teeth protruding over the lower. From the branches overhead came an answer; but I simply cannot make out the camouflaged

bird. We converse at length. Now a third party butts in from some nearby trees. He can hardly make himself heard at that distance, or else doesn't know the topic of discussion, so flies in close, alighting in the safety zone - too far for the auxiliary and too near for shell - on a pandanus branch below all leaves. He soon discerns the party of the first part in the case and leaves for the shelter of a broad-leaved tree. The hunter remaining quiet has always the best chance to find wary game. A little calling brings him out from behind the protecting leaves and he is mine. This is the first one I have killed since I left the Leeward Islands, and but the second obtained on this journey, though we have heard them at nearly all the islands visited.

No signs of pigeons in here. I have obtained a few lizards by shooting. The coconut crabs abound in these pandanus woods. Three of them approached to investigate our persons while we sat here writing notes. Just before entering the woods I shot a blue shearwater which was flying about the island. The morning had passed without a pigeon. I heard a shot and a shout, so knew the boat was in. Went over to landing and flushed a male pigeon as I left the woods. He alighted in a nearby broad-leaved tree. Changed shoes to a small tight pair of dress shoes I had Charlie hobnail and bring ashore as a last resort. They hurt awfully.

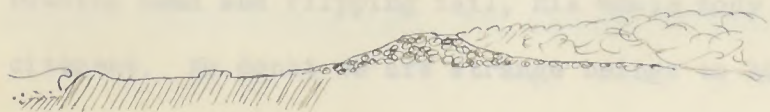
Expecting Beck to go along lagoon shore to the left where I had directed him to find blue-faced boobies and frigate-

birds nesting, I followed in that direction. Flushed a female dove and winged her just as she left the clearing. Found another male a little farther on. They seem to be amongst the low bush rather than in the higher woods. Beyond the pandanus woods I flushed another female and got her out of the air; these may, of course, be juvenile plumage as well as females. One more male and some sandpipers were all I obtained during rest of early afternoon. Did not find Beck whose shooting I could now hear back towards camp.

Returned to boat about three-thirty. They arrived soon after, having moved my camp up to this point by the channel. They had obtained two pigeons in the low bush across channel where I had spent the early morning. I sent aboard ten pairs of crab claws. They had about that many sea prawn. Beck told me the pigeons' crops were filled with a green leaf in one or two cases.

In the evening I hunted through the low bush between channel and tall pandanus woods. Came upon a female pigeon eating green leaves, the plant also eaten by the native Polynesians as a salad. It is a bitter green but serves its purpose well where other green foods are lacking. The auxiliary failed to kill the pigeon, which escaped.

June 1



The grading of the tops of the vegetation across the channel, culminating in the tall pandanus woods, is very noticeable. From the windward seashore low sturdy shrubs grade into taller and taller trees. The actual line is every bit as even and regular as the sketch on the preceding page. The red-footed boobies commenced leaving roost at daybreak and continued for over an hour and a half. Very few stragglers about as late as six-thirty.

I go first to the open glades where the purslane (?) grows and there flush a female pigeon. It is into the bush before I can shoot. Following in that direction I stand looking about, but see nothing. I watch the dog stand looking intently into a tree. I follow his gaze and there discover a male pigeon. The auxiliary wings him and I have a job running him down. The wing is broken too near the body to save the bird. In the next tree I see a female. I close in upon her and fire an auxiliary from rear, not three meters away. No effect and trees too thick for a wing shot. These auxiliaries are from a freshly opened box and are very weak.

Proceeding cautiously and quietly through the open edge of the woods we next come upon a male pigeon walking about the open forest floor. Pandanus leaves and a burred vine form patches of carpet. We freeze and watch the bird: he scratches his head once or twice with his claw; walks about a little indifferently; observes us and gives us his entire attention, with bobbing head and flipping tail, his whole body aquiver with excitement. No doubt we are strange beings to him. I make various

noises but cannot induce him to reply in any manner. As yet I have heard no noise that could be attributed to these birds. They are rather perky little fellows, bearing themselves very well in an upright bold manner. This one, however, has his boiled front badly soiled. He isn't very careful at table. Here are about ten of the coconut crabs of various sizes, not to mention the ever numerous hermit crabs.

Emerging from the woods into the strip of open parks we went quite a distance before coming across the next pigeon, once more a male; his bib and tucker is not so soup stained as most. He was perched upon a clump of low coarse shrubs. His jerkiness foretold a nervous disposition, so I decided to take him without delay. A sputtering auxiliary let him escape through bushes too thick for a wing shot. Following his direction about one hundred meters we again flushed him. He perched on the branch of a Tohunu - dead and leafless. This time the auxiliary was deadly effective. As I write, a perky little sandpiper walks back and forth along that same dead limb less than one meter above the dog and little farther from me, piping continuously. He went off with another in an ecstasy of joy, fluttering and piping in sharp staccato notes.

On to the half-way channels, two high water cross cuts not quite half way around island. Here decided upon returning. Came upon a pair of blue-faced boobies nesting, one upon the two well incubated eggs, one feathered chick and the other well advanced. It is a long haul, but decided to take in the pair in

preference to single birds. While killing them I stoned a sandpiper and was able to run him down not badly hurt. This one will not escape, for I have him securely in a shell box. Had not gone far on return journey when a female pigeon was flushed. Seeing she did not intend to fly far, I let her alight while I changed to the auxiliary. One should carry a three barreled gun. Then I deliberately pulled the wrong trigger and blew her to atoms. Twice this week have I done that foolish, inexcusable trick. It makes me damnably mad at myself, because I invariably select some valuable specimen to perform it upon. A white reef-heron out above the lagoon has evidently seen me.

Have hermit crabs an olfactory sense organ? I do not know from study, but I have often suspicioned it from my observations afield. While I sat here eating my lunch of Van Camp's pork and beans, oil sardines, butter and hardtack, with a lime and an orange, two hermit crabs arrived from leeward and are now feeding themselves from the tins. One meter to leeward comes the third, and a meter beyond the fourth. I watched these two come from the shade of shrubs four meters to leeward. Three meters across the wind is one going away from me. Had sight attracted these four that one, too, should have come over.

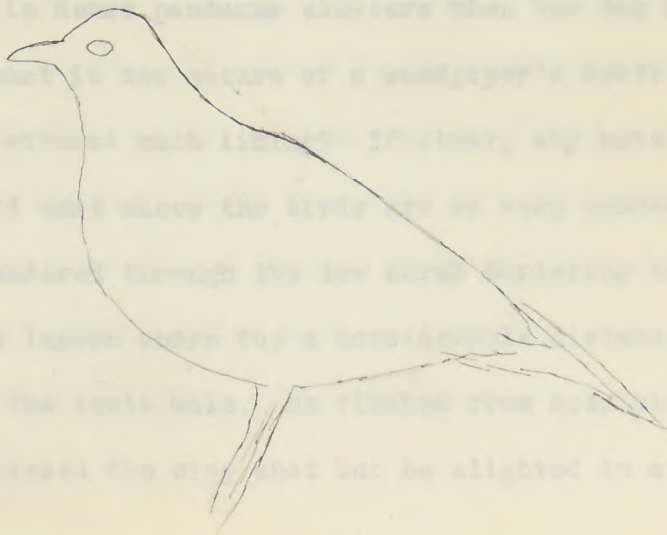
Returned to boat landing without seeing any bird save the common sandpipers and white terns. Ate an orange and returned to the haunts of the pigeon. From the results of my four days here I would say that the middle of the day is a poor time for the hunting of ground pigeons. Most of the ones obtained were

taken before ten and after three o'clock. I have little doubt that they shade up during the hottest hours of the day. Sea birds, likewise, are scarce during the hot hours. They, however, seem to be at sea then.

The boat is coming ashore now, so I'll return and see what their plans are. May hold them late for some sea birds.

Mr. Beck off to photograph; Charlie hunting pigeons; the natives gathering wood and crabs. The afternoon was entirely unproductive so far as I was concerned. Mr. Beck obtained one female pigeon. I plunged through brush all day and was rather weary of it. Obtained one young white tern with a long stick, killing it outright. Sea birds did not come in until after the boat had left.

In the evening I again walked around the pandanus woods but obtained no pigeons. Two rats, however, were shot; also a white booby which was too bloody to save. The boobies return to roost not much before sunset and mostly just after it is too dark for shooting. Frigate-birds seem to wait until after darkness falls in many cases.



June 2

Up and away this morning with the sun, but even that was too late for good booby hunting, no all white-bodied birds being obtained. The shooting roused two curlews, both of which I was able to call within shooting range. On through the brush until I noted the dog on a hot scent. Sitting down, I was soon surprised to look behind me and see a male pigeon. The dog ended his nose work by coming up the trail as the pigeon had come from behind some brush. I tried to sketch the bearing of the bird but didn't get any satisfactory results. This makes the eighth male I have found between this new camp and the old one. Where are all the females?

Less than a hundred steps from where I last wrote I came upon the ninth male perched upon the low green shrubs beneath open pandanus. He flew to a limb above and let me get around in rear of him for the shot. But where are the females? I am hoping that the dog will nose out a nest. Some of them may be nesting, according to their organs, says Beck. What is the nature of their nest? I am watching in every imaginable place, even in dense pandanus clusters when the dog noses about them. And what is the nature of a sandpiper's nest? Is it on bare ground without much lining? If other, why have I not come across an old nest where the birds are so very numerous?

Meandered through the low shrub bordering the taller woods on the lagoon shore for a considerable distance before coming upon the tenth male. He flushed from open clumps of low shrubs. I missed the wing shot but he alighted in a branch of a

pandanus soon after I fired. The dog was below him at the time. Still he permitted me to approach to within easy auxiliary range. The auxiliary barely sputtered, but did wing the bird. The break was too near body to save the bird alive. Once again, I wonder where are the females?

To the old camp where I had to get straps and cord used to tie lantern in tree top, and back half way ere next pigeon, a female which escaped, was flushed. Very sultry and the dog is panting awfully, so I did not expect him to work; but he got a fresh scent and went into the brush, flushing the bird. A clear field and a beautiful shot. The hammer spring Louis made is not strong enough. I'll carry the large shell in the other barrel hereafter. We follow up the direction. The brush was too thick for the dog to keep within sight of her. I forgot to search the bush for a nest. Wonder if the dog will relocate it for me.

We start back. Rounding a clump of pandanus a female bird flushes and quickly flits behind the cover of the trees. The dog follows up and I follow the dog. Neither of ^{us} locates her. We go on over to the place of first flush; the dog noses around a little but the sunshine drives him to sheltering shade. We again take up our journey, passing in the direction last taken by the female pigeon. At my very feet as I pass between a pandanus and Tohunu tree is a flutter of brown, then silence! I stand and look about, seeing nothing. The dog comes up and noses about the ground. I start on in the direction I supposed she had

taken. The dog remained in the shade of the pandanus. I turn back to call him. Seeing him gazing intently into the Tohumu tree I return and find the pigeon perched on a limb about three meters from where she had flushed. The dog is doing splendidly today. Well, there had to be females somewhere. The next occurs not very much farther. I wouldn't be surprised if the lack of white on them had something to do with my not seeing them. Perched on a lower limb of a tree they are decidedly inconspicuous. Upon the ground, also, they are much more difficult to see than the males. I have seen several males before flushing, but only one female. Tried some white terns but they were too bloody.

Returned to camp, more for water than lunch, but ate while there. Upon arriving I saw a curlew leaving vicinity of camp and going towards sea. He seemed to be carrying one wing loosely, but when I shot he flew off a short way. I ran him down and found the wing to be an old break; it was very likely the bird I could not find last Monday evening. Leaving camp to hunt again, for the ship is far out to leeward, I came upon a red-footed booby perched in a tree near camp. Brought him out of the air with a stone. Although not particularly desirable, yet because of his clean condition I'll send him in.

We have penetrated the jungle to about the place where the first two males (8 and 9) were taken this morning and are trying some still hunting. Lizards are quite plentiful in the dead pandanus leaves but I have not more than a dozen auxiliaries

here so cannot waste many on them. A young white tern just lit on a horizontal pandanus limb. The old birds are flying about above. One carries a small fish crosswise in her bill. She alights beside the young bird, which approaches her and eagerly takes the fish. It then mouths (or bills) the fish until the head gets inside the base of the bill, when down it goes! The white tern is the only tern I have observed carrying fish openly. After feeding the young one the parent bird takes wing almost immediately. The young fellow takes life easy for about five minutes, then joins the old birds which are fluttering excitedly above us.

We perambulate at length through the woods, still hunting and hunting still for pigeons. Along the outskirts of the woods where we amuse ourselves by trying to shoot white terns without getting a drop of blood on the breasts. A couple of sandpipers are following us up from shrub bough to tree top, perching to pipe at us as we pass; then fly past us to a new perch, still piping as they fly. There is a little blue ternlet! Bang! a clean miss and the auxiliary in the other barrel. No time to pull a black-Selby loaded # 10; so I insert a # 6 in the choke barrel and take a long chance. What luck! The bird is winged!

The men arrive, having landed at the old camp, and will move me back there. I plan another trip to the farther end of the island for tonight and the morning. Carried camp back to old site and cooked dinner. Packed light, and as the boys left

I struck out for the farther end, via west shore of atoll. Shot four neglected shearwaters and got them down to the boat before it left. Along the west shore (which is low and flat and evidently washed over in storms, with only a few clumps of low shrubs and Tohunu growing on the higher portions near lagoon) I killed eight more neglected shearwaters and one little blue ternlet (another extremely long shot at sixty-three paces) before dark. The shearwaters are nesting along here. We found one pair beneath a low bush and another bird on an old egg.

Made camp under Tohunu tree in preference to crossing channel. Leaves below and a light canvas above. A gorgeous moonlight night. Sandpipers about even in the moonlight. Certainly they are the very extremists of curiosity.

June 3

Little sleep last night. Wild dreams and uncomfortable coral rocks interrupted all attempts at slumber. At daylight a shower forced me to arise. Waded across the channel before putting on shoes. While performing that duty three tattlers got into line. I obtained but one in summer plumage. The dog retrieved it. A white, and later a blue heron along the flat beyond. Neither would let me approach within range. A neglected shearwater came by, which the dog retrieved also. He starts the morning splendidly, later locating a nesting neglected shearwater. Egg rather well incubated. From the colony of frigates

flying overhead I selected two desirable looking birds. Shot a white plumaged red-foot booby as she passed. Meandered back and forth through region between here and next channel, searching for doves. The dog works like a thorough-bred today for sure. He notified me of the presence of three pigeons. It was especially interesting to watch him sniffing carefully of the purslane plant they eat. (It tastes like pepper-cress.) Obtained two males and one female. Saw and shot twice at another male, but auxiliary was ineffective and trees prevented wing shooting. Killed a blue-faced booby on nest; collected eggs, though they may be too old. I start back with twenty birds and hope to pick up five more and reach ship by eleven. One more pigeon escaped from the ineffective auxiliary shells.

The dog got some hot scents on return trip, but we found no birds. After gathering my first cache and killing another blue-faced booby from nest and two red-tailed tropic-birds beneath trees (but without eggs) I had all the load I wished to carry. The tropic-birds are not overly abundant here - perhaps two or three dozen on the entire island. Frigate-birds were in flocks of thirty or more, soaring above me as I returned down the beach. Saw three blue reef-herons but was unable to approach within range on account of the level flatness and width of the beach along here, with no trees to afford cover. At the boulders, opposite which I had cached the shearwaters killed last evening, I awaited the arrival of Teiho. He carried the birds to boat from there.

For about a mile along this northwest shore are strewn these huge boulders of coral. From all appearances they have been raised by some terrific storm from the face of the reef and transported, frequently more than one hundred meters inland. This whole stretch of shore bears evidence of having been swept by just such a storm. It hardly rises a meter above high tide level in any place where gravel very coarse and consisting of angular pebbles has been heaped in cross veins. Adjoining the channels the pebbles are well rounded off, revealing ages of being washed to and fro. Beneath this layer of gravel, which extends from the lagoon shore somewhat less than half the distance to the reef, is a solid platform of cemented conglomerate which nearest the reef appears to be of the same form and contents as the great boulders. Nearer the gravel, the conglomerate appears to have embedded in it such material as now composes the bank above. Here walking was best, owing to the soft silt which covers the rough pavement, and which no doubt aids the cementing of the conglomerate below to the contiguous gravel above. Stopped at camp for lunch and then went after food for our two living ground pigeons and the green dove.

The Henderson parakeet lives almost entirely upon sugar solution; and the green dove has joined it in that luxury in preference to drinking water. The dove and parakeet are very friendly, the latter after his lonesome trip from Henderson being ready to associate with any agreeable bird. He has made himself very friendly from the beginning. The sandpiper worried

itself sick, flying about and continuously piping; he died last night or this morning. The first ground pigeon when placed in the large cave became the victim of the green dove's anger. A severe pecking on the back of the head and the loss of several feathers resulted in the Gallicolumba being removed to a smaller pen, where a bird winged by Mr. Beck was placed for company. They have been added to the large cage now and numbers seem to have put fear into the boldness of Ptilopus. I tried to get a female ground dove but had enough trouble getting dead specimens of that sex. We suspect them of nesting, by appearance of some organs. I searched in vain for nests. Mr. Beck saw two nests very similar to the nest collected at Marutea, which almost eliminates that being the Ptilopus dove's nest, and makes us suspect its being the sandpiper's. I wonder if these Gallicolumba nest on the ground, where I searched in vain. It would surprise me if they could successfully nest on the ground with the large coconut crabs ('u'a hâare) present in such numbers. I listened intently here for rail but heard none.

We made a good launching off the reef, but almost got beneath the bow of the ship when she came upon us. The old bow looks fearfully big as the waves raise her up above a small boat. With Louis working well we got out more than twenty birds after three o'clock. I spent considerable time upon my largest bird - a blue-faced booby. The pigeons are more tender than green doves and just as fat.

BOOK XXVIII

Voyage of the 'France'

from Maria

to

Actaeon Group

(Maturei Vavao, Tenararo, Vahanga, Tenarunga.)

Tureia, Vanavana.

June 4--24, 1922.

 June 4

We arrived off Maturei Vavao early this morning.

Some heavy patches of atoll woods noted, but apparently on motu or islets somewhat separated by shallow lagoon channels. It would greatly facilitate matters if one could walk freely from one islet to another. Wading through the salt water is exceedingly severe on shoes; perhaps 'tis time to put to use the gum-boots brought from America, but they are rather heavy

to carry along on a long trip.

On page 259, Volume XXI, May-June 1921, "Natural History" is a "View of the Seracs" of Llewellyn Glacier by L. C. Read. The picture so greatly reminds me of that portion of Henderson Island which I tried in vain to adequately describe that I feel justified in giving it a few more lines here. Coral-seracs would be a fitting term for them, but they far excel the ice pinnacles bearing that name as here pictured and any I met with on the little glacier below the Grand Teton, Wyoming. The coral-seracs are more sharply pointed and the sides of the pinnacles are honeycombed and serrated by irregularities and cavities with sharp cutting edges. I really do not expect to find anything quite so bad in the world. Imagination cannot picture anything more tantalizing as obstacles to progress than that coral-serac when combined with tangled vines, some of which possessed recurved thorns. As to thorns and jungle it may be excellent, but for paving stones suitable for the highway to hell Henderson Island can hardly be equalled. Mr. Beck tells me that I will very likely have the pleasure of visiting her sister raised atoll at Makatea while he overhauls our schooner at the end of this voyage.

Speaking of the voyage's end, the sailors are singing already in anticipation of that event. Well, we too are beginning to figure on which of these atolls it will be best to leave for a future journey. We are laid-to tonight off the first of the Actaeon group. Thence, perhaps, we proceed to Cadmus; thence to the Duke of Gloucester group, one other, and then Tahiti. Can

we work them all thoroughly? There is considerable wagering, but not much money, as to what birds we will find here. I bank on my old friend Porzanoiidea to square my bet with the Captain. The sooty tern is heard above the ship this evening; also a few red-footed boobies seen. The woods on the motu appear to be fairly dense where they exist. We are very anxious to get more of the cuckoo here since the two we have from this region appear to have longer bills than those of the Society and Austral Islands.

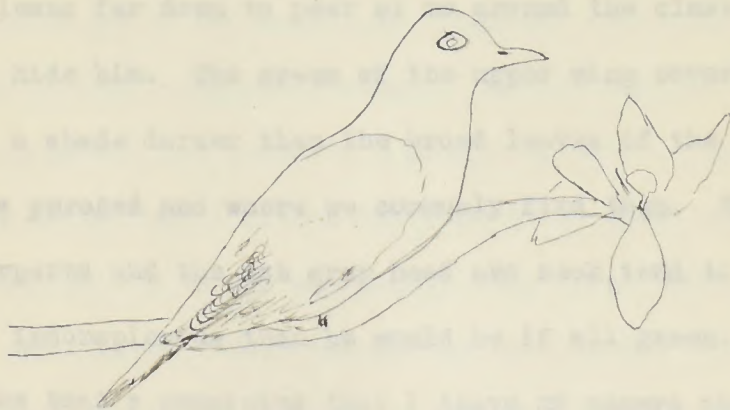
June 5

We did not land until about eight-thirty this morning. Mr. Beck came ashore too. While changing our boots I heard a green dove calling, not to mention about ten sandpipers around us as we dressed. I shot a male frigate, a few being observed flying above this portion of the island. Where we deposited my camp I killed three red-footed boobies, and later Teiho caught as many off the trees where they are in pairs. Some were observed building nests, but neither eggs nor young were seen. The sandpipers here are almost as numerous as on Motu Kaveka of Marutea and this motu is much longer than that one. Teiho was the first to see a dove and called me to him to shoot it. We walked along the motu at a good distance apart, and in a few hours (it is barely eleven as we stop to cook crabs for lunch) we have fourteen doves. Heard two cuckoo but could not get a shot at either. Teiho saw one. We found the doves

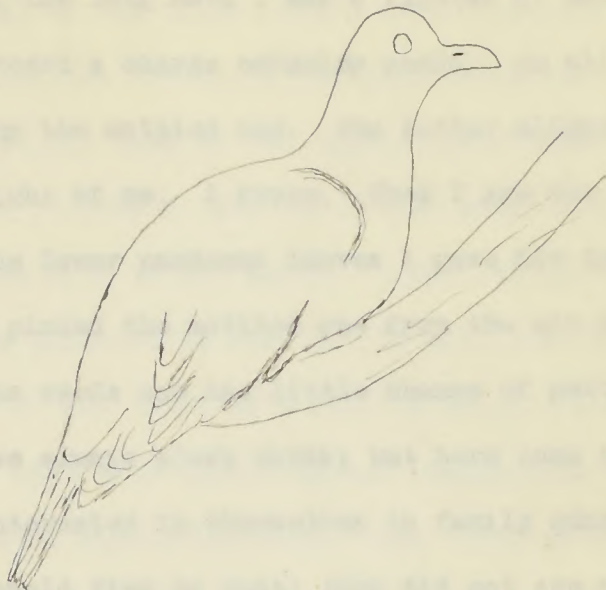
for the most part in the lower branches of the broad-leaved tree, and occasionally flushed one from the white-berried low shrub. Came upon one pair of blue-faced boobies but was unable to run them down. Teiho and I walked on until we had seventeen doves. He has exceedingly sharp eyes and saw many that I would have missed.

We came upon half a dozen coconut crabs and stopped to lunch upon them. Having brought some lemons along we made out well. The only food in the abdomen has a fair taste but one cannot eat much of it; claw muscles suit me.

Following is a sketch of Ptilopus coralensis. The body isn't so bad, though the head is rotten. He has permitted my approaching within two meters of him, but says that is my limit. Bijoe obtained one fairly uninjured and Mr. Beck a wounded one. The neck and shoulder feathers cover the proximal portion of wing more than my sketch shows. The primaries and secondaries are not covered by the saddle feathers.



In the following sketch there should be a more perky perch with wing tips below tail. No use trying! My sketching from life is fierce.



Saw another bird near this one,--this after the boat had left and I was out on an evening's hunt. Am now observing the third dove seen; but he has seen me so does not act natural, but leans far down to peer at me around the cluster of leaves that hide him. The green of the upper wing coverts and back is just a shade darker than the broad leaves of the tree in which he is perched and where we commonly find them. The light yellow underparts and the ash gray head and neck tend to make the bird more inconspicuous than he would be if all green. I am so afraid of the boat's capsizing that I leave my camera aboard. There is another dove in the next tree. No! two of them are there, while behind my back are at least half a dozen sandpipers. These

desert isles are not so uninteresting ornithologically.

Mr. Beck told me to watch for a mottled blue-white reef-heron. Coming along through the rather open bush of this west end of the long motu I saw a flutter of white beside a pandanus and heard a coarse croaking scold. An all white heron was chasing the mottled one. The latter alighted on a rock in plain sight of me. I froze. When I saw the pure white through the lower pandanus leaves I gave him the choke barrel and then picked the mottled one from the air with the other. Along the reefs one has little chance of getting within range of these always alert birds; but here luck was with me, and being interested in themselves (a family quarrel perhaps, though I could find no nest) they did not see me until it was too late. The three doves still sit observing me, every bit as curious as I, while the sandpipers continue to invite attention. But the sun sinks and I'm looking for rail.

I stop to kill a blue-faced booby. At the end of the performance I count at least twenty sandpipers and two doves within range of the auxiliary. Another dove sits on a dead shrub within large shell range. The dog has the scent of the doves and now comes to a beautiful point. We are not after doves, but I cannot let that point go without birds. Get the pair with one auxiliary,--the first time I ever did that with doves. Four red-footed boobies fly over, low down. They are coming in to roost. The sandpipers have quieted down to a very light "meh".

Proceeded along motu, keeping in the densest portions of woods and brush and stopping frequently to trill and whistle for rail. Could see Mr. Beck's tracks occasionally. Went clear to end of the motu. There a good example of the piling of large coarse blocks by the sea storms and of coarse gravel, and in places sand by the lagoon waves could be distinctly seen. A stretch of sea level reef shelf connected this with the isolated motu on the south. A few shallow channels across it. This platform as well as the motu are the conformable one fourth to one third of a mile in width. A few large blocks of coral have been thrown up and transported onto this shelf at low places across the motu. One block is within a very few paces of the lagoon. From all appearance from the shore the lagoon here is similar to that at Maria in being shallow very narrowly along the beach and deep, clear blue throughout the central portion. This atoll is very nearly circular; Maria had some decided indentations and was rather elongate. The wooded motu stretch well around the east, north and west sides; while two isolated motu are in the center of the open gap of reef shelf on the south. There may possibly be some birds there not present elsewhere. We are endeavoring to visit every islet around each atoll, but luck and weather may sometime interfere, as it did at Marutea.

After this evening's search through the west end I am quite satisfied that the rail does not exist there. In places the soil is sandy, and the shrubs almost dense enough

for rail, but there is nowhere the moss-covered humus soil usually found where they dwell. I heard a cuckoo but could not get a sight of him. What secretive birds they are! What little chance one has of finding the nests when it is so difficult to locate the birds! Have watched carefully for dove nests today, and also for the nest of twigs found at Marutea (Motu Kaveka) and observed by Beck at Maria, but have seen nothing. Nest hunting, except where luck comes into play, requires not only keenness of observation but patience beyond measure. Here are hundreds and hundreds of sandpipers - where are their nests? I have been unable to locate any unless those twigs are theirs. If the doves do not exist at Maria - and I have little doubt on that score - then the nests Beck observed must be, by the process of elimination, those of the sandpiper; and that one collected at Marutea must also be a sandpiper nest.

A curlew calls from the seaward beach. I killed one at the far end of the motu. Were it the least bit bloody I would eat it in the morning, for Beck said we had enough. On the sandspit beyond the motu, lagoon beach extension, I found a winged yellow-billed tern with bloody wing, so I relieved it from its misery. Had an interesting moonlight walk along the beach returning to camp, where I found a pair of boobies at roost above my shelter. Collected one but the other escaped. Once it alighted on further side of the tree but has not returned since I chased it away the second time. They were flying to roost all the time I was returning to camp. Apparently

they are quite plentiful here. They appear to be getting more and more numerous at each island as we get more within the tropics. Have not observed any S. leucogastra plotus here. There are several of the blue-faced boobies. Frigates are fairly common this evening. White terns more plentiful here than at the last two islands visited; noddies not so numerous; yellow bills more so. We obtained two lesser noddies today. Tatlers and curlews rather plentiful yet, but no plover heard here. The two reef herons obtained were the only ones yet observed.

June 6

While cooking breakfast this morning I heard the boobies croaking hoarsely in neighboring trees. I had already noticed that the birds were, for the most part, paired off. The croaking evidently consists of terms of endearment in the booby tongue. Observed several pairs in the act of breeding, which is performed while perched upon tree branches. It is perhaps due to the breeding season that the birds are found perched on trees most of the day here. I collected some interesting plumage phases. Also while preparing breakfast (when I'm ashore I eat a white man's breakfast the first thing in the morning, for I hate the French cup of coffee which may satisfy clerks and bookkeepers and colonial officials, but has no place in a workingman's day) I saw two white herons cross from seaward reef to lagoon shore.

I struck out along the lagoon shore to traverse the long motu to the eastward. Collected a pair of blue-faced boobies by sneaking up to windward of them. In this way one can usually get hold of the bills of both with a little effort and a holding stick. The usual company of sandpipers observed the slaughter. Along the shore I continued collecting plumage phases of red-footed boobies. Also shot two curlew; they'll be good eating if not desired for specimens. Saw but one tatter this morning. Showers of rain frequently throughout the morning.

Have penetrated a pandanus wood and am still hunting for a rest. Three large crabs approach; all else is silence. Just before entering here I heard a cuckoo but could not get sight of it. One crab now pursues another in the reverse direction about three meters; then with the sense organs, which appear to be specialized appendages jointed like the legs, held high in air and quivering, he turns in our direction and boldly approaches the dog. So near he goes with the second and longest legs flipping threateningly and the great claws open for a grasp, that I draw the machete and aid the dog. The one that this one chased has not returned, but the third one now commences to feast upon the killed one; while three others approach, all from the leeward. # 4 is larger than # 3 and chases the latter away from dead # 1; follows a meter, then returns to eat. I left ten dead crabs for the feasting of their cannibalistic fellows, for I have a hunch

that where these crabs exist the rail cannot survive - a good point to observe throughout future collecting. They would also have a serious effect upon shearwaters and, I imagine, on other ground nesting birds. What chance would a young bird have against these big, powerful fellows? The shearwaters at Maria were nesting in the isolated clumps of Tohunu and other shrubs not inhabited by crabs in that long stretch of territory which is frequently wave swept by storms. Where no pandanus trees grow, few, if any, of these crabs dwell. They climb a tree with the utmost ease and pull apart the ripe burrs to feed upon.

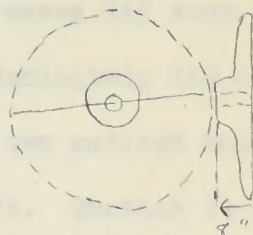
Emerging from the woods upon the lagoon shore I surprised a white reef-heron, but obtained only a very long shot. The noise aroused another white one down the beach farther. They both landed where good cover afforded the chance to sneak upon them; so I was able to obtain one. Did not see the other again. A little farther along the lagoon shore, however, another white heron flushed from an old dead pandanus tree and I got him fairly clean.

Came upon another ford where the channel ran like a mill-race and was well above my knees in depth. Stripped down to shirt and blouse and crossed. Although I felt it was about time to return if I hoped to get back by the appointed hour of three P. M., I continued on. Entering the woods of the last but one motu I was surprised to find it carpeted with a dense growth of the "fingered" fern. At the outer edge the ferns

were easily waded through and not much above my knees, but farther in they were armpit in depth and difficult to traverse. Here was ideal rail territory, every bit as good as Oeno. On the pandanus trunks was green moss, and the fine sandy soil was damp and full of humus and covered with rubbish. It was also extensive, fully one quarter of a mile in length and at least half as wide. So I trilled and whistled, hummed and hawed, sucked my hand and cursed - but not a sound of rail! Pandanus leaves entangled in the ferns hindered progress somewhat by dragging their prickles into one's thigh and knees. But my one experience in the Marquesas seems to have somewhat immuned me against pandanus thorns. One cuckoo heard and shot at as he departed through the trees was the only bird noted. Once I saw a streak of light blue pass from one clump of pandanus leaves to another, but it was only a little blue crab. The big 'u'a haare were plentiful enough here. The last motu was still better rail territory (if either could be improved upon short of a real marsh), but it yielded nothing at all. Somewhat disappointed, but planning upon another day's visit here, I commenced the return.

Two heavy squalls passed over and forced me to seek shelter during the worst downpours. Rather a strong wind to contend with and good sized wavelets lashing the fine sandy lagoon beach here, which explains the distinctive characteristic of the soil of these two motu. Except for some yellow-billed terns and a lesser noddy I did no collecting returning until

very nearly back to camp. I had gathered some of the boobies, herons and curlews cached along the route, and was carrying them at the end of a pole when a curlew flying by whistling was a temptation I could not resist. I shot him, and, to my surprise, a mottled blue-white heron down the beach flew up to me and alighted on the gravel bank too near for shooting. What is more, I had to throw rocks at him twice before he definitely took wing. The rest was easy. He is a very interesting bird indeed (# 3656), with blue-tipped white feathers, especially the wing coverts. By the time I reached the pair of blue-faced boobies I had a fairly good load - five red-footed boobies, three herons, four curlew, but was still inclined to break off a portion of a chalky rock, of which I found three small slabs one inch or so thick and less than a foot in diameter in a heap on the lagoon beach. Near here I also found a fairly large chunk of the black rock-like substance collected at several other islands. This morning I also found a chunk of pine resin (I tasted it) about the size of my fist. It was easily crumbled. There is a large saw log of fir about sixteen feet long and at least three and a half feet in diameter on the tidal flat nearest the lagoon at the camp motu. But the biggest surprise of all was to find on the lagoon end of a channel the two halves of what once had undoubtedly been a cart wheel, similar to those used in South American countries. It was the



Hub hole 3"
Hub 12"

cross section of a tree, in diameter at least forty-two inches; hub diameter, twelve inches; axle hole, three inches; width of hub, sixteen inches, and of outer edge or rim, three inches. Whence had it drifted, for there were barnacle shells still clinging to it?

At camp I found the three sailors wrapped up in my blankets keeping warm after having made a big hole in my G. W. coffee, awaiting my return with a note from Beck saying the Captain feared a storm tomorrow and for me to come off with what birds I had. The boat had landed two motu, at the end of the long islet opposite my day's journey. We hastily packed up and struck out to carry our loads. They were so heavy that we risked emptying the demi-john of water. In addition to birds and camp there was a small anchor weighing nearly a hundred pounds to be transported. Soon after we started the sun sank below the cloudy sky. We reached the boat before dark, and then commenced the almost impossible task of skidding it to the reef, there being no water on the tidal flat. With short, thick sticks below the keel we succeeded in getting it to the verge just at dusk. The ship in the meantime was standing in as near as they dared, watching us. At this point I put it up to the men as to whether or not we should risk our lives trying to launch the boat when unable to tell good waves (if such there be) from bad ones until they broke. Bijoe definitely did not care to try the sea and neither did I. The two natives boldly declared their willingness to make the effort. Whether it was

real confidence or merely bravado I do not know. There being no definite notch with an undertow to help suck us out beyond the wave breaking point, I decided against the rashness of the attempt, and with Bijoe took kerosene ashore and started a signal fire to notify the ship crew that we were not floating around between them and the reef.

The fire going, we brought in the stuff and made camp for the night. Had a good dinner, including prawns captured while returning from boat, and crabs that came into the firelight. A heavy squall struck us just after we had eaten, following which Jimmy, Teiho and I went out and quickly filled a kerosene case with the prawns. As a consequence of the sport I have a very badly lacerated forefinger. If spinosity precludes extinction this creature will not last long; and what about sea urchins? It was great sport, however, to wade shin deep over the tidal flat, which, save for the living portion along the verge of the reef, is usually rather even surfaced and coated with short algaous growths and silt enabling one to run frequently after fleeing prawn. From their lairs beneath coral blocks along the verge or those tossed up on the flat these prawns crawl forth to perambulate about the flat in search of food at night. Upon approaching one the prawn, himself, will advance until the long active antennae touch something foreign. Then there is a splash and a streak of retreating prawn, crayfish fashion. The natives step upon them and then carefully pick them up by holding legs and tentacles all

forward. My experience soon taught me something regarding prawns' protective measures. Held elsewhere, they have a very active and nasty prod backwards with their spiny antennae. Held too far astern and below, they have a still more effective weapon in the abdomen and tail which is flipped viciously against the underparts, and since both tail and abdomen are armed with spines a finger gets severely punctured if caught by them. Tonight (June 7) I noticed the stomach of one prawn to be full of barnacles about half a centimeter in length. Another squall drove us in from the hunt.

A heavy wind blew our shelter almost flat upon us,--so flat that the lower half allowed the rain to beat through. We had a lot of leaves piled upon coral rocks after removing the largest blocks. I divided my blankets (one for me and one for three) and dry clothes among the boys, and we made shift for the night, wondering how the cook and cabin boy would enjoy a trick at the wheel. Better there than in the cold briny!

June 7

Teiho deserted our meagre shelter and curled up on the leeward side of the hot coals, which glowed all night where our beacon light had burned out. For breakfast we had more lobsters and crabs in preference to the canned food, which was plentiful. Seeing that the ship was far to leeward, I decided, after packing birds, to make the isolated motu by going along the reef shelf which was terribly cut across by

channels. None of them were very deep, however, and I was able to wade across them all.

The first of the three isolated islets greatly resembled the two fern-bedded ones at the end of the long motu. Here, again, I called at all possible length and in every conceivable manner for the rail and cuckoo. No response! Ate my last orange here and planted the seed in two places in the fine humus sand near a large tree. Shot a lizard. Lesser noddy and white terns flying above trees.

The second islet was a clear pandanus woods with no ferns beneath. Here I came upon a coral rock about one foot across. In a small opening, scattered about it, were the fragmentary remains of the shells of hermit crabs. Something had deliberately broken those shells upon that stone and apparently eaten all of the crab. What was it? I noticed several such dinner tables yesterday, and always in the vicinity of the large coconut crabs, which leads me to suspicion them. The engineer says we would hardly believe that these crabs will take a coconut in the two claws and pound it against a stone until the husk is mashed sufficiently for them to grasp it. Then they pull off enough husk to enable them to break the nut against a stone. The rest is all pudding. Very interesting, if true.

The third motu had but few pandanus trees and other scattered shrubs; a carpet of grass and low, flat shrubs. Here were nesting twenty or thirty red-tailed tropic-birds. Here

were no 'u'a haare; these large crabs may explain several things in regard to birds.

The tide was up at my return, and consequently I had much more wading to do. The ship had arrived opposite the boat. It passed along just as I reached the first motu, so I was in a hurry to get back. A white heron evaded me safely both trips. Two tattlers in winter plumage were observed. A few white terns and lesser noddies and one noddy tern and one yellow-billed tern were the only other birds noticed.

Last night Teiho took the coffee pot and filled it with brackish water for supper. I filled all the pots from the shelter tent pool after the first squall, for this morning. On my jaunt out to the motu I tasted several pools, always selecting those highest above the tide. Many of them I found to contain perfectly good water. With rain frequent enough, a shipwrecked man could live a long while on such an island. I also saw a hole in the fern motu yesterday that looked very suspiciously like a well. No doubt the water obtainable there would be as good as that found at Oeno. Food,--shell-fish, fish, sea birds, doves and sandpipers would be sufficient to hold out upon for many a month. The sandpipers I saw all along the shelf, where a few coral boulders were strewn. An interesting feature here was a string of coral breccia along the seaward edge of the shelf next the tidal flat,--mostly in the last stages of disappearance by wave action and the solvent property of water. The coral boulders observed were strewn

definitely in beds across the shelf. The breccia rocks were about four or five feet above mean tide level; their tops were very uniformly level. The three motu were composed of lagoon-washed fine gravel and sand.

Getting the boat off the reef was decidedly interesting and quite dangerous enough in broad daylight. For a while I tried to help by holding outside, but while above the crooked notch crevasse a wave shoved the boat over upon me and I banged my shins severely against the coral beside the crack. After that I got inside the boat and kept busy by bailing. We were more than an hour getting away. The waves carried us back several times as we neared the edge of the reef. What little pass there was was crooked and very little undertow flowed out it. Once we tried to get away, but were right at the combing point when a wave struck us; we were shot like a surf board, high up on the reef. But we bailed her out and tried again. Finally got safely beyond the break of the waves on a couple of descent swells. Everybody was thoroughly drenched, and one box of boobies was spoiled. It was high noon when we boarded the ship.

Now comes the report that while I was ashore Charlie, who likes to show how close he can sail to a reef, failed to get the ship about in proper shape, and her leeway was driving her against the reef. They were in where the waves break, some say. No doubt everyone aboard saw green. The engine, however, responded to the first turn of the wheel and saved the vessel

from a sad ending. It is all very well to sail in reasonably close to land to pick up or let out the boat, but at other times it is best to keep safely away. This work has enough thrills in it without adding to them by pure foolhardiness. Our course has been altered more to the northward because of the high southwest swells which prevail here. The unusual continuance of northwesterly winds has also added considerably to the troubles of the trip and storms.

June 8

We sailed close in by the next two islets of this group - Tenarunga and Vahanga - both rather round atolls with lagoons, but having the rough mound style of reef, which at low water does not afford favorable landing for boats. High wind from northwest also is unpropitious. The third atoll, however, Tenararo, proved to have a fairly good boat passage. So after breakfast the boys landed with me, making a perfectly safe and secure landing.

We found the sandpipers as common as usual on the last two islands. The green dove, which may be different from Coralensis in having a slight splotch of red on the breast feathers, is more plentiful here than any green doves yet met with. In less than two hours we secured twenty-five, many of which were females past laying, but none apparently feeding young; no young birds obtained. Hunted through woods and bush for ground doves, thrush and rail, but found no indications of

their presence. Turtles have been on this island recently.

'U'a haare crabs very numerous in pandanus woods. White terns, yellow-bill, lesser noddy, noddy terns and frigate birds were observed. We were able to get off the reef in perfect form, out the pass.

Spent the rest of day skinning birds. Our bird cage now contains four green doves and one ground dove. The little Henderson Island parakeet, ^{died} his only food having been sugar-water for two months.

June 9

This morning Mr. Beck and I both came ashore. Low tide prevailing, we were only able to get partially upon the reef. The boat had to return to ship. Saw at least eight green doves as I entered the woods where I continue searching for cuckoo, rail, and possible pigeons and thrush. Sandpipers accompany me all around the island. We put up a few last evening, noting the darkness of their underparts. Today I have kept a strong lookout for light breasted ones, but find them very scarce. Saw a white heron fly from lagoon to outer reef. A tatler came too near me - in good summer plumage. Another I shot along the lagoon shore flew out and dropped in to the water. It was but a few moments before a yellowish-green nose emerged above him and a resounding splash announced that the shark was satisfied with the morsel.

This lagoon is small enough to be as picturesque as

romantic writers would have an atoll. It cannot be more than two miles in the direction of the longest diameter and little over one across. The north side is good level motu land, tending towards roughness, while the south side tends towards sandy soil and is cut across by three or four small channels not full at mean tide, and one permanent channel about knee deep. I shot one of two curlews which flew over me.

At the east end of the island I began to find frigate birds and a few boobies. At a small channel I came to the first signs of former inhabitation in the form of several rock ponds for preserving live fish. On the Southeast side of the islet I saw across an open flat the ruins of a former shack, with a trail leading to it past an old well hole. Behind the shack were many crab shells, mollusk shells, and bird bones. Here is real sign of the romantic marooning of mankind upon a desert isle. In this voyaging to every island our chances of rescuing similar people is good. Here are the remains of some refugees' hut, floored with planks combed from the beach and pandanus logs bearing evidence of the work of a good sharp auxiliary. The framework is very frail, with thatching of coconut palm fronds. There are no coconut palms on this island. A heap of shells and a hat band look like the work of a woman. Here I found lying in plain sight an old rotten black purse containing three cheap rings, a Chilean coin, a blister of mother-of-pearl, a roll of black silk hat band material, and a typewritten paper. The pulp is badly run together, and the

Tahitian words are not entirely decipherable. The word "tarahu", meaning "debt" occurs. A typewritten form which apparently was put out by "Nicolas Tuhiva" to a woman named "Roro a Ruamarutaata" of "Pueu", a district of Tahiti. Louis interprets what bits are legible as a contract between Nicolas and the lady for the clearing and planting of land - this island perhaps. The figure 1920 occurs; also names of men with numbers:

II. Terai. III. Pau. IV. ...

VII. Mikara. VIII. Poi. IX. ...

Louis suggests that showing this to Nicolas may stir up something, for two years is a very short time in Polynesia and he may think the party of the second part is still performing the duties of the contract. It is not below the South Sea trader to so leave natives to shift for themselves as best they may for years at a time.

A little beyond the shack I came upon Mr. Beck in his glory amidst a colony of red-footed boobies. The curlews were very numerous along these sandy flats. We gathered in a few. Just before I reached Mr. Beck the dog flushed a dove which didn't look green to me. He barked treed, so I went after the bird and found it a female ground pigeon, more bluish in plumage than that sex of the Maria bird. Mr. Beck had obtained a male in bright plumage with clean breast. We collected his cached boobies and frigates, took a hurried glance at an old dug out canoe made from a wormeaten drift log, and proceeded

back towards boat around southwest shore.

While crossing a short channel we saw another male pigeon flying across in the opposite direction. Returned to where he entered trees and Mr. Beck got him. Along the reef returning we flushed two herons, a blue and a white one. I stalked them, and by keeping down behind a ledge of coral breccia succeeded in getting within good range. Took the blue one with choke barrel and had much nearer shot at white one with other barrel, but missed him. While packing birds and changing shoes, four different yellow-billed terns at as many times passed, but something always occurred to keep me from getting in a shot. Just as we were ready to leave, Mr. Beck went along the shore a way and obtained some eight lesser noddies. Went aboard especially for dinner and was served canned pork and beans and sardines. Came ashore again, equipped for the night to hunt for ground doves.

Saw three green doves as I entered the woods. Nothing but crabs ('u'a haare) through the bush. Followed again around to the left; though it is farther by half a mile, there is no channel to ford or jump as there is on the right. The pack getting heavy, I took it off to rest. Hunted back into iron bush (not the typical ironwood or Casurina, but a sage brush-like shrub with a dark brown heavy wood). Saw but a green dove and the inevitable sandpipers. Along the east shore the dog seemed to pick up hot scent, so I traveled just within the line of bush. He flushed two or three green doves and finally

a female ground pigeon which alighted in a nearby pandanus tree. She, too, is distinctly of a bluer phase of plumage than the Maria female. Encouraged by this result we kept inside the bush all along the west side, but had no more luck.

Arriving at the sand flats, I flushed a curlew and obtained him. I have never struck that bird so thick anywhere as they are here along this sandy south side of the island. This morning at daylight we saw four flying about the ship. I thought them ducks at first, but Mr. Beck soon recognized them as curlews. Whistling brought them closer, where their identity was much more certain.

Arriving at the first coconut trees, I left my pack and went hunting in the region where Beck had obtained the two male pigeons. Killed two more curlew. They certainly are plentiful here. Obtained a much desired drink from a puddle of rain water on the tidal flat shelf rock. This rock seems to be so seldom washed by salt water that the rainfall keeps these little pools good and fresh. But three or four days of sunshine would dry the deepest of them. Where sandy islets occur, however, good well water can usually be obtained at lagoon level in the center of the islet.

Returning from a fruitless outgoing trip around to the channels, I flushed a female pigeon from the shrubs adjoining a patch of woods. She, too, alighted in a pandanus tree, and is also bluish underneath, rather than buff. How fortunate to get three females out of five birds! May my luck continue in the

morning. Green doves are here too in apparent abundance. They are decidedly numerous and very gentle. I am tempted frequently to reach out, trying to catch them alive. The pertinacious little sandpiper, however, is the dominating bird of this group of islets. He is everywhere at all times. They come to meet one from considerable distance and follow along in numbers, piping softly but very frequently. I saw three tattlers this afternoon; and very late this evening, three golden plover. I called the latter, but in response they just didn't swing back within range. Is it not high time these birds were going north? There are several people of rather more than average Polynesian intelligence who claim that the curlew, especially sometimes, nests down here. What a find that would be! But their sexual organs do not yet show signs of laying or breeding, though some seem to be swelling a little. I am killing more, perhaps, than we need as skins, in order to add numbers to these June collections; for it is only in numbers that scientific laws can be determined. The greater the number of specimens the nearer the truth of the decisions reached by study. As I write - by the light of the full moon approaching the zenith - I hear a curlew whistling some distance around the lagoon shore.

I am camped in the midst of a colony of red-footed boobies. Here Beck obtained some interesting plumage phases. I killed but one white bird from the flock this evening. I would estimate this colony at well above two hundred birds. They extend some distance along this southern shore. No birds

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observed nesting on opposite side of lagoon. Here we have located a few eggs in the nests. I brought the basket along to collect what eggs I find in the morning. There are a few dark young birds; most, however, are the grayish phase with white tail. Nearly every Tohunu tree here and many other trees have two or three nesting pairs in the coarse branches. In the evening a little before sunset until considerably after dusk the birds were flying about and alighting on their perches. At every shot most of the perched birds would again take wing. Alighting is almost invariably accompanied by an agitated conversation of coarse croaking between birds in the tree already and the descending one. The new arrival is sometimes greeted by an unsociable pecking which induces him to reconsider the matter and take to the air once more.

The frigate birds nest or perch more along the southwest stretch of lagoon shore in the sturdy branched iron-bush or Tohunu trees. Their number here is not large - perhaps fifty altogether. There were considerably more at the last two islands visited. Here should be noted the total absence of the blue-faced booby at this island. (Again Phaeopus tahitiensis calls down the shore.) Some boobies indulge in a midnight controversy, or it might be a little domestic squall, or possibly love notes for that matter. Their vocal gifts are decidedly small.

When I returned to camp at dusk I found two or three crabs about the place, so decided to move out onto the white

coral sand of the lagoon beach. Spread two halved coconut fronds, then my blanket, and covered myself with two more fronds, which latter kept off most of the dewfall. Piled some green convolutions of pandanus leaves up to windward as a shield and slept comfortably until half an hour ago, when I felt something move in the vicinity of my knees. Raising the palm frond on the wind-break side revealed one of the large crabs. How he had gotten there I don't know. He was in the very midst of camp. Now he is nicht. Such a moonlight night is this! The bright white sand of the beach is bordered above by the low green bush and lapped by the gentle lagoon waves. Along this sandy shore the water is very shallow and stretches a light green for some distance before the dark blue occurs. Beyond is the opposite fringe of bush which marks the further limits of this coral ring on the ocean's finger tip. Save for a very slight opening on the west and a few slighter ones here - a tatler startles the stilly night - the green fringe is complete. The reef here is of the rough mound type with very little tidal flat, and that little interrupted by protuberances of coral breccia, the origin of which will take more study than I can now afford to give. The first island of this group, Maturei Vavao, had the opposite style of reef, with a wide tidal flat, and very few notches for boat landings. Here there is hardly any flat and several passages between the mounds, through which a skilfully steered boat can land at high tide, well in towards the gravel beach. That

there is considerable washing away of coral rock, mostly breccia, along the shelves where no land covering protects it, is plainly evident on nearly all the open gaps of these atolls. Most of this I would attribute to falling rain, the roughened surface of the shelf being good evidence of that work. That this shelf has been successively cemented in thin layers seems very plausible when one observes how readily slabs of coral, five or ten centimeters thick, can be broken off it. On the shelf here is some good evidence of that phase of action. The shelf is at least half smooth where the blocks have been broken off. Over this portion even a "popaa" can walk barefooted with safety. One portion of the shelf, nearest the lagoon, was covered with a layer of these loose slabs, which had evidently been ripped off the more seaward portion by storms on the west gap. These blocks were overlapping one another in a very uniform manner.

 (Diagrammatical)

Clouds dim the moonlight, causing too much strain on the eyes for further writing.

June 10

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Thus is

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to the intruder. Was not interrupted by them again during the night. Heavy dewfall during early morning and decided chilliness, which was not conducive to slumber. Dawn was announced by the sandpipers commencing their perpetual piping. I wonder how much noise they make when no unusual visitor is about. The boobies commenced to leave their roosts and were departing in flocks of three, four and five for the day's fishing; so I got up and went after them. Obtained four odd and white plumaged birds. Wandered about through brush and was fortunate enough to come upon two ground doves, both males. They were more in woody country than open brush. One I saw flying across an opening, and on following him up the dog flushed him. They usually alight in nearby trees when flushed.

Returned to camp and ate breakfast; then struck out to eastward exploring country generally, with no other results than seeing several green doves and a few curlew and the ever abundant pipers. With those little birds about all the time one has very little chance of hearing rail whistle. The minute one tries calling rail they surround one with their piping. Brush does not seem exactly favorable here for the rail. There are no ferns, and the low shrub wherein they dwelt at Marutea does not grow as high and dense here as it does there. Heard a cuckoo in a grove of iron-bush, but was unable to get sight of him. Lizards are to be found in the fallen pandanus leaves, by sitting and awaiting their appearance. Shot a white booby and female frigate which came down to harass the fallen booby. Returned to

to the island. Was not interrupted by them again during the night. Heavy drizzle during early morning and decided chilliness, which was not conducive to comfort. Doves were announced by the sandpipers commencing their perpetual piping. I wonder how much noise they make when no unusual visitor is about. The boobies commenced to leave their roosts and were departing in flocks of three, four and five for the bay's fishing; so I got up and went after them. Obtained four odd and white plumaged birds. Wandered about through brush and was fortunate enough to come upon two ground doves, both males. They were more in woody country than open brush. As I was flying across an open ing, and on following him up the dog flushed him. They usually alight in nearby trees when flushed.

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camp with them. Struck over to place where Mr. Beck obtained his first dove, and there knocked a white booby from roost. While killing it the dog spotted a female ground pigeon in a low tree within easy range of me. Another white booby flying above me I winged. Have had great luck with them, not getting the body feathers the least bit bloody. Have a good load of birds for Teiho now. This female dove is like the others in color, which I think is quite distinctive and apparently true to the birds of this island. I tried getting some white terns, but none obtained were clean enough to save.

Teiho arrived just after I had eaten lunch; he pulled a lot of grass for bird bodies. We walked back along the smooth portion of the breccia shelf. This extends from the living nullipores at the verge of the reef lagoonward usually to where fragments or gravel are heaped upon it. It is the tidal flat and the shelf proper, the former being submerged half a meter or less by mean high tides and retaining a few centimeters of sea water, which splashes over the growing verge always higher than the tidal flat beyond. The tidal flat proper and the breccia shelf are usually separated by an abrupt raise of half a meter or more, but sometimes are continuous in a gentle sloping upwards. The tidal flat is coated with coralline algae, small colonies of tunicates and other shallow water inhabitants. The breccia shelf in places is roughened by the solvent rains in a manner which produces innumerable small prickly points of coral. Even a native does not appreciate walking barefooted over them. In most places

on this particular shelf, slabs of the breccia have been torn loose by storm action from the more seaward portion, and are now heaped up over the lagoonward half as described on page 29. I could distinctly see the purple spines of sea urchins in several newly split-off slabs today. The overlapping slabs, though many were still loose, have already been cemented down to the breccia on which they rest. Near channels, or between channels, as at Maturei Vavao, these slabs had been rounded off into elongate flat boulders, which were strewn crosswise to the reef, or parallel to the channels in perfectly evident bars. Where the gravel of the regular beach adjoins the tidal flat the breccia is white, hard and polished. It frequently resembles marble, but is probably nothing more than very hard limestone.

The boys being very fond of eating green doves, I made a sally from the beach inland through the open bush and shot ten doves in little more than a quarter of an hour. Found Bijoe out with pole and string after live birds - he had caught five doves and two sandpipers. The natives are very fond of the green dove as a pet, which may account for its original introduction, as well as the parakeets and warblers. He also caught two more sandpipers to accompany the pet of the hold. The first caged piper died after severe struggles against the wire of the cage. The one liberated in the hold, however, has become very tame and may prove a good destroyer of ants and cockroaches. We gathered some bird food.

The boys said something about hurrying off, so I did

not take time to collect plants which I had foolishly postponed until the last minute. The boys as they left the island yesterday saw a turtle on the reef near the boat landing on the north of the island. We had a good high tide this afternoon, which permitted us to row off with no difficulty whatever.

Spent the rest of the day skinning specimens. The largest shark observed on this trip has been hanging around since last night, enjoying the bodies of boobies and frigate birds. Some say he is three meters long, but others cut off half a meter or more.

June 11

Our cage now contains nine green doves and one male ground pigeon (from Maria); one green dove from Marutea; three from Maturei Vavao; and five from Tenararo. All look alike, and since the first day have associated with one another. Two of them are mating. Let us pray for an egg! They coo occasionally too. For feed we have an ample supply of white berries, which keep for a month in fairly fresh condition. The ground pigeon also eats them; but when wild, according to the crops of two females skinned last night, they eat a multitude of things found on and near the ground - caterpillars, insects, grass seeds and the like.

The chief amusement of the day was the catching of five good-sized bonitoes. One fish was badly hooked but not landed. He cut capers about the ship with most of the fore

part of his body out of water until apparently dead. I suppose the big shark has feasted upon him ere now. The boys were forewarned of the presence of the fish by noddy and white terns and Puffinus obscura fishing ahead. The obscura have been observed by Mr. Beck several times since we left Mangareva, but I have neither found nor heard the slightest sign of their nesting here. It is quite possible that they come this far from Mangareva, and it seems doubtful that such cliff dwellers would nest on these atolls. Yet they may do so in spite of the nature of the land and the big crabs. Strange that the dog who has worked so surprisingly well on doves should not pick up their scent if they are present. I certainly have searched in diversified conditions on all these atolls and should have come across everything that is here, with all due allowance to chance and luck.

The long roost of our aviary is occupied by seven of the green doves, many of which are very tame and sociable. One bird continues to be grouchy and disagreeable. It is interesting to watch them swallow a berry about two centimeters in diameter. Their widely gaping lower mandible permits their eating much larger berries than the ground dove can manage. His chief performance is holding the large, fleshy, white fruit with one foot while he pecks the pulp from the fibrous core. Now eight of the doves are on the long perch, all faced in the same direction. We have decided it is a little cool up here in the wind, so set the cage down in the cabin. It has been a rather cloudy day with a little drizzle of rain now and then. Charlie saw a waterspout

above the island. Unless we have good weather, landing there tomorrow will be rather precarious.

Mangareva is one hundred and forty-four miles by the chart from here, which certainly is not beyond the limits of possible range of strong flying shearwaters like P. obscura. At 8:25 P. M. the Captain, who was on watch, called us to see a moonlight rainbow. The lower arch was perfect, and since the moon had just risen an hour or less was as full an arch as is usually seen. The upper arch was faint and only perceptible for about forty degrees. The main bow, though not vividly prismatic, had a reddish yellow and bluish green area rather distinct, the latter on the inner side of the band of light. I would not be surprised if the rainbow accounts for the green lights observed above lagoon atolls. South Sea mariners claim they have often accurately located islands by such a light. It is very probable that above lagoons in the tropical sunshine a greater amount of evaporation takes place than above the ocean. Just last Sunday a rainbow was observed in the clear morning sky. I was not apprised of the fact until later, but since we were east of Maturei Vavao it is very probable that a distinct bow could be seen that early in the day. The green light would be the top arch of the bow, or all that is observable about nine o'clock when the sun approaches the highest elevation at which rainbows are at all visible. These green lights, apparently horizontal, could be observed above atolls in the late mornings or early afternoons.

June 12

A whale was observed near the ship last night. This morning we were quite a way from land, so skinned boobies saved over from Saturday's collection as we ran in to the atoll of Vahanga. Found a landing place on north side opposite a tall grove of pandanus trees, a few hundred meters west from opening across the motu. A good notch or crevasse permitted the boat to ride upon the reef. Curtis ashore to collect plants - his first trip since Marutea, where he developed ulcers from coral bruises about the ankles and instep. He wears my gum boots; it is good to get some use out of them.

As I changed clothes on the beach I remarked about the fact that no sandpipers came to greet us. The next note was that lanes had been cut through the bush and coconuts planted, which seemed to be doing excellently. A hundred meters farther west ~~were~~ piled hundreds of barrel hoops, iron junk to be placed about the trees. An old table, some scanthings, rakes, boxes and sheet metal roofing told of recent inhabitation. This main grove had patches of ferns growing through the pandanus leaves, carpeting the ground. I called at length for rail. Decided to follow around the island.

Found several small narrow motu with interspersed openings, into which inlets of the lagoon proceeded one or two hundred meters. The solid shelf, however, was continuous clear around the island and no wading was necessary. We forgot to bring off drinking water; but fortunately found a very good puddle where we landed on the high shelf rock. Getting a bit thirsty, I tasted a pool in

one of the channel openings, but found it very brackish, with a decided resemblance to a solution of magnesium sulphate. The difference in taste and salinity of adjoining puddles is very surprising. The best way is to watch the dog.

Flushed a curlew but failed to hit him hard enough. Obtained one of two tattlers in winter plumage. Saw one golden plover but could not wheedle it into flying my way. Saw a white heron out on the reef in an impregnable position. Later I flushed a blue bird of that species (Demigretta sacra sacra) from some pandanus trees near a clearing in the woods. Failed to drop him with two shots through the brush. During my entire journey around this island (six miles or more) I saw but four sandpipers, three of which I obtained. The white and purple berries were very abundant on all the bushes where they were growing, but there were no signs of their having been eaten. The purslane grew abundantly in one place and as thick as usual in other places, but no definite signs of its having been eaten. Not a sign or sound of either the ground pigeon or green dove. What a mystery! This island is within plain sight of Tenararo where the green doves were upon almost every tree in favored localities, and the sandpipers were everywhere. I know it is perfectly plausible for ground doves to be present and for one to walk all day with a fairly good dog and not be aware of their existence; but not so with the green doves, and certainly not with the sandpipers. Did the natives who were here planting coconuts liberate cats? That

is my first suspicion. It will not hurt to spend another day searching for the ground doves, rails and cuckoo. But what I don't understand is the green dove and sandpiper. The latter would be the first victim of cats; but the green doves should not succumb in two years. The natives might have eaten them; but why haven't they eaten them on Niau, Makeno and other inhabited isles to northward? The food seems to be present; the woods still are ample; where are the birds, and why?

I shot at more than half the white terns I saw - perhaps a dozen or two. Obtained four clean ones. A yellow-billed tern was spotless too. The tattler obtained was far too bloody to make up. Three or four young noddies were about; four or five lesser noddies; one frigate and one blue-faced booby above ocean at landing were the only other birds noticed. Have decided to run over to Terahunga tomorrow, and later come here to spend a night for evening and morning hunting.

June 13

Tenarunga

Having a waning moon this morning, the ship was held in towards land so that we were able to go ashore very shortly after coffee. Yesterday noon having eaten some purslane salad with my lunch and having found it very palatable, I filled my pocket with some which we had served for dinner. Everyone tasted it, but no one enjoyed it save myself. I had what was left this morning. A little green food is very good at the end

of a prolonged journey where no fresh vegetables are procurable.

Mr. Beck also is ashore today, and Curtis is collecting plants. Near the shacks I obtained two green doves and saw a sandpiper. One of the latter, a tattler and a rat are the only additional collections since. Territory is exceptionally good for ground doves, there being any amount of the berries, fruit and purslane; the ground, too, is somewhat sandy. But there are no signs of them. I am now stopping in a stretch of wood well carpeted with ferns, but here find no sign of rail or cuckoo. White terns are much more plentiful than at Vahanga.

Crossed back towards lagoon. Emerging from a pandanus wood, with large fruit trees and Tohunu near edge, I was surprised to see a ground pigeon fly towards me and alight on a low prostrate branch. Searched thoroughly for her mate but found no more signs. Picked up all the green doves seen, about seven or eight in all. Flushed a white heron from a clearing in the bush; the second shot dropped him. A yellow-billed tern flew over me when I called after it; not very dirty. Also obtained a few lesser noddy terns, several of which have flown over. Heard some more curlew and tattlers. The sandpipers are fairly thick at the opposite side from the landing coconut palm. Here are several cross-draws, but none deep enough to call channels. Saw half a dozen sharks swimming about in one. Here I met Mr. Beck, who has had no luck except with herons. A white one stood down the draw as we talked.

We decided to return the way we had come. I always like to look over all of an atoll, but prefer to hunt ground pigeons where I know they have been seen. Ate lunch in a clearing in a pandanus wood where ferns were plentiful. Heard no sound of rail. I do not believe they would live habitually under the fallen leaves.

Have returned as far as the place where female ground pigeon was taken. I am sitting upon the old rotten log on which she perched. Towards the lagoon about sixty meters away are Tohunu trees and "fruit" trees. The ground is clear beneath them, but carpeted in openings by low dense shrub which bears occasional green berries eaten by green dove. Here is a small clump of "fruit" trees with old windfalls and ferns beneath. Behind me is a typical dense pandanus wood, with ferns knee deep but not dense. I hoped that sitting here a few moments might bring forth the mate. White terns, however, have been my only visitor, other than small flies. I see here a plant that I have not noticed before on these atoll islands - a white, five-petaled flower; a green berry; and a tall, willowy plant. Just before arriving here the dog picked up a hot scent and hastened up wind to flush a curlew. Shortly after lunching I obtained a pair of green doves. Found them amidst the second growth of brush following a fire of indeterminate age. They are very scarce compared to Tenararo. One more green dove, and just at the huts a shearwater (Pterodroma sp.), similar to the small black, gray-throated ones taken at

Henderson Island, ended the day's hunt for me.

Arrived at boat landing exactly as Mr. Beck reached it. A can of fruit goes exceedingly well at this time of the day. If I were not so tired I would think seriously of coming ashore this evening. I may feel so inclined after supper. Saw some very good rail territory this side of the place where ground pigeon was taken. If we could be certain of getting ashore as early as we did this morning there would be little need of sleeping ashore, but it is hard to tell what time the ship will get to land after daylight.

June 14

Came ashore about six-thirty at Tenarunga to hunt for ground pigeons. After two hours I at last found a female resting beneath a pandanus tree, near which grows the purslane. One green dove observed so far, and but two sandpipers.

I continued zigzagging across the island, wading through tangled, knee-deep shrubs in clearings and as deep thorny pandanus leaves in woods. Of particular negative note here and at Vahanga is the fact that not one coconut crab ('u'a haare) was observed on either island. Their absence and favorable territory induced me to call for rail, but no results were obtained. By favorable territory I mean not too rocky, moss-covered soil, and ferns or dense shrubs in considerable patches. Much of this island has been burnt over about two years or less ago. Some more about five, or perhaps ten, years

ago. The pandanus groves are all that burn, and apparently are rather slow to restock themselves.

I finally emerged from woods at the exact spot where yesterday's pigeon was obtained. Saw a bird on a branch of pandanus, and was about to pass it up for a young noddy when I thought it better to look more closely. I dropped to my knees and hurriedly shot the wary cuckoo before she had an opportunity to hide. Later in the day I saw two more flying but was unable to get either one. Their flight is very rapid, with swift wingbeats and fairly straight as to course in the open. Just how many of these secretive birds live on one of these small atolls (less than ten miles in circumference) it would be very difficult to judge. Yesterday I heard two, and today saw three. In my opinion there may be twenty-five birds, or even more here. Sexual organs continue to be small, showing no signs of swelling. Will the mystery of their nesting habits ever be solved? There is one consolation: they are a bird that will persist for ages yet. It will be a problem for future ornithologists to settle if we fail to get the evidence on this expedition.

Getting thirsty, I struck along the motu for the drybeds where Beck and I met yesterday. Water in the large leaves of the fruit tree and curled pandanus leaves having a taste like very bitter tea made from stagnant puddle water and not being very palatable, I decided to go to the rock pools for lunch. Obtained one more green dove en route. Saw one old male and two young rusty, white-headed frigates. Lesser noddies were

ago. The pandanus groves are all that remain, and especially

are rather slow to react to themselves.

I finally emerged from woods at the same spot

where yesterday's pigeon was obtained. Saw a bird on a branch of pandanus, and was about to pass it up for a young noddy when I thought it better to look more closely. I dropped to my knees and hurriedly shot the way across before she had an opportunity to hide. Later in the day I saw two more flying but was unable to get either one. Their flight is very rapid, with swift wing-beats and fairly straight as to course in the open. Just how many of these secretive birds live on one of these small islets (less than ten miles in circumference) it would be very difficult to judge. Yesterday I heard two, and today saw three. In my opinion there may be twenty-five birds, or even more here. Sexual organs continue to be small, showing no signs of swelling. Will the mystery of their nesting habits ever be solved? There is one consolation: they are a bird that will persist for ages yet. It will be a problem for future ornithologists to settle if we fail to get the evidence on this expedition.

Getting thirsty, I struck along the water for the day-bats where Beck and I met yesterday. Water in the large leaves of the first tree and curled pandanus leaves having a taste like very bitter tea made from stagnant pond-water and not being very palatable, I decided to go to the rock pools for instant. Obtained one more green dove on route. Saw one old male and two young rusty, white-headed flycatchers. Lesser noddies were

more abundant than yesterday. A few young noddies about. The usual flutter of white terns above us all morning; but when ready to go aboard, but one was within range.

Found a few good pools of drinkable water, which certainly were appreciable. They are drying up very rapidly after these two hot days. I would hate to have to live upon the saline water I found in the wells apparently dug by the late working inhabitants. The dog filled up from one, but I could not drink it. Heard a few scattering tattlers during trip around island. Having reached half way, I went on around this trip. Found little territory favorable for rail or ground pigeons around the latter half. Just before arriving opposite the one tall coconut tree I heard two golden plover. Succeeded in calling them back over me. They were flying rather high. Missed two shots, but called them back from afar to leeward. Got one bird out of the next two shots. Again called the other bird and dropped her, though I had to let her fall in lagoon. No chance of wind drifting her into shore, so I stripped down and went after her. Wading was bad to begin with, and impossible beyond waist depth, at which elk-horn coral grows. Thence I swam with a shallow breast stroke, caught the bird in my teeth, and returned carefully to shore with no more than two little coral scratches on my right big toe.

Saw a curlew run through the shrubs near the huts, and the third cuckoo flew over them. It is very strange that here also, as at Vahanga, no boobies were observed during the two days

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 in calling them back over me. They were flying rather high.
 Missed two shots, but called them back from start to forward.
 Got one bird out of the next two shots. Again called the other
 bird and dropped her, though I had to let her fall in Japan.
 No chance of wind drifting her into shore, so I stripped down
 and went after her. Landing was bad to begin with, and impossible
 beyond waist depth, at which six-foot coral grows. Thence I swam
 with a shallow breast stroke, caught the bird in my teeth, and re-
 turned carefully to shore with no more than two little coral
 scratches on my right big toe.
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 also, as at Yabur, no boobies were observed during the two days

ashore. Did the native planters eat them up? If left a year, as is not uncommon with South Sea traders and planters without other food, eight or twelve voracious natives could soon clean up the young birds and many of the old red-footed boobies; and all blue-faced ones and frigates. This may also explain the scarcity of green doves and ground pigeons and even the little sandpipers. They did a good job with the crabs, however, and that is one blessing. One of our crated pets aboard ship escaped, and yesterday morning we saw him high up the foremast riding the highest block and shackle. No one knows what happened to him.

June 15

Our three little sandpipers have become fully adapted to life in the hold and run about eating ants, cockroaches, and anything they find, including bits of bird meat. I hope they also include scorpions in their diet. Yesterday I shoved my legs into my wading trousers and received a warning sting on the side of my calf. It was just a little fellow about two centimeters long, and nothing serious resulted from the sting, although I felt it decidedly at first. After this I'll shake clothes, especially damp ones left in the hold - for a week or so. It is somewhat consoling to know that their sting is not very painful, and certainly not harmful. It relieves one of a great deal of unnecessary fear and caution.

Today I pulled the champion bonehead of the trip by

shore. Did the native planters eat them up? It left a year, as is not uncommon with South Sea birds and planters without other food, eight or twelve voracious natives could soon clean up the young birds and many of the old red-footed boobies; and all blue-faced ones and frigates. This may also explain the

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escaped, and yesterday morning we saw him high up the foremast riding the highest block and tackle. No one knows what happened to him. He was very tame and friendly.

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for a week or so. It is somewhat annoying to know that their sting is not very painful, and certainly not harmful. It re-

leases one of a great deal of unnecessary fear and caution. Today I killed the smallest scorpion of the trip by

running off to shore without my hunting jacket, in which were papers, auxiliary barrel, notebook, pickle bottle and cyanide. It could only have been excelled by leaving my gun. Upon landing, we went over to the pandanus trees for a "wild-man" picture, so the boat had returned to the ship before I noted the mistake of the jacket. Curtis carried my bedding roll and grub around to coconut trees by the short west shore. With a pareu for a bird bag and the fish basket I managed to hunt around the long route. Green doves and sandpipers were overly abundant everywhere, especially along the open seaward, shrub-covered portion of the motu.

Strictly speaking, this is almost one continuous islet rather than the usual series of motu. On the west, however, is a considerable stretch of open shelf-rock where but the first layer of loose blocks has been heaped in the process of land building. This is, no doubt, flooded by high storms and high tide, and is therefore not exactly land. Under ordinary conditions, however, it is perfectly dry except for two narrow channels about one meter deep which connect the lagoon with the tidal flat just inside the reef. On the southwest the land is cut by several dry washes not clean to the reef rock but mostly so. Here are extensive sand flats on the lagoon side, while the soil of the islet is sandy. The woods here are mostly open beneath, save for light growths of herbs and grasses. In these woods, or very near their edges in the berry shrubs of clearings, practically all of the ground doves were found. The green doves

keep well within the range of berry shrubs. The sandpipers here are everywhere, including dense woods with the exception of the deepest pandanus patches. Along the lagoon shore of the north side a few frigate birds were observed upon bushes; not nesting and not abundant.

All along the south and southwest red-footed boobies were nesting, most of them breeding and nest building. A few were found with eggs, and one downy young bird was seen. There were a few young dark birds seen flying about. The mating birds, however, were all of the light gray varieties, mostly with white tails; and several rather white birds were found. The collection taken is fairly representative of the plumage phases found in a colony of two to three hundred; but it must not be considered proportionate. By far the greater number are ash gray with white tails. My estimation would be about .1 dark young birds; .1 light gray without white tail feathers (3631); .5 light gray body with white tail feathers (3650); .2 mostly white of body and tail (3567); .1 all white save primary and secondary feathers (3514). The numbers refer to specimens representative of the phases. No very dark birds (first phase) were observed as mating, though some of the second phase were dark for light gray birds and were seen holding down a nesting site. It was very interesting to see a bird perched upon the barely begun nest during the day. A great commotion occurs when the mate arrives with or without more nest material. A still greater racket announces the threatening descent of any other bird but the mate.

Throughout the late evening birds returning from fishing arrive and are greeted with much croaking. Sometimes during the quiet tropical night the silence is rudely disturbed by their hoarse noises in contrast to the gentle pipe of an occasional sandpiper, or the whistle of the curlew or tattler. The curlew today came in for further notes. Before reaching the coconuts on the southwest I had obtained four of them, mostly in single cases. One of them was entirely due to the dog who became absolutely uncontrollable, going far beyond range and disappearing into the woods. He came back later carrying a living curlew, which, upon inspection, proved to have a broken wing and to be extremely poor, with decidedly worn plumage. I found them, much to my surprise, in the tall woods where no berries were growing. Of course they occurred occasionally through the berry-shrub patches of the interior; but were mostly found at the edge of the bush beside the extensive sandy flats, or alongside the dry draws on the southwest. Just before dusk fell I was stalking a reef heron which had alighted on a point of rock along the lagoon shore and had occasion to pass through one of the narrow wood patches between sand draws. A curlew flushed from the midst of the wood and alighted within range. The heron, however, became suspicious, so I had to take a long shot at him (missing) but got the curlew. I think the latter had located in the wood patch for the night.

While Curtis and I were eating lunch two blue herons

came flapping along the lagoon shore. They saw us and raised over the trees above us. I winged one and touched the other so that he hovered in one place long enough for me to reload and shoot. I think he, too, fell, but we were able to find only one in the dense growth of young pandanus into which they fell. Coming around the lagoon I touched the shore where two yellow-billed terns were flying about, and got one of them fairly clean. The trip around netted but one male ground pigeon which flushed from some low brush and flew into neighboring woods, alighting on a limb of a pandanus tree. Not having the auxiliary barrel, I was obliged to back off into the clearing before shooting. The bird moved about a little but evidently wanted to keep me within sight.

After Curtis and Mr. Beck, whom I found photographing the booby nestling, had left I hunted about through the various patches of woods. I came upon a male at the first entrance into open ground beneath shady trees. I always stop and look carefully upon entering such places. This bird was on the ground, on a patch of flattened grass (one male skimmed had a craw full of young grass shoots). In the opposite side of this wood patch - about three hundred meters distant - I sat down upon a rock of coral to try some still hunting. The dog acted as if on hot scent. I watched him several minutes before catching sight of a female bird under a fruit tree which has large leaves that turn rusty brown when dead. She was not ten meters away. I hastily retreated to decent range, all the time watching

her and hoping the dog would not flush her. He had followed scent off around a clump of pandanus, however, so I succeeded before he arrived at the game.

During the remainder of the evening I found no more pigeons. Collected two white-bodied boobies. At camp I found an invading army of hermit crabs. I dispersed them rudely by batting them with the machete. This served to form a protective ring of dead crabs about camp, at which I hoped further invaders, including the big land crabs, would stop to eat. I was not bothered during the night save by one hermit that I overlooked. He was hidden in my pandanus wind-break and frequently awakened me.

June 16

My shelter of three coconut palm fronds, held about eighteen inches above the ground by stakes and rocks, served well during the one light shower which passed over during the night. I overslept until six-thirty, but was out before all the boobies had flown to sea. Obtained two or three more interesting plumage phases. The little white terns were about in flocks of ten to twenty above me and the dog as we hunted around. Spent the morning on the new system of still hunting in open floored woods, and obtained four more ground pigeons. One male came feeding along through the dead leaves and scattering herbs, perfectly unconscious of my presence until within two or three meters of me. He stopped feeding to scratch his

head; noticed me as he finished the performance; came over to within one meter; took a good look, and apparently passed unfavorably upon my appearance, for he cautiously but hurriedly moved away some three or four meters, where he hopped up to a low pandanus limb. From that perch he peered at me as I backed off to shooting range. One female came flying through the woods upon my entrance and alighted on a tree branch within a few meters of me. I have forgotten the details of the two, but remember finding them in similar conditions. The last female flushed from a patch of herbs about hip deep and alighted in the nearest tree of the adjoining woods. Another female I flushed from the bushy clearing in the interior. Had a good clean shot, but hesitated to aim low for fear of hitting the dog who was in hot pursuit. Perhaps a little shot would break him of that fox-terrier trick. We could not locate the bird.

This brings our collection of these interesting and rare birds up to forty-three, seventeen of which are females with considerable variety in their plumage phases. Strangely enough, no males were obtained without the fully developed white "bib and tucker", unless the two questionable sex birds are young males. The breeding season is just begun apparently; though some birds were thought to be nesting. One male had a bare abdomen as if he had incubated an egg. Collected a male frigate, having no chance at females; also some terns. Aboard at four-thirty.

Live birds: Bijoe had the live bird cage packed like a box of sardines. We now have no less than thirty-one green

doves in three cages. It will keep us rather busy getting food for them unless we strike another island like Vahanga with plenty of berries. "Kahaia" is the Tuamotu name for plant # 503, which has broad green leaves in clusters at the end of stout twigs, and a large nut of seeds coated with a juicy white fruit, upon which the Maria ground pigeon fed and dirtied his hard boiled front. The first cage of doves has become quite tame, and occasional cooing is heard throughout the night with a set reveille at five in the morning, at which the whole, or most, of the trumpet corps unites. The other cages are still a bit wild. The first night considerable fluttering occurred whenever anyone passed nearby. Last night they roosted peacefully even as I replaced the cabin light beside them. Just what their destination is I do not know. I am for liberating them on such atolls as Tetiaroa where islets can be found free of cats and other enemies to which these birds are unaccustomed. Very likely a few will be caged until death by individual parties. The ground pigeon of Maria died Thursday night; I imagine the diet was insufficient, as he was very poor. Their feeding habits are so varied that it would be hard to keep them alive. We have solved the problem with the insectivorous sandpipers, however, and find that with wing tips clipped they run about the hold and cabin eating cockroaches and ants. Apparently at least three of six are fully accustomed to us, and one finds them flitting about one's legs as one walks through the cabin. In the hold the oldest bird climbs upon the skinning table and all over our sand-meal and flesh boxes and also through

the arsenic pan, in search of insects insecurely secreted.

Yesterday we broke out some cases filled loosely with excelsior and other rubbish, and cockroaches. The little sandpipers caught the nearest roach, and then with it in their bill stood amidst the scampering horde in utter bewilderment. One tackled a full-grown winged roach, which set up a fluttering struggle that quite dumbfounded the piper. The roach was stunned, however, by the pecking and later quieted down, the piper having dropped him in the excitement. It was decidedly interesting to see the bird stalk warily around the big roach and then leave it entirely alone. Have we also solved the cockroach and ant problems? What a blessing, if we have! It adds untold interest to the days aboard ship to have bird friends about one's feet. May their number and kind increase with each journey!

June 17

Lat. $20^{\circ} 50'$. Long. $137^{\circ} 26'$.

Upon coming aboard last evening sails were set and our course taken for the island of Tureia. Spent the day skinning terns, curlew and boobies. We have had an invasion behind the mast of the irreconcilable enemy of mankind - Pediculus capita. They arrived, no doubt, via the sailor on deck snoozing when off watch at the wheel, by or beside the after-sailors. As for me, my last night on Maturei Vavao was altogether too near natives, and I had loaned one my pareu and the others my

blanket. The proverbial viper on the hearth has nothing upon the louse on the bedding. But one must expect such things when knocking about with unclean people. My suspicions, however, were not thoroughly aroused because a species of bird lice is very abundant upon the black terns, and carrying one of those birds in the hunting jacket half a day means an onslaught of the insects. It isn't bad when one is sweating freely about the neck, for the perspiration kills them. Otherwise a soapy head wash is necessary. But Pediculus capita is able to survive soapsuds. Kerosene, though rather harsh, is a perfectly reliable insecticide.

Now that we are beginning to work towards Tahiti, of course calm weather sets in. The long stretch of northwest wind blew itself out while we were laying-to near Actaeon.

June 18

Spent the morning reading and writing letters. In the afternoon I became nauseated from the uncomfortable motion of the becalmed ship. Took to my berth and the Mesozoic - romantic age of reptiles. Very sick of stomach in evening and night.

June 19

Still becalmed and still nauseated. A cup of hot water helped a little. Threaded labels as we gassed in to Tureia, where we arrived between ten and eleven. Went ashore

after lunch. A peculiar break in the reef here where a gradual incline permitted us to get right up to beach, just below which was a bad shelf of foreset formation. Most of the islanders were there to help pull the boat in, a priest arriving soon after. They tell us to expect no land birds here. The land is very nearly continuous. The lads with me say I'll have to wade a channel up to my neck somewhere.

I came along the right hand, counter clockwise, shore-line of lagoon. Flushed a white reef heron and two tattlers the first thing at some fish traps. Obtained only one of the tattlers; winter plumage. Proceeding along the lagoon shore, I got a shot at a yellow-billed tern, but she dropped out in the lagoon and the boys did not offer to get her. Still farther along I got one with a long shot. A flock of six raised at the shot and came over their stricken fellow, five of them to fall. The boys, at my request, waded after them.

The coconuts extend but a short distance this way; then there is a long stretch of open gravel with clumps of flat shrubs and the inevitable Tohunu tree. At one place I have found a series of foreset strata overlapping as those at Scilly, and dipping like them towards the lagoon. The composition of the breccia is almost wholly particles of the elkhorn coral so common in shallow lagoon waters. They are very level-topped on the same level as the present lagoon beach gravel, now sixty meters lagoonward. Slope not above fifteen degrees from horizontal. Went on along this southwest strip of the atoll; like Maria, it is washed

barren. The priest informed us it was done by a hurricane lately; broken tree stumps furnish evidence of its fury, and great blocks of coral transported upon the reef also tell of a high sea. This strip of gravel bank is rather barren of vegetation now, save the patches of Tohunu and young coconuts just recently planted. Followed along until I reached a few scattering old coconuts, from one of which I shot four green nuts. With the dog's greedy help I finished off all of them - nearly four quarts. The ground shrub was very thick here, like that at Marutea where the rail was found; no sign of birds, however.

Returning, I kept to the dry tidal flat and the gravel beach, along which were a few scattering tattlers and two blue and one white reef heron. These I stalked at length, the two blue flying short distances down the reef until finally I ventured an extremely long shot. Uttering hoarse croaks, they flew out above the ocean and circled back. The white bird flushed at too long range from behind one of the large boulders. He flew back along the reef at long range distance, and all I got from him was a series of hoarse croaks. While unlacing my shoes, and just after I had unloaded the gun, two more flew down the reef well within range. One was white, the other mottled with blue. Teiho took the gun and went in pursuit, but didn't bring them back. Mr. Beck arrived with the astonishing information that he had obtained a warbler. They must be scarce, for he saw but the one all afternoon. We are disappointed here not to find food berries for the doves. It may be necessary to pick the scattering

green variety from the ground shrub. The priest informs us that many cats run wild here. There are, nevertheless, thousands of rats according to him. The dog caught one during the day. Tomorrow I shall go at least as far around as the channel, and if it is fordable clear around the island, but will search some for warblers and rails.

June 20

We landed about seven. I struck off to circumvent the atoll. Three lads came along for three miles or so. They were able to keep up with me along the gravel beach and foreset breccia oceanward; but after we had stopped to drink some coconut water I crossed over to the lagoon shore and proceeded through the bush - rather open woods of pandanus and the fruit tree (+ 503) with not much undergrowth and occasional patches of coconut groves. Along the beach I succeeded in stalking a white heron. He was kept busy by the waves and his fishing, so did not notice me creeping up to the shelter of a gravel bank on the beach. I left him hanging in a tree to save carrying him all around the island and probably getting him all bloody. Saw a frigate bird. White terns not overly abundant, but occasionally observed. Tatlers scattering along the reef. A yellow-bill tern flying along just at the verge of the reef. Have been calling for warblers at frequent intervals, wherever conditions seem favorable, but without results. Along the ocean beach foreset strata of breccia are very prevalent. Am now about opposite the point reached yesterday.

Proceeding along the lagoon shore, I shot a yellow-billed tern which was perched upon a rock out in the water. Seeing me it took wing, coming down shore. I called it inland for the shot, but the wind carried it into lagoon and drifted it away from shore. I went on a way before hearing voices behind me; turning about I saw the boys undressing (what little they needed to) prior to going after the bird. They threw a rock at a shark before entering the water.

Seeing a patch of woods that appeared to be thick enough to harbor warblers, I entered it. After calling a short while I was rewarded with a light "suck". The bird was in the tree above me. Encouraged by this success I called at length, but had no further luck. However, when the woods looked propitious I deserted the easier walking along the beach and waded through the undergrowth. Heard no more birds until I stopped to rest quite a while afterwards. Then heard another warbler singing their typical song. I had to go back somewhat to get him. Found a small group of lesser noddies in some tall trees and collected a couple. A little farther on I came to three huts on the shore of the lagoon, inland a short ways. Found there a small brackish well. Being a mass of sweat above the belt, I stripped down and bathed. Washed out my shirts and now am enduring innumerable flies while they dry. Am not yet half way around the lagoon and it is getting well along towards noon.

This is no small atoll, being perhaps a mile or two

farther around than Maria. I am hoping all channels will be easily fordable so that I can go on around and not have to come back this long route. The land here is less than one fourth of a mile in width. Two more side excursions netted me three more warblers. The auxiliary failed to injure two others well within range; and had no effect whatever on a cuckoo very close by. He and two warblers alighted in a flutter in a small tree beside me as I was whistling warbler-like. One warbler, then the cuckoo, and behind him the other warbler. Later, while again calling warblers, I heard another cuckoo. By whistling upon entering a patch of woods I have twice had birds come flying to me from distant trees, stopping two or three times en route to whistle a bit themselves. Others I have seen hopping about quietly, or making a very light sucking noise. Am perhaps past half way around the atoll, but it is also past noon. Very hot and flies very pesky.

At last I rounded the southernmost bend and commenced along the south southwest stretch. Stopped for a coconut drink, and while refreshing upon it heard a warbler. Calling brought him into coconut trees overhead, but was unable to get an auxiliary shot. Killed him on the wing but was unable to locate him, the dog being altogether too hot to work. With the walking cane I struck out madly along the beach. After a mile or so I realized that nothing but straight and strenuous walking would get me to the boat before dark. Deciding that hunting was more important than racing, I left the beach and entered the woods.

Two warblers were the result. Saw another cuckoo while calling. One warbler came into the pandanus leaves but a few feet from me. An old bird later observed feeding the full-grown youngster; obtained both. The shell shot at the cuckoo hung fire and he escaped.

Proceeding through the woods, I soon came to the first channel which I had to ford. Now commenced a series of small motu and cross washes with channels from lagoon to the edge of the tidal flat, where I have succeeded in jumping all but the first one. While out around the last channel passed this evening I flushed a white heron. He circled about me well beyond range and alighted. He flushed the minute I started for him, and again circled about. I fired at long range but missed. He croaked a bit and another along the beach also croaked. He again alighted not far behind me, but flushed and away when I started toward him.

I was starting in towards a motu when I heard a strange, weird cry come in from the reef, with only one note to it - a high, resonant "Äh!" It was repeated several times as I went towards it. Then came another note which identified the curlew, which was just visible in the dusk. I obtained him with two shots. Went along a rather unusually long motu beach, and swung around the edge of it until I found a dense cluster of pandanus leaves low against the ground. To leeward of them I curled up for the night - a little hungry and a little cold,

but satisfied that the island would be hunted and not raced over. Had an uneventful night, save for the times when thorns stuck in me or rocks became uncomfortable.

June 21

Went back into woods and obtained a warbler the first thing. No others heard here nor in the next series of low and small motu. They inhabit the larger trees where insect food seems more plentiful; they feed from about the leaves a great deal.

Though I visited every motu, I was unable to find anything more of warblers or other birds, for that matter. (Last evening after shooting the curlew and when it was rather too dark for good shooting I succeeded in stopping a rat which was running across the dry tidal flat. Evidence that part of their feeding is done out there.) After crossing a few dry washes, some of which were only dry owing to the extreme lowness of the tide at the edge of the tidal flat, while others still trickled across into the lagoon from the flat, I came at last to the coconut trees where I refreshed before turning back Monday.

I then struck out for the village along the lagoon until the curve was reached; there I crossed over to the fore-set pavement, or concrete, which, though rough, was solid footing. Once or twice I was forced to take to gravel beach. Being

rather leg weary, or else lacking fuel for the engine retarded progress. Along here I saw one blue and two white reef herons. Again heard the weird call like an "explosive twang" ending in a whistle, of the curlew. Obtained a long shot but failed to drop him. A few scattering tattlers down the reef and tidal flat. Also two lesser noddies, one of which I obtained.

The boat was at the west landing, around the point on which the village stands, owing to easterly wind. Left birds and purple berries, which I had found growing only at the further end of main motu, just before reaching the channels, in Beck's camera bag and walked on to village where I found the boys, Curtis and Beck photographing. Made up for lost meals on a can of salmon and some biscuits salvaged from some given the priest. Beck to ship with birds for skinning, after getting a picture of me lunching before the crowd. I went on down the island beyond the coconuts in search of warblers (Beck obtained six or seven here yesterday). Half a dozen kids commenced to follow me, so when just beyond the main coconuts I lay down and feigned sleep until they left. Then I went on. Very thirsty all morning, the dog and I having drunk five good nuts since leaving the village. They brought no grub ashore for me; but I have one biscuit and some salmon left. I don't feel much like rambling around any distance but hope to find warblers by calling all along the bush. A few white terns flying above the trees. Obtained a white reef heron returning along the ocean beach.

June 22

Vanavana

Had a severe attack of stomach trouble last night about midnight, and again this morning after coffee. Fortunately we were away from land and becalmed, not getting ashore until after an early breakfast. What a difference in the bird life on two islands within thirty miles of one another! This has been planted recently - four or five years. A few natives now residing here greeted us at the long shallow reef landing. Some unusual tall trees attracted me. Boobies and white terns were about them, the former nesting. The warbler, also, was heard in several numbers but was unobservable in the high foliage. Obtained three, however, between these isolated trees and a grove of similar ones; also the sandpiper. Sickness is forgotten when birds become abundant. Rats are very plentiful from actions of the dog. Lesser noddies also about. A tattler seen at the boat landing. Here's where we get our hundred and a half birds to make up the two thousand for the trip!

The noddies are also quite abundant down the island, especially south of the east channels, or dry washes, where this morning's rain left welcome pools of water. Found the sandpipers true to form in being most abundant along the open land between washes. Came upon another small group of warblers in shrubs and the low ground carpet here. They are more plentiful than at the last island, though not very abundant. Mosquitoes

are here, and from report were so thick under the trees at the last island that the natives slept out on the beach. From the dry washes south the soil has been mostly a fine sand with very few rocks, and along the beach considerable dunes well grown over with shrubs, trees and pandanus. Ferns now join the ground-carpeting shrub, which induces me to call in vain for rail.

This is a very small island, being perhaps smaller than any yet visited. The small atoll with its lake-like lagoon nearly circular and surrounded by a low fringe of trees above a white beach is as picturesque as romance writers would picture the atolls generally. Large ones are not nearly so fascinating. One the size of Tureia, however, where the mirage gives the opposite motu the effect of standing up out of the sea are more interesting than the ones where only the present shore fades into the distance either way. There will be time tomorrow to hunt rail, since it will be easy enough to get sea birds for Saturday. We have heard the sooty tern nearly every night since leaving Marutea but have seen little or nothing of them by day. It is odd that the warblers are not more evenly distributed about this island; very likely families one comes across. Splendid rail territory here, but not a sound or sign of the birds.

My stomach seems all out of order, which kept me from successful hunting today. Beck returned with thirteen ground pigeons - more than I ever got in two days at the other islands;

are here, and from reports were so thick under the trees at the last island that the natives slept out on the beach. From the dry weather south the soil has been mostly a fine sand with very few rocks, and along the beach considerable bushes well grown over with shrubs, trees and pandanus. I now join the ground-sweeping shrub, which induces me to call in vain for rail.

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he says they are very plentiful. Three of the number were young male birds in juvenile plumage. Natives here have been eating them. They have been eight months without food, except pandanus and fish - no coconuts. There are dense woods here of a tree new to the Tuamotu of my experience. We had a hard job to find anything of fruit or blossoms. Curtis, however, found what he says fell from the tree. Growth seems mostly from root suckers. It makes the island odd in appearance. Some trees are large enough for canoes.

June 23

Came ashore this morning after eight. Made a good landing in spite of the inauspicious swells. The boys in launching the boat, however, were driven back against the reef on a point of rocks. Finally they got off and away safely. Went around to where Mr. Beck found the ground doves. They were here in some open bush, with heavy patches of a coarse stalky herb (upon the seed of which they feed) which affords excellent shelter. The dog started the day well, but after flushing the first bird quit work and spent the rest of the day seeking shade. Here was his opportunity and he failed. One cannot expect a bull dog fox terrier to be a bird dog.

Soil sandy from lagoon beach leading over to the mass of loose boulders along the seaward side. A few scattering clumps of fruit trees, but mostly a very dense growth

of coarse stalky herbs, open near the ground and about hip deep. The natives had cleared criss-cross lanes through this, affording good walking. Except for two male birds observed standing (one along a lane, the other beneath a tree) all sixteen of the doves taken here flushed like partridges and were killed on the wing. Very frequently one shot aroused another bird nearby. Once two others flushed. It was very significant that today these birds were very little observed except on the wing. Yesterday Beck found them sitting about, sometimes more than one, on the bushes and low branches of trees. So tame did they strike him that today he sent Bijoe with cage and bird-pole noose to catch some. Bijoe saw but one bird and it flushed and flew. Just what caused such a vast difference in their actions I cannot understand. Certainly it could not have been the two days of shooting. I spent most of the day trying to get thirteen, the number Beck obtained in a very few hours yesterday.

In the afternoon (Beck was ashore in the afternoon yesterday) I came upon the birds in greater abundance, and had the second barrel of my gun been in firing order I would have obtained half a dozen birds which flushed at the first shots. This abundance I then attributed to the particular locality, but it might have been the early evening feeding commencing. The birds when flushed from the low shrubs invariably flew towards the trees bordering the covey on the seaward side. Food seemed to be the chief attraction of this decidedly

of course sticky berries, open near the ground and about 10 ft. high. The natives had cleared out the trees through which they were passing. Except for two male birds observed standing (one along a lane, the other beneath a tree) all sixteen of the doves taken here finished like partridges and were killed on the wing. Very frequently one shot showed another bird nearby. Once two others finished. It was very significant that today these birds were very little observed except on the wing. Yesterday Beck found them sitting about sometimes more than one, on the bushes and low branches of trees. So late did they strike him that today he was not able to catch any. He saw one with a cage and bird-pole nose to catch some. He saw one and it finished and flew. That was all that was seen. Great difference in their action I cannot understand. Certainly it could not have been the two days of shooting. I spent most of the day trying to get thirteen, the number Beck obtained in a very few hours yesterday.

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localized colony in an area of about five hundred meters in length along the leeward side of the lagoon.

I set two tall coconuts as our lunching place, and there met Curtis and Bijoe about noon. Curtis saw one dove beyond, where I had hunted in a desultory fashion yesterday while suffering from stomach cramps. Just after finishing lunch the dog flushed a bird at the edge of the woods in which I was calling for rail. A tree occurs here which has not been noticed for some time. There are large specimens, sixty feet tall, and dense woods in patches well carpeted with ferns. All my efforts yesterday and today got no sound or sign of rail. In hunting the doves I neglected the warblers, only obtaining five. Of sea birds I obtained none, expecting to come ashore in the morning for a batch of them. Picked up a golden plover and a curlew, but was unable to get any tattlers, though several were heard and seen.

High swells having come up during the day, we had a very exciting time getting the boat launched. One breaker reared up and combed over our bow, but we did not ship enough to swamp. Realizing that the critical stage of the game was at hand, all pulled their strongest and we got to safety for the next.

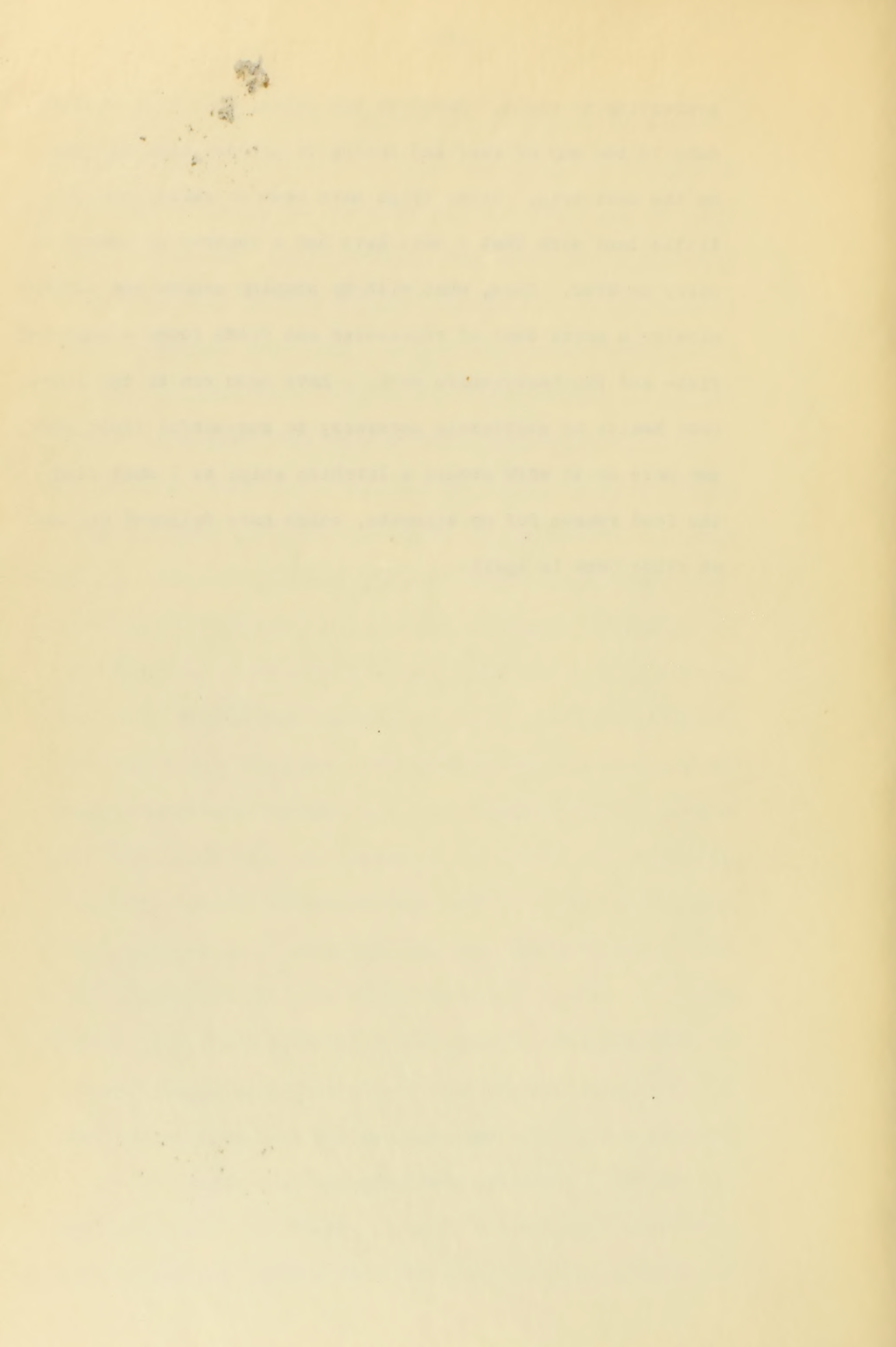
June 24

The swells were so great yesterday that when within a few hundred yards of the ship, and both boat and ship in

troughs, we could just see the mastheads. Today they are worse, and a high breeze added to them makes landing impossible. We had hoped for more warblers and ground doves and sea birds here, one white tern obtained by Mr. Beck having the first tinge of pink in the feathers that we have noticed. Ground doves could well be spared from this bounteous flock for museum purposes, for the handful of natives left here by a typical Polynesian planter to work have been eight months without food save what the sea and island have furnished them. Fish, invertebrates, sea birds and doves and pandanus burs being their entire diet. The old American planters were not in the habit of starving their slaves; but such things as this are the rule in the South Seas - a rule which certainly is ethically criminal, no matter whether law permits it or not. The planters have everything their own way: they offer the natives enticing remuneration and reward, take them to such an island, and leave them to subsist as best they can. The strange part of it is that the natives do better work than is expected of them. The planting here is as regular and systematic as any California fruit orchard. The trees are thriving and seem to have been well cared for since planting.

Again today I have been attacked by severe cramps. Held out until birds were skinned and then took to the bunk for the day. Evidently something has gone wrong with my heretofore invulnerable stomach. There must have been something wrong in my eating - too much sauces, sweets, or possibly

overeating at night. Whatever the cause, something must be done in the way of food and eating to prevent such trouble on the next trip. Other trips have been so short, and so little land work that I must have had a reserve of energy to carry me over. Here, what with my camping ashore and thereby missing a great deal of vegetables and fresh foods - meat and fish- and the heavy shore work, I have been run to the limit. Good health is absolutely necessary to successful field work, and more so to work aboard a lurching ship; so I must find the food reason for my ailments, which have followed off and on since Oeno in April.







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