

Honolulu

Wetmore - Journal

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Sibley

March 10 - Depart Washington

March 27 - Arrive HONOLULU

four trips of a month each - one to Johnston and three to the West Islands

Commander King - Captain of the minesweeper - *Tangier*

MARCH 28 - planning - odds and ends - supplies

MARCH 29 - comments on introduction of birds

March 30 - meeting of 18 people involved in the scientific work

March 31 - Dicky arrives

April 1 - accounts

April 2 - " In the evening Reno and I called on Max Schlemmer who resided on Laysan from 1894 until about 1907 or 1910. He was engaged there as foreman of the crew who gathered guano. He told me that he kept a diary and that the books were on file with the guano Co. at their offices." *He now resides at 1100 Guirick Ave., and is employed as watchman by the American Factories Co., of Honolulu. He has*

" The guano deposits were finally exhausted and the island was abandoned. He described the guano as from one to three feet thick and as containing eggs, of which he had two Sula eggs and many bones.

"He said that in digging in the island he had encountered old deposits of bones at a depth of three feet. On one occasion he (~~word~~ <sup>put down</sup>) from a well 18 feet deep and found bones at that depth.

" A few of the albatross arrive about October 25 each year. Others assemble a few at a time during the succeeding days until by the middle of November all are present. By June the young are mature and all forsake the island save a few cripples that soon die.

" During his early years from 50-60 Laysan Teal were found on the lagoons. He never molested them.

" Other ducks among them 'Canvasback' and 'little black divers' came

Honolulu - Oahu

" in winter and once he killed two Canada Geese and gave the heads to Bryan.

" Rabbits were brought in about 1901. At that time as old photos indicate the island was pleasantly green with vegetation but now the rabbits have destroyed all this growth.

" He also brought in guinea pigs and had hogs there at one time but killed them as they destroyed too many eggs. Cows were brought over but died in a short time.

" Albatrosses were formerly more abundant than now."

April 3 - Completed purchases

April 4 - Depart

Party: A. Wetmore, C.E. Reno, D.R. Dicky (Photographer), D.F. Fullaway (Entomologist, Board of Agriculture), E.L. Caumf?? (Botanist), Dr. S. Ball (Biologist), D. Thaanum?? (collector of marine invertebrates), J.W. Thompson (preparator. expert in fishes, Bishop Museum), C. Grant ("my assistant in ornithology, army major on detached service), Eric Schlemmer (general utility man, son of Max Schlemmer).

went between Kauai and Niihau

"Black-footed albatross were about in small numbers and I saw a few wedge-tailed shearwaters."

April 5 - Nihoa in sight.

" The Laysan albatross appeared here. Many black-footed albatross are about the wake and hundreds of wedge-tailed shearwaters ? over the water. Occasionally we see a tropic-bird (red-tailed), Sula cyanops, a white tern, or Procelsterna saxatilis, Sterna lunata, or a Frigate bird. "

Passed Necker at midnight



Laysan

April 6 - Off French Frigate Shoals.

April 7 - Off Laysan at five P.M. - "At five P.M. we sighted the two coconut trees on Laysan ...."

" It was with mingled feelings that I swept Laysan with my glasses. As we lay a half mile away it presented merely a barren sand island rising a few feet above the water. Two coconut trees that rose in front on a half a dozen low tumble down buildings with a low bush or <sup>tow</sup> at either side were the only signs of vegetations. Birds were everywhere but there was no sight of green. Grave fears for the smaller birds passed through my mind and it seemed inevitable that the Teal, miller bird, rail, Himatione and finch had perished.

"Laysan Albatross passed continually, frigate<sup>s</sup> birds soared over eyeing us curiously with hosts of four species of terns and two of shearwaters passing on all-hand. "

April 8 - Start ashore a SAM with Comm. King, Dr. Ball and Reno.

"Sand had drifted in among them (refereing to the buildings of the guano works) partly filling the porch on the larger one and drifting<sup>in</sup> great heaps had half filled several of the rooms. Two coconut trees in front had in some strange way weathered the brunt of the encroaching sand and stood free through<sup>more</sup> or less bent and scarred.

" Birds were everywhere, four or five Laysan albatross stood on the sand of the porch with a fuzzy youngster half grown at the corner. Hawaiian Noddies rested on the roofs and window ledges flying out with great clatter while the white terns rested on scant nests of Sesuvium stems probably made by other birds or perched about on the rafters or window sills inside. Wedge-tailed shearwaters were everywhere alone or in couples. The desolation of the scene with its appeal of the active bird life will remain long in ~~mem~~ memory Birds were everywhere and true to my

" imagining were unbelievably tame. A red-tailed tropic-bird ? on a nest under a porch chattered at us savagely a protest joined by a group of red-footed boobies in the two or three stunted trees near by. "

" Seals, Monachus schauinslandi, were seen at two points near camp, two pairs, hauled out on the sand. Eric Schlemmer told me that usually when the island had been deserted for a time that seals were found at these points but that as soon as men appeared they left. " -- collected and started to skin animals -- " To our surprise the largest animal was a female and the smaller one a male. Both were fully adult. The female was not pregnant She was distinctly darker in color than the male. The tongue was fleshy and was distinctly bifid at the tip. The stomach of the female contained remains of twenty five of the ordinary reef fishes from five to ten inches long. The intestine was highly convoluted. The animals were only moderately fat." April 9 --- "This morning Grant and I with Mr. Kerr a cable operator bound for Midway who was on board the Tanager, went out and cleaned up the skeleton of the female seal work that required until ten."

plans to visit Lisiansky and French Frigate Shoals next trip  
Necker and Nihoa on third trip.

Dicky ashore King on for visit

"... walked out across the island around the lagoon. Low areas here that are probably flooded after ~~each~~ rains were covered with a mat of Sesuvium, a pig weed like plant that was making a brave struggle against the depredations of the rabbits. The latter hopped or squatted about among the albatross and shearwaters occasionally taking alarm and dashing away to run down a ~~sh~~ hole. ....About 150 to 200 have been killed here since our arrival. All are of large 'Belgian Hare' size and vary in color grizzled grays and grayish browns predominate with numbers of reddish brown, dull black, and blackish brown. All had the abdomen well distended but two or three that were examined were not at all fat though in good flesh. I noted scattered



Laysan

"carcasses of animals that had died before our arrival, The food supply here I take it is practically at a minimum for them. The Sesuvium in damp localities near the lagoon ~~has~~ can spread its root system and produce a few leaves in spite of the attacks of the mammals while the numbers of the latter is held down by the food that the plant can supply. All rabbits seen were adult but Reno found embryos in several females. Their number is without question fixed by the rate of growth of the plant.

" I was greatly pleased to find eleven Laysan Teal~~s~~ <sup>(6 collected)</sup> here and numbers of finches, Laysan Albatross~~s~~, Blackfooted albatross, Wedge-tailed Shearwater and a few Blue-faced Boobies were scattered over the flats. Sooty and gray-backed terns were colonizing and Frigate-birds soared overhead. Flocks of turnstones fed at the edge of the lagoon and I noted many Bristle-thighed Curlew and a few golden plover.

" ~~\*\*\*\*~~ I killed four Laysan albatross. ~~\*\*\*~~."

Fullaway and Caum staying on ship - ashore during day

Ball out to do dredging

Dicky out for medical treatment. - back on 10th

Thaanum on shore

April 10 - referring to early morning " A few Bulwers petrela are about at this time of day but soon disappear."

along north end of island " Terns were preparing to nest along here and in ~~some~~ instances gray backs and love birds had eggs. Turnstones and curlew ran along the beaches. ~~At~~ Turning inland along the sand we came down toward the lagoon. A patch of green proved to be a tract grown to tobacco, an area a hundred by two hundred feet where the scattered stalks apparently proof against attack by rabbits grew two or three feet high. Scattered little plants of the same species were noted elsewhere. Frigate birds and boobies nested in the tobacco. "

*Laysan*

"I noted a second patch of Sesuvium along the lagoon and Mr. Fullaway brought in a plant of a legume Tribulus castoides.

" I collected a series of frigate birds ..."

April 11 - " This forenoon I worked north along the beach to the northern point of the island and then returned along the inner rim.

" At one point there were growths of Scaevola lobelia (formerly Koenigii) barely holding their own. Normally a shrub four or five feet high here the plant merely protruded gnarled and twisted limbs above the sand which had drifted in and covered their trunks. Only those persisted that grew near the crest of the slope that came up from the beach where the sand was blown away from them to some extent. Most of the limbs were bare and denuded of bark. A few still viable produced scant bunches of elliptical fleshy leaveshipped by the rabbits or other agencies. To add to their difficulties a colony of frigate birds were choosing nest sites among their scant branches.

" For a considerable space along here the black-footed albatross was the most abundant.

" There were large colonies of gray-backed terns were beginning to nest among the rocks on the beach. Curlew and turnstone were common and I shot one sanderling."

" Mr. Caum has planted seed supplied me by Mr. Judd of ironwood Casuarina equisetifolia and Milo Thespesia populnea." in message to admir al

April 12 -- " The Black-footed albatross occupies the outer slopes of the island on the northern side almost to the exclusion of the Laysan species. On the east is a tremendous colony of Frigate birds and a large group of Sooty Tern has come in there also. "

\*\*\*I\*returnd\*



Laysan  
Pearl and Hermes  
Ocean Island

April 13 - Captain Dingham and Commander King came ashore --

plans for ships departure tomorrow

"... collected a series of three species of terns including a number of sets of Sterna lunata."

went on board ship for departure

Dr. Ball ( in charge) Reno, Dicky, Thompson and Shhlemmer left on

Laysan with Haig "the colored boy remained as camp assistant and cook."

requested seeds to plant on Laysan next trip.

April 14 - underway

April 15 - Off Pearl and Hermes Reef.

"At seven this morning we sighted Pearl and Hermes reef. We passed close in and I had a good view of Southeast Island which showed a crown of vegetation.

To the westward I was suprissd to note two other islands nearly as large that were covered with vegetation on top.

" Black-footed Albatross<sup>#</sup> came off to us in large numbers. At one time I counted fifty behind us. The <sup>(Red-footed)</sup> common booby was also noted."

stopped at Midway in late afternoon - Mr. Desmoueu - superintendent and Mr. Fraser - manager. Mr. Ker departed.

April 16 - departed Midway - off Ocean Island at ten.

"There was a sand island half a mile long on the eastern side ..."

[ Green Island ] "The entire island was grown with a heavy stand of Scaevola. I noted tracks of a rodent in the sand and saw six seals hauled out. "

stayed only 10 minutes

April

April 17 - Ashore to set up camp with Thaanum, Grant, Caum and Fullaway.

" Six seals were hauled up in sight on the beach and I shot two at once before the animals had been disturbed."

"Grant returned in an hour with the munnified body of a gull found on the south beach that I do not recognize."

*Ocean Island*

Victor, a filipino mess attendant joined <sup>party</sup> ~~paper~~ ashore

April 18 -- "Innumerable rat tracks dot the sand among the bushes and for a short distance below in the open. Four traps set last night yielded three of the animals, small in size slight in body, large rounded ears, sandy gray color, warmer brown than ordinary rats with long tails nearly naked of hair."

"Mr. Hyle took Thaanum and Fullaway over to the large sand island. They found it wholly bare of vegetation with ten seals a colony of black-footed albatross and little else."

"A careful estimate places the seal ~~pop~~ population at this atoll at 40 to 50 animals." "I killed this animal with a neck shot." "I finally managed to get a shot at the youngster without hitting the mother...."

"A hundred yards beyond a female had just given birth to another young as there was blood on the ground and the umbilical cord of the animal was just recently severed. Apparently this is one of the regular hauling grounds of the animals. A remote spot where with protection they may persist We skinned the two taken by noon."

~~"..... and I penetrated to the center of the island."~~  
[Scaevola]

"We forced our way through these \* to the protected center of the island where there were open spaces of irregular form grown with grasses, Ipomea and Tribulus."

"Common and Blue faced boobies were nesting here and the loose sandy soil was absolutely honey combed with petrel burrows. I was continually breaking through up to my knees and walking was exceedingly difficult. I killed eight common boobies in here and decided that with a few sets of eggs and other birds I had a load before I got out to the beach.

"In evening Pterodroma hypoleuca were flying. I killed three before dark and then shot four more on the wing by the aid of a flashlight after expenditure of considerable ammunition."



April 19 -- preparing skins and photographing

April 20 -- "A sloping beach of coral sand from 50 to 80 yards wide led down from small rounded dunes to the water's edge. The dunes varied in height and contour but were all clothed uniformly with a growth of Scaevola heavy on the protected sides lighter toward the winds. On the west and north extends the broad waters of the lagoon on the east and south the reef ~~W~~ approaches closely to the island shore. The water between is studded thickly with heads of coral. There is a long open sand spit to the south and west. A smaller one to the north. Some of the dunes pile up to 25 feet above the beach. Near the eastern part of the island is a level area covering one fourth the surface, ~~perhaps~~ perhaps with sandy soil grown with grasse~~s~~ and creepers, with an irregular outline dotted with occasional clumps of the persist Scaevola. Blue-faced and common boobies inhabit this. It is undermined by innumerable petrel burrows and shore birds run over its surface. High dunes fringe it on the west and north, elsewhere the island is low. The dunes on the west and north extend along that entire side of the island .

" At six this evening Grant and I crossed to the meadow after petrels. At dusk they began to appear and I was delighted to kill a fine Bulweria (later identified as Pterodroma neglecta). As darkness came on Pter. Hypoleuca became common and a good many wedge-tailed Shearwaters came out. When it was really dark the air was filled with dozens of the white-breasted petrels. I shot a good series by aid of the flashlight getting about one bird for every three ~~shots~~ shells."

April 21 --- " The morning was occupied in preparing birds on hand and in the afternoon I collected a pair each of the two species of albatrosses the only remaining species that we had not taken. The bird list ~~now~~ ~~total~~ totaled 18 species not including the gull found on the beach."

pull grass to take back to Laysan for planting

Midway

\*\*\*\*\*(cont.)\*\*\*\*

April 22 - departed at nine

arrived Midway at 1:30 -- Wetmore, Thaanum, Grant, Caum and Fullaway went ashore

" The island that houses the cable station was named Sand Island because of its original bare condition well shown in a series of old photographs. The cable company has worked steadily to improve conditions. Quantities of earth have been brought from down from Honolulu and wind breaks of Ironwood (~~Cas~~ Casuarina equisetifolia) entirely surround the grounds. The main building are of steel and concrete and are four in number with a grass grown plaza occupying the center. Ornamental shrubs and flowers are distributed about and tree lined walks lead down to the water. The whole forms a little oasis of green ~~with~~ which entirely shuts out a view of the sand and is very restful to the eyes. An occasional glimpse of the clear green water of the lagoon gives a pleasant contrast to the grass and trees. A vegetable garden at one side produces corn, peas, potatoes, beans, lettuce, tomatoes and similar crops. It is necessary to screen young plants against the depredations of Laysan Finches. Outside this forested tract the sandy wastes are grown extensively with Scaevole lobilia with occasional reaches of bunch grass and a Juncus said to have come from San Francisco. In some of the older growths Scaevola trees are 10 or 12 feet inches through. With the earth from Honolulu have come all of the usual weeds of Oahu. "

April 23---



*Midway - Eastern Island*

April 23 -- referring to building on Sand Island ~~"The railing"~~ A feeding tray on the railing is visited regularly by Laysan Finches and canaries while Turnstones, golden plover and curlew run about on the lawn beneath and Laysan Rails scurry about in the shrubbery. "

Eastern Island " The island is level with an elevation of only 12 or 15 feet. The broad portion is covered with Scaveola ~~growing in a soil~~ growing in a soil of coarse coral sand with openings leading through it. 16 or 18 donkeys run wild there progeny of a pair brought from Honolulu nearly 20 years ago. " five caught by sailors

"On this island the Laysan and Black-footed Albatross were abundant. Frigate-birds nested in a small colony in company with red-footed boobies and the Laysan Rail and finch were abundant. A sand beach entirely surrounds the island on which I found Turnstones, golden plover and a few Tattlers. Gray-backed and Sooty terns nested in the openings with a few Gygis common noddies and Hawaiian terns. "

April 24 ---" According to Mr. Axelrod the white-tailed tropic-bird is seen ~~but~~ very out here rarely. None have been taken."

"Between 1906 and 1908 ~~he~~ he brought the Laysan Rail from Eastern to Sand Island ~~where~~ ~~the~~ ~~bird~~ The bird is now abundant on both. "

" I was told that two geese with pink feet and bills and gray speckled bodies had come here last year.

" Ducks of two species arrive occasionally. A larger form may be a mallard and a smaller Teal. All are much exhausted in arrival and after a time usually die.

Midway  
 Pearl and Hermes - Southeast Island

" A small owl is seen occasionally as well as a small hawk.

"Mr. A. J. Ker described a web-footed bird, gray, with a knob on the bill. Mr. Glasspole in the cable office in Honolulu has a photo of it. "

went out to ship in afternoon

April 25 -- Underway at five. -- arrived off Pearl and Hermes about two.

April 26 --- In surfboat by seven for trip to Southeast island.

"The island is elongate about 900-1000 yards long by 500 yards wide, rising 15 feet above high water. On the western ~~side~~ portion the beach is of coral sand. Somewhat west of the center there is a tiny irregular lagoon. A bank of limestone, blackened and eroded, joins the southern shore here and extends out in a broad hook to the eastward. The island rises between 10 and ~~15~~ 18 feet at the highest point. Two ridges are covered with clumps of bunch grass one to two feet tall and a sprawling shrub with thick rounded hirsute leaves of grayish green color is abundant. There is a low spot with blackish soil on the eastern portion of the north side that evidently holds water after rain. It was now dry. Near this we found remains of an old camp. "

" When we camped we were astonished to find rabbit dung scattered about and later found the animals fairly common in the bunch grass. Apparently they had been introduced three or four years ago by the crew that had camped there. Indications were that the animals had come from Laysan as they were of the same size and mixed colors. I shot a considerable number and Dr. Wilson more so that we killed 25 before I was out of shells.

"Birds were abundant in this island as shown by the following



*Southeast Island*  
*Grass Is.* list."

" Diomedea immutabilis  
 Diomedea nigripes  
 Puffinus cuneatus  
 Puffinus nativitatis (reported by Caum  
 Pterodroma hypoleuca  
~~Burmeister~~ (young only) Oceanodroma tristami  
 Phaeton rubricaudus  
 Sula cyanops  
 Sula piscator  
 Sula leucogaster  
 Fregata  
 Sterna fuscata  
 Sterna lunata  
 Megalopterus hawaiiensis  
 Anous s. pileatus  
 Gygis alba one  
~~Larus -- (this crossed out)~~  
 Arenaria  
 Pluvialis d. fulva  
 Heteractitis  
 Numenius "

April 27 -- out from ship to visit other islands

Grass Island "It is about 450 yards long by 100 yards wide  
 15 feet high, surrounded by a beach of coral sand. The crest of the  
 island was covered with bunch grass with a few of the shrubs recorded  
 on Southeast Island. About 30 seals lay on the beach. A second sand  
 island of small extent lay just east of it."

"As this island was small we remained here only from 8:40  
 to 10:45. Following is a list of birds seen.

Grass Island  
Seal Island

"" Diomedea nigripes about 800 pairs  
Diomedea immutabilis About 100 pairs  
Pterodroma hypoleuca 1 seen  
Puffinus cuneatus 50 pairs  
Fregata not breeding  
Phaeton rubricaudus 2 pairs  
Anous s. piliatus 20 pairs  
Megalopterus hawaiianis 20 pairs  
Arenaria  
Heteractitis  
Pluvialis  
Numenius tahitiensis "

Seal Island -- " It was also elongate 600 yards long by 300 yards wide rising 15 feet above high tide with a beach of coral sand and a point of limestone rock in the east. The crest was covered with the bunch grass with much of the grayish leaved shrub. There was no sign of rabbits on either Grass or Seal Islands. This Island was much more interesting than the middle one and we remained here until 4:30. "

"Following is a list of the birds seen: (Seal Island).

Diomedea immutabilis 150 paird  
Diomedea nigripes 1200 pairs  
Fregata 80 pairs  
Bulweria bulweri a few yg. seen  
Pterodroma hypoleuca two yg. 1 adult  
Puffinus cuneatus 300 pairs  
Sterna fuscata 3  
Sterna lunata 150 pairs "



Seal Is.  
Southeast I.  
Laysan

" Anous s. 30 pairs  
Megalopterus hawaiiensis 20 pairs  
Larus 1 mummy on beach  
Arenaria  
Pluvialis  
Numenius tahitiensis  
Heteractitis  
Phaeton rubricaudus 15 pairs "\*\*\*\*\*"

April 28 --- rabbit hunt on Southeast Island -- "The number killed today and on the 26th made a total of 90 rabbits. I estimate that perhaps 30 remain. The animals were wilder than on Laysan and usually ran as soon as they saw us. ~~\*\*\*\*\*~~ " collected two seals "About 125 seal have been seen on the three islands explored here and undoubtedly more inhabit the islands in the northern part of the reef. In all I have actually seen 200 seals here and at Ocean Island in the past ten days. Stomachs of two taken contained remains of parrot fish." left at 11:30 for ship - underway at 12 for Laysan.

April 29 -- Off Laysan at two. -- "Reno reported rabbits as very scarce"

"After we left (i.e. earlier in April) with the rabbits gone a sprinkling of green vegetation appeared over the sand but was (severe sand storm) completely wiped out by the storm. Destruction to eggs in the tern colonies was almost complete."

" In the evening we walked out and released 8 Laysan Rails brought from Midway. "

April 30 -- packed specimens -- Dicky, Thompson, Caum and Fullaway returned to Honolulu on Tanager

Wetmore, Ball, Thaanum, Grant, Reno and Schlemmer and camp cook George Haig remained.

Laysan

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May 1--C. Grant, collector of fish for the Bishop Museum, instructed to take one specimen (minimum) of each species. Schlemmer instructed to set out the grass brought from Ocean and Pearl and Hermes Reef, said that the albatross were very curious about and pulled up part of it. Also caught and killed rabbit.

Trade wind blows steadily at about 20 miles an hour with considerable sand flying. It is decidedly warmer here than farther westward.

May 2--The beach sand is much finer now than on the islands at Pearl and Hermes Reef when the shores lay 300 yards or more inside a broad fringe of coral that broke the force of any heavy waves. Here little of the sand was fine and frequently large areas were composed of broken fragments a quarter of an inch across. Here at Laysan the sand is fine enough to drift strongly with the wind. In fact sand here is finer than at Ocean Island in considerable part.

The Laysan Albatross have decreased at least one third in number since I left April 14. Turnstones, Golden Plover, Curlew and Tattlers are in migration. Many Bulwer's Petrels have come in and we collected a series of fifteen from beneath rocks and from crevices in the limestone. Many more could have been taken easily. Practically the entire colony of Gygis have lost their eggs and a number have laid afresh. I collected a series of six.

The ravages of Turnstones and Curlew in the tern colonies are exasperating in the extreme. I can see little hope for the bird colonies here until these robbers pass on northward.

The guano formerly worked here was of two kinds, hard and soft. It consists of the coral sand impregnated with excrement and containing many fragments of bone and bits of egg shell. Some of it is consolidated to the consistency of soft sandstone. More can be crumbled between the fingers and some is simply loose. It varies from yellow to almost black in color and frequently has a strong odor. Schlemmer tells me that formerly they found entire eggs beneath the guano rock.



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The amount of bird bones present here in the sand is tremendous. When the wind sweeps the loose sand from the surface entire bones and bits of others dot the grounds...The majority of the bits are fragments of long bones. Occasional humeri, tarsi, tibio-tarsi, and femora persist with extremities more or less worn. Metacarpi wear well as do culmae and broken radii. Coracoids and sterna and pilves are usually much broken. Bits of crania or upper mandibles are less frequent. All are very fragile. I am struck by the comparison with what we find in fossil deposits.

In the Frigate colony Schlemmer caught two males and after killing them I inflated them and ligated the trachea. The throat sacs were dissected out in the afternoon.

...Our little harbor had a sand beach with no coral. The bottom goes off steeply so that twenty feet out it is six feet deep. The shallow water to the reef is a beautiful clear green, but the deeper water is a deep purple.

May 3--Scaevola lobilia is found along the crest of the hill above the outer beach in some abundance, the shrubs projecting as little points of apparently dead limbs that rise from four to ten inches above the sand. In spite of their dry dead appearance these twigs carry life and are producing little leaves. Many of which have been blighted.

Reno killed a rabbit here last night.

On the slope immediately above the lagoon were innumerable little plants starting from unsuspected seeds. Unless weather conditions prove unfavorable again the vegetation should be fairly extensive here in a month or two.

The albatross have pulled up much of the sand that we have planted.

Two turtles along the beach: One had crawled out to sleep and let me walk up within ten feet to photograph it, though it moved its eyes and finally raised its head.

It did not offer to bite though we touched its head. When turned over its front flippers waved wildly for a few minutes and then it settled down to an attempt to turn over.

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Female; green turtle, Chelone mydas. In progressing hurriedly over firm sand the animal uses the same flapping motion of the front flippers that it does in swimming. On coarser gravel it is restricted to a crawl.

Reno tells me that during the heavy sand storm all of the albatross and shearwaters went out to sea leaving the young albatross to battle the storm as best they might. About one third of the albatross those without young have failed to return.

Today I counted 34 humeri of albatrosses in a space 10 x 15 feet on the summit of a dune. This did not include other bones which were in abundance.

The reef closely invests the entire island with one extensive lagoon.

I found a specimen of Puffinus gravis washed up on the beach today, apparently the first record for the Hawaiian Islands.

Puffinus cuneatus is howling and yowling with redoubled noise tonight...

Grant came in with a Locust crab, a curious flattened beast with flattened foreshortened and greatly modified antennae and no pincers. Its eyes glowed with a bright orange color in reflected light. Crayfish Palinurus japonicus abound on the reef and grow to 12 inches in length. The sailors from the Tanager caught over 75 lbs. one night, sufficient to feed the entire ship's crew.

May 4--...along the eastern tracts. The reef here was joined to the shore and in some places breakers shot high in air at every wave. The wreckage from a sailing ship was supposed to have come from a schooner wrecked six or seven years ago on Maro and Dowsett Reefs.

Small shrubs apparently dead projecting only a few inches above the sand are throwing out a few leaves and little plants are starting over the sand and the Sesuvium patch is prospering. I though I detected a rabbit track in one place and Schlemmer killed one later under a rock pile. ...Reno took another.

I collected a series of immature Frigatebirds and a box of eggs of the Sooty Tern.

May 5--This morning I made a circle of the lagoon returning to camp at noon. This

took



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me through the colonies of Laysan Albatross and Frigatebirds. Kept careful watch for any sign of rabbits without detecting any.

May 6--In the early morning I went out with Schlemmer and collected some albatross and other birds.

At dusk with Schlemmer I crossed to the Sesuvium patch and sat against a pile of rock waiting for darkness and watching the marvelous bird life about me. Wedge-tailed Shearwater were common and as darkness came on Bulwer's Petrels appeared and with soft calls clambered over the rock piles. As they passed I had a whiff of this petrel odor. One came over and looked down my coat sleeve in its search for a nesting burrow. When darkness had come on we went out through the bird colonies armed with our search lights. Shearwaters were present in innumerable hordes and blundered against us at every turn. I had to walk carefully to avoid treading on them. Sooty and Gray-backed Terns turned their backs to the light while Golden, Plover, Turnstones and Curlew walked <sup>l.c.</sup> About uncertainly. Any could be picked up at will. The Laysan Albatross paid little attention to the light but were frightened at their own shadows especially when they waivered or flickered in the dancing light. After some search we found the Teal in a small salt pond and captured four. Going was bad here, as the ground was soft and quivered like jelly but we got out without difficulty. Schlemmer brought in a bag full of live curlew, plover and turnstones which he released in the cabin where they blundered about uncertainly.

May 7--Reno has put out several blocks of poisoned alfalfa near rock piles where the last of the rabbits seem to be hanging out.

Counting birds and walking across the sands here is precarious business as at every ten steps I step into a covered petrel or Shearwater burrow. Schlemmer and I have discovered ;the remains of stumps of 2 palm trees northeast of the lagoon. I have seen these figured in old cuts.

May 8--At the northern end of the island [after morning rain] we found three small

Laysan

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turtles hauled out and collected one for the table. I kept the shell, which was an unusually perfect one as a souvenir of Laysan.

May 9--Gray-backs and love-birds are laying again after having been drowned out during a storm two weeks ago.

Many tiny shells are found in the wash of the waves at high tide and I picked up some beautiful ones. Also found many Ophiurans here.

May 11--No longer any rabbits seen in the three locations (for the past five days).

Reno has used poisoned sweet potato in deep holes in rock that might harbor rabbits and has put out chunks of poisoned alfalfa in areas where rabbits were last seen. We have been hunting steadily for them during the day and toward sunset in the evening. Only six or seven have been killed since my return from the west and only one seen has escaped. We presume that this animal has been killed by poison since persistent hunting has failed to locate it. Growth of vegetation has been remarkable considering the absolutely barren condition of the island when we first landed. Seeds whose presence in the sand was wholly unexpected have sprouted and bits of green are appearing in many places. The Scaevola along the northwestern shore, almost buried in sand, has put out new shoots and has grown many new leaves so that when protected from the wind it looks quite thrifty.

The Sesuvium has grown to a great extent and a new plant, a pigweed like affair with pale green leaves that grows from a somewhat woody stems is coming in among the other plants. Apparently this was a favorite plant with the rabbits as before it was entirely absent. On the inner slope of the island basin toward the lagoon are many plants of a creeper with a heavy two-spined seed. These are barely above the surface now but promise more extensive growth. A shrub along the shore south of camp is also putting out new leaves though the stems appear badly chewed by rabbits. Unless sand storms interfere vegetation should again appear to a considerable extent within the next few months. Recent rains have favored germination.



Laysan

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The sand seems to hold a considerable amount of moisture at all times. The well dug on our first arrival has cleared and is not palatable though somewhat yellowish in color. It was dug six feet deep and has about two feet of water in it.

As I left camp this morning day was just breaking. Most of the Albatross had gone to sea to fish but there was much activity among the shearwaters... Two Laysan Teal waded about for a time in one of the pools [from a recent rain] and then came over and went to sleep in the sun within forty feet of me. A Laysan Finch hopped all about me at a distance of four feet peering up curiously and then coming up behind hitched slowly up the fold in my hunting coat until it reached my shoulder and then startled flew away. Shearwaters were all about. The Christmas Island species sought the shade of the rock piles as the sun came up. Myriad. Sooty Terns kept up their continual clatter while the Hawaiian, Gray-backs, and Noddies in smaller numbers were in the foreground. Behind me the Blue-faced Boobies squawked hoarsely at intervals.

The Sesuvium has a tiny flower that exhales a scent pleasing to the nostrils. In early morning I can sometimes get this odor at a distance of half a mile.

May 12--Grant came in at supper time and reported a large seal, sighted first last night as still asleep... I shot it. The bullet struck it squarely through the spinal cord apparently as the animal merely jerked with the first shock and then was dead save for a faint muscular palpitation over the body. Like others seen it was lying asleep. It had scooped a furrow with its head three feet long and a foot wide to receive the breast and lay prostrate as usual. We rolled it higher on the beach to avoid the surf and in its new position I was able to appreciate the value of the furrow as on the level sand pressure on the breast arched the neck and back vertebrae to an extent that must have been uncomfortable. The animal was a female and very old as the teeth were much worn. The mouth cavity gave off a disagreeable odor when opened. There were a number of scars on the body, apparently from coral. The [lagoon] waters contained a heavy concentration of salt, nearly to saturation

Laysan

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apparently. Cuts on my hands burned from it and as the water dried it left a heavy encrustation of salt in the hair on arms. Brine shrimp (Artemia) were as abundant as I have ever seen them and occurred everywhere in shallow water beyond a depth of six inches and everywhere that it was deep. The northern and southern ends of the lagoon are deep with a shallow shelf extending across the middle. Dr. Ball found 23 feet the maximum depth in the southern end. I was unable to reach bottom with a twelve foot pole in the northern part. The basin was floored largely with a hard limestone over which was drifted more or less sand. Near the shore particularly near the east and north, the side of the prevailing winds were quantities of birds bones lying on the bottom. On examination I found these firm and solid and very well preserved. The contrast with bones lying exposed on the open sand where the sun had full play on them was especially marked, the latter being much worn and brittle so that they frequently crumbled at a touch. Those in the water had been more or less eaten by crabs before their deposition but subsequently had been free from all attack and from decay. Those formed in sand covered at times by the salt water were also well preserved. Such a formation would lead readily to fossilization. It may be noted that humeri, ulvae, tibio-tarsi and metatarsi predominated, with a good many femora, metacarpels and vertebrae and occasional fragments of skull, sternum, or pelvis the relationship on abundance being about as in aviary fossils.

Ball and Fullaway have seen a shrimp-like creature an inch or two long and very swift in movement in the lagoon that no one has collected as yet.

May 13--At Three I walked down the beach to the blowhole. Heavy surf was running and terns' nests all along had been destroyed. d But others are being made. From here I crossed inland to the lagoon for a last look for small passerines and rabbits. The tern colony was of interest as always and I passed to examine many of the young Albatross.

I was interested in comparing a young S. cyanops and a young Fregata, both about



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24 hours old. The former born on the ground was partly clothed in down, had the eyes closed, and though it called and moved about showed no inclination to climb. The latter from a stick nest had its eyes open, was silent and showed a distinct tendency to climb by hooking its head over my finger and by grasping with its feet.

List of Resident birds

Sula cyanops (actual count) 160  
Sula fuscator " " 80  
Sula leucogastra " " 2  
Fregata (count and estimate) 1500 (1377 counted)  
Diomedea immutabilis young 3400  
Diomedea nigripes young 4700  
Puffinus cuneatus (estimate) 77,500  
Puffinus nativitatis (estimate) 2000  
Bulweria bulwerii (estimate) 750  
Phaëthon rubricaudus count 80  
Anas laysaniensis count 14  
Porzanula palmeri (8 others brought from Midway and released) 2  
Sterna lunata (count and estimate 1000  
Sterna fuscata estimate 12,000  
Anous stolidus estimate 500  
Megalopterus 600  
Gygis alba count 80  
Himatione (three seen before storm) 0  
Miller bird (one seen?) 0  
Telespyza cantans 100

I estimate mortality among young albatross at 50% so that on this basis there should be 13,600 adult Diomedea immutabilis and 18,800 adult D. nigripes. I cannot

1. Laysan
2. En route to Lisiansky

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see that there has ever been room for many more. The molting can best be checked by a count at the period when eggs have been deposited.

May 14--Beacon set up for Tanager attracted many Wedge-tailed Shearwater who squalled and groaned to such an extent that I did not get an over amount of sleep.

Mr. Gerril Wilder came off today with a great quantity of seed and seedlings secured through C. S. Judd, Executive officer of the Board of Agriculture and I sent out Eric Schlemmer with him to show him suitable places for planting. Two sailors carried the seed. Following is a list of the material received.

Calophyllum inophyllum--native Kamani 1 gunny sack

Barringtonia asiatica Botong (dn P.d.) 2 gunny sacks

Casuarina equisetipolia Lowland Ironwood 2 pounds

Thespisia populuea Milo 5 pounds

Pritchardia pacifica Fiji Fan Palm 10 pounds

Leucaena glauca Ipil-ipil Haoli Koa 26 pounds

Haematoxylum campochianum Logwood 3 pounds

Ipomea pro-caprae Beach Morning Glory (Pohuehue) 1/2 pound

Scaevola frutescens Beach Naupaka (Naupaka Kahakai, Huahikili) 1 pkt

Hibiscus tiliacens Hay seed 1 pkt

Hibiscus Tiliacens Hay 1 potted plants 9 plants

Hibiscus tiliacens Hay seed branches 40

Mr. Wilder who was in Laysan 18 years ago tells me that he sees no marked decrease in the number of albatross now over the condition then.

May 15--[traveling toward Lisiansky] An occasional Sooty Tern or Laysan Albatross passed and many Black-footed Albatross hung over our wake. Wedge-tailed Shearwaters



Lisiansky

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were common. What seemed to be a peculiarly marked Sula leucogastra appeared about 15 miles off the island and followed us nearly in. The back and wings were sooty, the head was usual but there was a broad white collar entirely about the neck. The bird circled the ship frequently so that I had several good views.

Lisiansky, Urey, A voyage Round the World in the Years 1803, 4, 5, and 6; performed by order of his Imperial Majesty Alexander ;the First, Emperor of Russia, in the Ship Neva. London, 1814 pp. 250-256.

(According to a dedication published previously in Russian)

On the night of October 15, 1805, the Neva struck on a coral bank and on the following morning found a low island a mile to the west northwest. The ship was finally warped off on October 17 and on that evening some of the ship's officers landed on the island, who returned with four large seals killed with hand spikes on the beach. Lisiansky landed on the following morning and spent the day in a survey of the island. Numerous birds were found which annoyed the landing party by picking at their legs and were kept away with difficulty. Seals 7 feet long were seen and it was recorded that at almost every step they sunk almost to the knees in holes dug by birds. Creeping plants and grass covered the soil of coral sand. A high pole was fixed in the ground and a bottle containing an account of the island buried near it. There was no water; turtles were abundant.

"Amongst the birds we saw the most worthy of notice was a species of wildpigeon XXXX when flying at night it made a loud and disagreeable noise."

[Apparently Puffinus cuneatus.] A chart of the island is given.

About ten we sighted the island and came in toward the northwestern side with caution since the original survey for the island had been made in 1805 with other corrections later. The island seemed a barren sand spit save for a dark line along the northern end that might represent vegetation

...We found 4 to 5 fathoms of water over the entrance and practically all the way in to within a quarter of a mile from the island. The bottom was partly coral

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and partly sand. We came in through the southern boat passage and found three feet of water clear in to the beach...The beach sloped gently here and though the first elevation was safe enough it showed evidence of water with storm or other exceptional tides [area 175 yards from the water line] so I deemed it expedient to cross a little depression to a higher slope where a smooth expanse of sand was comparatively free from Shearwater Burrows.

...prevailing winds from the east, southeast or northeast...nice sign of rabbits  
Arrangement was made...to take Reno to Pearl and Hermes Reef and to put him ashore on Southeast Island which he will poison thoroughly to destroy remaining rabbits.  
Insects and plants are so scarce that Dr. Gregory has not deemed it expedient to send out a botanist and entomologist for this trip [also to keep parties small].

The present party stands as follows:

A. Wetmore--in charge

C. E. Reno, Eric Schlemmer my assistants

Dr. S. C. Ball Bishop Museum

D. Thaamum mollusks and marine invertebrates

C. Grant To collect insects for this trip.

G. P Wilder--Federal warden for the Hawaiian Bird Reservations. to inspect the island s and to replace Caum as botanist.

John Baker Native Hawaiian fisherman to assist in collecting fishes, was supposed to make first trip but missed the boat.

L. A. Thurston owner of Honolulu Advertiser conchologist to assist in collecting shells.

Theodore Dranga conchologist and expert diver.

Frank R. Lawrence according to a letter from Gregory  
amateur naturalist and expert photographer.



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Austin Jones friend of Dr. Wilson on the Tanager come for the fishing.

The party landed here for this camp consists of Wetmore, Schlemmer, Ball, Thaamum, Grant Baker with George Higgs as cook. Wilder, Thurston, Dranga, Reno and Lawrence who were ashore for a few hours in the afternoon have gone on to Pearl and Hermes as has Jones.

May 16--Temperature 7:00 a.m. 72°; noon 74°; 6:00 p.m. 73°;

After breakfast I walked around the coast line of the northern two thirds of the island in a preliminary survey. As charted the island seems very accurately delineated. It is roughly a parallelogram a mile (nautical) long by slightly less than a half mile wide. A low ridge on the northeast end marks the highest point and there is a central depression bounded by a raised rim protecting it from the ocean that must in an earlier stage of development have been the basin of a lagoon similar to that at Laysan.

The only vegetation on the island is a narrow strip of grass, and a pigweed of perhaps two acres in total area that extends along the ridge above the beach in a narrow line at the northwest point. Elsewhere the place is absolutely bare. An examination showed that denudation had been due to rabbits as I found parts of skeletons in small number scattered about considerably worn and weathered. Careful examination revealed no sign of living animals so that the statement that the rabbits here ate up their food supply and then perished apparently is correct. I examined vegetation carefully for signs of cutting and looked for dung but found no indication of either.

Wedge-tailed Shearwaters were spread over the entire island as at Laysan and were the most abundant bird. Laysan and Black-footed Albatross were fairly common though not so abundant in proportion to the area available as elsewhere. The grass tract

Lisiansky

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naturally was the focus for bird-life and here I found a colony of Gray-backed Terns, many Sooty Terns, Frigatebirds, Blue-faced Boobies and Common Noddies. A few Christmas Island Shearwaters were scattered about with the other species, Noddies are fairly common and I see a few Hawaiian terns. One love-bird appeared last night and Sula piscator is fairly common. Such is a brief review of the bird-life.

Encountered two apparently gray phase of Wedge-tailed Shearwater. Schlemmer, then Wetmore two others. Altogether four collected and two or three more seen.

Mr. Wilder encountered last night a seal asleep in the grass and Wetmore found same in the morning, "lying on one side in a depression. As I approached several terns fluttered out across it and it raised head and flippers in protest. The skin in these animals seems very sensitive as it reacted to the slightest touch from wing or foot of a bird. I killed this animal with a neck shot and found it to be a young female in full molt on the dorsal surface with the old hair adhering in large patches to the back and new short hair coming in beneath. The animals have a beautiful silvery sheen to the hair when they are just shed.

The teats in the female of this species number four and are arranged at the corners of a quadrangle with the scar of the umbilicus in the center as shown below

They are slight depressions in the skin. In the present animal the posterior ones were approximately 120 mm. apart, the anterior ones 150 mm and the anterior and posterior mammae were separated by approximately 180 mm. Apparently this animal had not moved from its position assumed the night before. The stomach was filled with the fish known as Manini. Digestion seems somewhat slow in these great beasts and from recent observations I believe that when they have secured a full meal they haul ashore and often remain there asleep or resting for as much as two days if not longer. Toward dusk Eric...announced another. [Killed with rifle by Schlemmer]



arrangement  
of mammas  
in  
Monachus

Livinsky

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May 17--Temperature 7:00 a.m. 74°; noon 72°; 6 p.m. 76°.

[Re: seal killed night before] It was a male apparently between two and three years old that had shed into fine fresh pelage. It is much easier to skin these animals when fresh than after rigor mortis has set in as the flippers stiffen so that it is difficult to force them apart because of the near proximity joints to cut on the inner sides. Like all others this animal had the body overlaid by a coat of fat 1 1/4 inches thick, certainly superfluous so far as heat is concerned in this climate. I cut out the heart of this animal with the larger vessels leading from it and preserved it for dissection. The blood is very dark and the heart small in proportion to the bulk of the animal.

Both Laysan and Black-footed Albatross are not overly abundant and, as on Ocean Island where similar conditions prevail, they were rather wild. The Black-footed was especially wary and only one was secured...Walking across the flats is difficult as one steps through a shearwater burrow every ten feet on the average. Conditions are not much better on the beaches as there the coral shell sand does not pack even where wet from the wash of the waves.

...had only to turn my flashlight behind to see dozens of the Sooty Terns standing over their eggs. Frigate birds went past with many Wedge-tailed Shearwaters and occasionally a Bulwer's Petrel was seen.

We came across a huge female turtle above high water mark and Eric turned her over to wait until tomorrow.

We looked carefully through the grass and in half an hour had secured five Bonin Island Petrels. Frigatebirds flapped up heavily and boobies were dazed by the glare of our lights. Terns chattered at us and turned their backs but many did not fly.

Turtles are enormously abundant here and occur especially in certain bays. Algae grow in great patches in quiet sheltered water three or four feet deep and here the animals browse with no enemies save the sharks. As they feed they thrust the head to the surface at intervals for air and then go down again.



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Black spots on land presumed to be groups of turtles...I counted 80 at that point in a distance of 300 yards partly on shore and partly feeding in the water ranging in size from 15 inches to 4 feet long. At certain points 25 or 30 hauled out to lie together close to one another or even with large ones partly covering small ones.

May 18--The water runs out four or five feet deep for some distance off with coral heads in either sides of a little sandy entrance--little waves washed the fine sand along the beach.

[Turtle taken the night before] This animal proved to be a female nearly ready to lay as she contained fifty eggs with the shell and a large number of others not yet covered by the membrane. We found them very good eating. This animal had the posterior margin of the shell smooth. The shell measured        long by wide. I prepared the head as a specimen.

Another killed by Captain Grant had dentations on the posterior margin of the shell and was a male.

Some of the turtles are more or less seared in the flippers probably by sharks. I saw one yesterday of over 200 pounds weights with the front flipper cut off raggedly and the end of the ulna projecting.

The grass plot here contains about 3 acres and is arranged in a long semicircle along a ridge above the beach. With the grass are one or two other plants.

This is the only vegetation found on the island. Apparently roots persisted here until the last of the rabbits died. The grass is extending slowly held down more or less by birds breeding on the tussocks. There are none of the small land shells (Partula) usually found on this vegetation on all these islands but Mr. Thaanum has discovered the dead shells in some abundance in humus held beneath large lumps of coral that have been cast high on the ridge and have been in position for many years.

May 19--Temperature 7:00 a.m. 72°; noon 74°; 6 p.m. 70°.

The island of Lisiansky is highest on the north and west where it rises in a rounded slope to about 40 feet above sea level to the southward it slopes away to a rounded central basin that is encircled by a low rim separating it on all sides from the long reach that stretches to the beach. This central depression is now dry but probably was formerly the site of a lagoon as at Laysan. The island thus may be older than Laysan as its lagoon was entirely filled in.

The soil is sand with a strong infiltration of guano that compacts the earth and stains it brown in many places. On the higher slopes this has formed a firm crust that either stretches as a smooth hardened surface or is eroded in pits. On the eastern side is a low stretch of limestone rock that projects along the shore.

At the southern end of the central depression is the remains of an old camp apparently of Japanese construction. Originally there had been a shed here with a galvanized iron roof thirty feet long by 12 feet wide. One or two small structures stood nearby. The larger structure had now blown over and only a few posts marked the sites of others. About 30 five gallon coal oil tins lay at one side buried in sand with top or sides eaten away by rust. That the camp had been made by Japanese was attested by the method used in construction and by ideographs found on stray bits of board nailed to old rafters. It had been abandoned seven or eight years ago if not longer.

Our camp is located on the western side toward the southern end of the island. On the beach near it was the frame of an old whale-boat. On the eastern side of the island near the south end is part of an old sampan and a ship's dingy. The earth is undermined by shearwater holes so that walking is difficult.

[eastern side] Numbers of turtles were hauled out here, one of them, a female with one flipper bitten off leaving the ulna projecting from an open wound.

Mr. Wildern remained ashore with me and planted a number of Barringtonia asiatica



a tree that is said to do well in the sand.

May 20--Left aboard Tanager--headed out past Laysan.

May 21--Gardiner Island-- two rocks--The summit of the larger one appeared white as snow apparently from guano.

May 22--At the end a small rock was separated from the main mass above this rose a rock 170 feet high with a deep cleft of the center and then a lower peak. The large island was about 200 yards long. According to the pilot notes the rock was inaccessible. Blue-faced and red-footed Booby, Frigate-birds and terns came out to circle about us and among the latter I was pleased to see a few Procelsterna saxatilis.

Down to island in whale boat and surf boat. "At first sight it appeared steep and precipitous and in spite of the relatively calm sea a heavy swell washed the rocky base or surbed up in foaming crests that dashed against the steep walls. Near the base of the great cleft in the main island was a somewhat gentler slope with two large rocks resting against one another at a right angle at the water's edge in one side of this space was a rock ledge a foot wide and three or four feet long. As the surges well in the water came up almost to the ledge and then after two to five seconds dropped down against. At frequent intervals heavier swells broke and dashed up over the higher rocks with a heavy wash. Under the direction of Commander King and Mr. Hyle the surf boat edged in slowly to give opportunity to study the landing. Finally landed Schlemmer, Wetmore, Dranga, Thaanum, Wilder, Ball, Dr. Wilson, John Baker.

...Though the sides of the rock were steep they were eroded out so that progress was merely a matter of climbing up over sides of ledges...

The rock of the island was volcanic in nature and black in color. I noted occasional lumps of crystal in the heavier mass, the crystal seemingly being of calcite as it was soft. The entire upper third of the rock was colored white by deposits of guano.

As I landed I found colonies of noddies with Gray-backed and Sooty Terns and

Gardner Pinnacles  
Nihoa

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searched eagerly among them for Procelsterna. For the first fifteen minutes I was afraid that I was mistaken in my identification of them in the uncertain light of early morning as none appeared. On crossing however to the smaller peak dI was pleased to find two resting on a ledge and soon secured them both.

Tropicbirds nesting below the summit and many blued-faced boobies most of them with well grown young.

Spiders were common under rocks and I saw several large ear wigs. Half a dozen plants of a pigweed were seen but no other vegetation was found. In working about I. thorns apparently from some seed like that of the spiny seed from Laysan but saw no plants that might yield them. (Tribulus cestoides)

The lower reaches of rock where washed by waves were covered with algae with many of the conical shells know as opaki. The animal of the latter makes an excellent chowder...

May 24--This morning at noon we were in sight of Nihoa and toward noon ran up past the high cliffs at the western end to examine Adams Bay which opens to the south and southeast. Steep slopes ran up from the beach to the abrupt cliffs that break to form the northern shore. Three small bights formed the inner face of the bay. A sand beach lay in the western-most which with a shoulder above the middle bight seemed to offer two sites that might be available for camping.

Because of a southeast wind surf was breaking heavily in the bay precluding any attempt at landing. We ran up far enough to see the opening through a tunnel cut through at the eastern end of the island and then turned and sought anchorage in the lee at the western end of the island a little over half a mile distant.

...Commander King, Thaanum, Dranga, Schlemmer and Grant and myself went on to the foot of the cliffs. The rock wall towered from the water's edge sheer to the summit from 370 to 900 feet above. The black volcanic rock at irregular intervals



was cut by the somewhat sinuate seams made by dykes of harder rock from 6 inches to two feet broad that extended vertically by the rock face. At one or two places this intruded material had filled some cavity forming an expanded shield like a medallion. The summit supported by these harder materials was cut in huge triangular indentations. One pinnacle of rounded form and erect position of a suggestive form was known as Ka Ule Na Na Hoa. According to legend in the old days a fisherman lived here who in his family had a daughter of great beauty of form and person. The renown of this handsome young lady came to the ears of a prince of Kauai who came across and requested her in marriage. The old fisherman told the royal suitor to consult the girl's wishes in the matter. She ran nimbly up the steep slopes until finally she came to the edge of the cliff far above the water. Here she paused warning her would-be lover not to touch her or she would leap over. His ardor overcoming his reason, he continued to advance and she jumped to her death while was changed to stone the pinnacle rock representing his erect penis, Ka Ule Na Na Hoa--the male genital erect in a marital position. Another version of the story the chase begins in the eastern Islands and continues westward from island to island. The girl trapped finally on Nihoa the last land to the westward known to the Hawaiians leaped to her death. The remainder of the tale is as above.

Three or four caves have been driven by wave action in the base of the cliffs. As we passed heavy swells rose and fill in them with hollow mysterious slapping and booming in the hidden depths. After landing Grant, Thaanum, and Dranga on a broad rock ledge to search for shells...boat was guided for 60 feet into one of these caverns. The end was barely visible 75 to 100 feet beyond. The water runs from 6 to 8 fathoms clear to the base of the cliff and was 7 feet deep in the entrance of this cave.

On the rocks outside were abundance of the shells known as opeki and a few other. The shell men were landed in three places and made collections of

*Nihoa*

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everything available...Gygis was present in great number, Shearwaters circled past and boobies and Frigatebirds circled overhead. I delighted to see numbers of Procelsterna.

June 8--Party for the third trip:

A. Wetmore

Eric Schlemmer, my assistant

C. S. Judd, Forester and Executive officer of Board of Agriculture. To assist in ethnological work.

A. L. C. Atkinson lawyer. interested in ( ) on Necker.

E. L. Caum Botanist

C. Grant To collect fishes and marine life.

Dr. M. Cooke Conchologist, interested primarily in land shells.

D. Thaanum Conchologist.

Dr. H. S. Palmer Geologist Prof. of Geology, Univ. of Hawaii

E. H. Bryan Entomologist (Bishop Museum)

A. H. Rice resident Bur. of Agriculture out for the trip

W. G. Anderson General assistant. Sailor and fisherman acquainted to a certain degree with Niho

Bruce Cartwright Pres. Historical Hawaiian Society.

June 10--Only one Black-footed Albatross on the stern. Occasional tropicbirds boobies passed and a good many Wedge-tailed Shearwaters seen.

[Nihoa] The island was sighted about 2 p.m. and we were at anchor a half mile off shore at the entrance of Adams Bay at 4:15. T

The sand beach at the western end of the bay was impracticable as heavy swells broke on it every two or three minutes. On the eastern side of the small western bight is what we have called Wilder's landing after G. P. Wilder. Here there is an



Nihoa

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irregular rock six feet across on which I jumped as the swells lifted the boat in. A little overhanging rock shelf sixty feet above the water offered a little protection and a ledge in front of it gave just room for our cots...

Nihoa Island is about  $3/4$  mile long by roughly  $1/4$  mile wide. Adams Bay, The only break in the great precipices that form its sides lies at the center of the island and opens to the south and southeast. The bay consists of three bights. Our landing was made at the inner point on the easterly side of the middle one and our camp is located at the northeast corner of this same bight. The hill slopes rise steeply inland from the bay. Three main valleys divided by high sharp ridges drain into the three bights and small secondary valleys in addition may be traced in the two eastern sections. The rock of the island is entirely volcanic with the dikes examined previously on the western face exposed in many places. The steep slopes have considerable soil though it is shallow and contains many rocks. Vegetation is abundant.

A woody stemmed shrub, a goose-foot with leaves and inflorescence of a Chenopodium is most abundant and covers great areas. It grows from one to three feet high in the average, reaching 4-5 feet in sheltered corners. What looks like a Suphorbia is found on the higher slopes and bunch grass occurs in the sides of some of the steep ridges. There is a small amount of a woody stemmed legume, a small lily, a pigweed and other plant. In the eastern and western valleys are small groves of the Nihoa Palm (Pritchardia) growing from 6 to 30 feet in height. This palm has a swollen base, a slender trunk that except where twisted by wind is straight and an expanded head with broad fans and an abundant supply of round seeds as large as a hickory nut. These trees grow in small clumps on the sides of the slopes in several spots high up or in small ( ) spaces in the bottoms of the valleys. There are probably 200 or more of them. I noted many sprouting seeds in the soil. Found Nihoanfinch and a Tatare.

In the eastern valley I found water of poor quality at several points. It

*Nihoa*

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was flavored strongly with guano but would serve for consumption in a pinch.

Several small pools were noted in the valley and one trickle of a few drops was located in a small cave high above.

Gray-backed Terns were nesting abundantly over the slopes with many Noddies and Sooty Terns. Red-footed Boobies were common, with occasional groups of Frigate-birds. Wedge-tailed Shearwaters and Bulwer's Petrels were scattered everywhere. With an occasional Blue-faced or Common Booby these made up the bird life of the island. I collected a small series of finches a few Miller-birds and some other things.

In the old village site in the eastern valley I picked up a fine stone calabash entire and part of another.

Insects are abundant, among them blowflies which do not occasion much trouble.

June 12--This morning we worked along the ledges to the sand beach in the eastern bay where I collected a number of Necker Island terns. This sand beach is about a hundred yards long and slopes gradually. Waves dash on it heavily so that it makes a bad landing while with heavy surf it is swift almost to the base of the rock. Some logs of driftwood have been cast on the beach and there is a cave into which waves enter at the outer end.

...The western face breaks sheer in the huge pali examined from the ship...Opposite our camp is a small cave merely large enough for shelter for one man that has been occupied by a Japanese within 18 months. Two old wooden buckets, remains of a bed of grass, the inevitable bit of bamboo, and a bottle or two containing soya sauce were evidences of the nationality of the occupant. Above were remains of birds used as food.

June 13--...and climbed to the summit of the central valley. From here I worked along the edge of the precipice to the eastern valley, descended through the ancient village and then returned to camp at noon...The huge black wall descends sheer



*Yehoa*

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to the water below rising in jagged peaks that form fantastic outlines. Below made out shallow points on the ocean bottoms. Terns, Frigatebirds and Shearwaters swing back and forth overhead.

At one point the edge of the cliff receded somewhat offering a steep slope down which we climbed and collected a few white terns. The cliff dropped sheer for 600 feet below us. Finches twittered about us and evidence of their work on petrel, shearwater, and tern eggs were evident all about. The number of eggs that they destroy is enormous.

[Second party to Necker] [Remaining: Wetmore, Schlemmer, Cooke, Grant, Thaanum, Bryan, George Higgs as cook]

June 14--This day I devoted to exploration of the eastern portion of the central gulch. Along its lower portion were several small pools of water strong with guano washed from the rocks above but still fit for drinking if boiled and filtered. Finches swarmed in the bushes about these and I saw a good many Miller-birds. Gray-backed and Sooty terns were scattered along the slopes, noddies nested on the rock ledges and I passed occasional groups of Red-footed Boobies and Frigatebirds on their nests. Wedge-tailed Shearwaters were everywhere under foot and I found numerous Bulwer's Petrels. Red-tailed Tropicbirds scolded at us from little caverns.

We continued the ascent to the summit of Miller's Peak which is given as 903 feet above the sea. The steep slopes were covered with the woody stemmed Chenopodium with areas of bunch grass below the summit. Occasional lilies and clumps of Euphorbia were seen. The peak rose abruptly in a pinnacle of rock that was sheer on the north and west but that could be scaled easily from the south. Below the peak on the west was a huge cleft that separated it from a point to the northwest nearly as high. The cleft descended steeply between two high cliffs its stony slopes covered with nesting noddies, boobies, and sooty terns, while love birds hovered on the shelves above. After a steep pitch of 400 feet it dropped over a precipice into the sea. A winding ridge led out to the second peak from a small flat in the very summit of the island. It was astonishing to find this flat occu-

ped by a small colony of Black-footed Albatross. Accompanying them were many Blue-faced and Red-footed Boobies.

The summits of the two peaks were occupied by cairns of rocks built up in rectangular form to make platforms to 8 feet square with level surfaces strewn with fragments of coral. These may have served as watch towers or may have been used for beacon lights to guide belated fishermen to the island or--most entrancing thought of all--they may have served as light for the guidance of pilgrims returning from homage at the shrines of Necker, many miles to the westward.

From these high points I had a wonderful view of the island. The great triangular hill at the eastern end was visible as a huge majestic pile, sheer to the north and sloping steeply to the south. Below the irregular hill slopes was the small indentation of Adams Bay with the projecting peninsula on its western side. To the west and north the rock walls dropped sheer for hundreds of feet to a sea that appeared broken merely by slight ripples from this altitude until I noted the white froth of the huge breakers thrown up in impotent force against the bases of patches indicating shoals were clearly visible and alternating with shifting purple cloud shadows...

June 15--...to the eastern valley. There is a shelf 50-100 feet wide that extends above the water line from the sea itself to the base of the cliffs. This is washed frequently by the larger waves, above this the cliffs rise from 60 to 125 feet with a series of slanting ledges above along which one may work without great difficulty.

The Necker Island Tern was common here and I collected a small series. Gray-backed Terns nesting in little groups, Wedge-tailed Shearwaters and Bulwer's Petrels were breeding everywhere and I located a few small colonies of Sula leucogastra.

Several pools of water in the little valley were strewn with guano. At one



side of a small cave was a tiny pool of perfectly clear water and I was astonished to find this sour and bitter with mineral matter, wholly unpalatable and without special treatment unsafe to drink.

June 16--Census of the bird life of ~~Hinea~~ *Nihoa*

Diomedea immutabilis 2 birds

Diomedea nigripes 60 pairs

Puffinus cuneatus 15,000 pairs

Puffinus nativitatis 20 pairs

Sula leucogastra 50 pairs

Sula cyanops 125 pairs

Sula piscator 3,000 pairs

Fregata 5,600 pairs

Sterna lunata 5,000 pairs

Sterna fuscata 6,000 pairs

Anous 2,000 pairs

Gygis alba 4,000 pairs

Procelsterna 800 pairs

Telespyza ultima 800 individuals

Tatare 100 individuals

Nihoa at one time supported a considerable human population considering its size. In the eastern valley are 30 or 40 platforms a part of which served for houses and a part apparently for other purposes. These have been built up of stones often as heavy as a man can lift from three to fifteen feet high on the front depending upon the steepness of the slopes on which they are placed. The front and side walls are perpendicular with the stones nicely fitted together leaving only comparatively small chunks between. Earth filled in above gives a comparatively level platform. In some two stones two feet apart at one corner against the hill seem to mark the doorway of a grass hut. In some are stones three to five inches in diameter and 18 to 24 inches long set upright usually

four together in a quadrangle. These may have served to support storm bowls or may have been the supports of tables. On one of these platforms perhaps the site of a (hēiau) there were two upright stones a foot across the face and four inches wide, two feet tall standing six inches apart. The platforms range from 4 X 6 feet to 10 x 15 feet in area. Some stand out boldly looking out across the valley toward the sea. Certain hill slopes here have been terraced with stone work for considerable areas to make bunches four feet wide and often many feet wide that seem to have been used for cultivations probably of sweet potatoes. Along the two main ridges dividing the three main valleys are little stone enclosures that may have been heiaus or may have served as watch towers. Small platforms overlooking the valley toward the sea, others with closed walls guarding temple secrets, terraced fields of sweet potato or taro with stalwart Hawaiians climbing up and down the slopes with here and there a lookout on a commanding point on watch for schools of fish, caves drawn on the rock ledges below where a dozen men might seize them and waiting a favorable instant launch them in the surf. Such is the picture we may bring before the mind of ancient life in these valleys.

Though some of the peoples may have been transient here the terraces for cultivation would indicate a considerable period of residence for some at least. The fair preservation of the walls would indicate that the valleys have been occupied within from 300 to 400 years. Water must have been a problem met perhaps by some method of impounding the winter rains in the lower courses of the drainage valleys. Bird life in those days must have been confined to the patis save for petrels and terns that nested on the cliffs, the miller bird that hopped about in the clumps of bushes and other finches that came in friendly fashion about the houses. Now grass huts have disappeared and platforms and terraces aloke are masked by heavy growths of low bushes. The sea birds have



Nihoa  
Necker

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come in to their own and nest in every available space over the rocky slopes.

At the base of a high platform to the west of the main clump of palms in the eastern valley I found a stone bowl about six inches wide and twelve inches high.

Grant found two other near here one 10 inches high by an equal breadth and a flat stone pan that may have served as an evaporator for salt.

Cooke and Thaanum discovered three bowls in a cave at an elevation of 500 on the eastern side of the most eastern valley. Two of the bowls were of the high type and one nested within another with these was a piece of perforated wood from its form apparently the yoke of a boat rudder.

June 17--Necker...appearing as a square block of rock rising from the ocean.

Landing was made at a rock ledge on the western of the northern peninsula where there was a high ledge at the base of the cliff with a depth of 7 or 8 fathoms of water. The peninsula offers a lee from the north and east and though there is much rise and fall of surf the boat rides free as the rock face is sheer. Found A. L. C. Atkinson in camp here with Andersen in a small basin at high tide level. The cliff rises steeply here but with a series of ledges some with a slight overhang that offers shelter. Climbing is steep but not difficult.

June 18--The "trail" led up a cliff with steeply slanting ledges with many overhanging rocks. Care is necessary in climbing as the (st m) is often decomposed so that comparatively large masses sometimes break away with the weight of a man. Sooty and Gray-backed Terns were everywhere, Frigatebirds were common and on the summit were many Laysan Albatross, Blue-faced and Red-footed Boobies.

There was comparatively little soil on the knoll and plant life was confined to a Portulaca and a shrubby legume. Spiders abound, there are Dermestid and other beetles, moths, Lycaenid butterflies but apparently no blow flies.

The summit of the hill was given over to large platforms of old heiaus.

Flat spaces had been made by building up a foot or two where necessary and in some cases were partly enclosed by low walls. The largest was 15 x 30 feet. Along the northern and western borders blocks of stones two to four feet high a foot to two feet wide and six inches through were stood on end at distances of from two to four feet. In general these blocks were rectangular. One, two or more were placed in the center or at some other point within the enclosure. One or two were of rounded form and were water worn apparently brought up from the beach.

June 19--Today I worked farther out along the slopes of the island finding them rough and rocky with slight soil and little vegetation. Colonies of Red-footed and Frigatebirds wherever there are any shrubs, Blue-faced Boobies and two species of Albatross are distributed over the higher slopes. Sooty and Gray-backed Terns are everywhere.

The summits of the hills are occupied by heiaus of the type previously described: the erect stones face indifferently on all sides but nearly always toward the open sea.

The relative fearlessness of birds here is interesting. Noddies are alert and fly before danger is near. Gray-backed and Sooty Terns are more fearless but still are difficult to catch. Albatross, frigatebirds and boobies are indifferent to our presence. The hosts of terns are the dominant fraction of the bird life. Wedge-tailed Shearwaters are common but not abundant. Bulwer's Petrels are in evidence only at night, when they circle about our camp.

The sides of the island are more or less sheer and to visit the various rock platforms at the water's edge requires considerable labor in climbing about.

June 20--Necker Island is a huge rock that rises in 5 more or less well defined peaks connected by low ridges with a 6th point, at the northwest set off and



almost separated from the main mass. A rock lies off the southern end of the island. The slopes are steep and in some places precipitous though in most parts by careful choice of routes it is practicable to climb up or down along small ledges. The rock is decomposed and care is required in choice of hand and foot holds. Soil is scant and there is little vegetation. Slopes everywhere are covered with the excrement of birds but not in sufficient volume to make it profitable to gather guano. The peaks unstained lie in one long somewhat curving ridge that at the north end partly encloses a small bay. This bay at the present season is on the weather side and landing is made on the western side of the northern end. Here there is a broad rock ledge and at the western end where this ledge joins the main cliff boats may be laid broad side to even in heavy swells when by fending off with boat hooks they will ride clear, rising with the swells and dropping as the water recedes, carried out by the back wash. Below at this point the water is deep and there are no dangers.

There are numerous clefts and caverns on the sides of the hills but none are extensive. The stone platforms in the summits of the hills are the most interesting feature of the island. Today I saw two that were at least 70 feet long by 25 broad. In the ordinary form these are perfect rectangles with a platform of stones a foot high and three or four feet wide along one of the large sides. The larger and more prominent upright stones stand at the back of this. Other upright stones may be ranged at three or two of the other sides. To my mind these are all temples. I see no indication that Necker has been regularly inhabited and believe that people came here for worship at certain seasons of the year.

Four or five turtles haul out on the rocks of the little bay in early morning. I see others from the cliffs swimming in the water. Sharks and other fishes are common also.

Necker  
French Frigate Shoals

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June 21--[Tanager] The afternoon was occupied in making soundings to the southeast of Necker in search for a shoal which is charted but which seems to be non-existent.

Anderson today climbed to a cave on Necker and dug out a very curious implement whose use is problematical. It is a T-shaped form with a hook at one end. King suggests that it was used in repairing nets. It was of rather coarse grained stone but was smoothly worked.

June 22--[French Frigate Shoals] ...went around the northern end into the lee on the south passing near the rock and continuing in to what is shown as the main island. We went over to this at eleven and I was greatly disappointed to find it much smaller than is indicated on the charts. It is elongated, slightly curving in shape and according to an accurate map made by Judd 1890 feet long by 400 feet wide at the widest part. On the chart it is shown as over a mile long.

The reef extended along the southern side so that the surf boat was forced to detour through a break to get in...

The surface of the island is coarse coral sand with many fragments of large shells. It is filled with shearwater holes and toots.

The party here consists of Judd, Thaanum, Grant, Anderson, Schlemmer, Wetmore and George Higgs, colored cook. Palmer, Bryan, Caum and Cartwright work from aboard ship.

...We visited a small sand spit a short distance east of East Island as we have called the island on which camp is located but found it a narrow elongate island 60 yards long by 10 wide, merely a ridge of sand rising 5 feet above the water and evidently swept. A few Noddies rested on one end and I killed one Hawaiian tern from a little flock that swept past.

We continued from here northeast nearly to the end of the reef and then



French Frigate Shoals East I.

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turned back and ran across to another sand spit 100 yards long by 30 or 40 feet wide. This was also bare of vegetation being simply a ridge of coarse shell and coral. A short distance beyond was a circular island 100 yards in diameter rising 8 to 10 feet above the sea. The higher portion was covered with plants of four species. A grass, Tribulus, Portulaca and a fleshy leaved spreading plant. There was the boom from the mast of an old schooner here and evidence of a camp some years ago. Bird population of this island was as follows.

Diomedea nigripes 90 young (no adults)

Anous 150 pairs

Sula cyanops 30 pairs

Puffinus cuneatus 50 pairs

There are many coral heads just awash in the lagoon here and shoal patches all through. On the average the water here ran from 4 to 7 fathoms.

Anderson tells me that formerly on Fanning Island the Gilbert Island laborers in making their labor contract specified that each man was to receive 2 birds (i.e., boobies) per day as part of his ration. The birds (*S. piscator*) are captured at night from their roosts in the coconuts and that care was taken not to disturb the nesting birds. The practice has now been discontinued. He tells me too that ducks come in large numbers from October to January to Fanning and Washington, northern migrants that appear each year.

...He knows of no seal in those parts nor did he find any on Johnston.

Captain Ingham is certain that he saw a seal in one of the caves on Nihoa.

June 23--Today was occupied in a survey of East Island as we have named the islet on which we are camped. The island rises from 8 to 10 feet above sea level and supports seven species of plants. Vegetation is not continuous over the surface, but grows in mats with little gaps between. The beach is narrow and rather steep.

French Frigate Shoals  
[East = King?]

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Bird population is as follows:

Diomedea immutabilis 100 pairs

Diomedea nigripes 75 pairs

Puffinus cuneatus 1750 pairs

Puffinus nativitatis 2 pairs

Phaëton 4 pairs

Sula cyanops 150 pairs

Anous 400 pairs

In addition about 20 Sula piscator and half a dozen Fregata roost here at night. Gygis and Sterna fuscata pass in small numbers and curlew. Turnstone and Golden Plover range in small numbers in the beaches.

At one point there is remains of an old tripod of timbers and below it a three inch iron pipe driven in the sand with a boxing of wood around it. Not far away are two portions of masonry of large fire-bricks held together in two blocks three feet square by 6 feet long. The bricks are old style flat bricks and the masonry is apparently ancient. The two masses now lie on the beach. The use of these is problematical.

The island has been much larger but has been cut away by storm.

A gentle trade wind blows steadily and one does not feel the need of shade. Shearwaters, Blue-faced Boobies, Noddies and young albatross are all about our camp...Shearwaters here are still mating and at nightfall gather in large numbers to moan all through the night.

Judd has planted the following on King Island.

50 cuttings of Hibiscus tiliaceus (Hau)

8 sprouted coconuts

seed of Haematoxylon campichianum Logwood

seed of Thespesia populma Milo



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Seed of Casuarina equisetifolia ironwood

Seed of Pritchardia pacifica Fiji Fan Palm

Seed of Pritchardia gaudichaudii Hawaiian Lob Palm

Seed of Livistonia australis Australian Fan Palm

Seed of Calophyllum enophyllum Hawaiian Kamani

June 24---...We made a cruise to the eastern sand islands in the lagoon of which there were two.

The first and most northern of these was a curving sand spit,  $1/3$  of mile long and from five to 150 feet wide. At the widest point there was a small area 19 feet above sea level and here were a few scattered plants of Portulaca. There was no other vegetation on the island. From this wider point a long curving spit ran out to the north.

Three or four turtles were seen one with a front flipper missing. The beach was of coarse shell and corals. Very few shells were found.

About 10 pairs of Sula cyanops bred here and now had well grown young.

The island was given its name from fond memories recalled by an empty Gordon gin bottle that we found cast up by the waves.

Little Gin Island which lay about 400 yards south was approximately 300 yards long by 100 yards wide in its main part and 10 feet high at the highest point. A slight depression at the summit 50 yards across was grown with grass, Portulaca and another plant and was occupied by a colony of birds. Toward the north a sand long and narrow extended for 250 yards. At one end of the island we found a nest of turtles eggs with developing embryos.

On this island I recorded the following birds:

Diomedea nigripes 150 young

Anous 125 pairs

Puffinus cuneatus 20 pairs

*French Frigate Shoals*  
[Shark, others]

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Sula cyanops 8 pairs

...through the lagoon to Round Island and then on to two small islands to the westward. We examined these in passing and then turned down to the largest of the western islands.

The lagoon on the average in this western part ran from 3 to 5 fathoms, but was broken by many coral reefs and heads over which there was often only 6 or 8 feet of water and which in some cases were nearly awash. The water was calm with only a slight ripple on its surface.

At the western island we had some difficulty in getting through a small offshore reef and finally went aground on sandy bottom at the northern end of the island.

Camp was located on a stretch of fine coral sand adjoining the vegetation on the southern end of the island.

June 25--Large rays, known here as diamond fish, seem fairly common here...

At one end of the island we discovered a cache in which a hammer, saw, nails, ship's compass and other similar articles were wrapped in a sail and thrust under a log. Nearby were stakes and other refuse from a camp evidently of Japanese. Apparently the wreckage of some wrecked sampan had lived here for a time and had been taken off perhaps 18 months ago. The time that had elapsed since the camp had been abandoned was indicated by the condition of the canvas, etc.

In the afternoon we visited a little sand spit a mile and a half toward the northwest, the most distant land in this direction. The island which we called Shark Island was of curving form, narrow, 200 yards long by 15 yards wide at the widest point. It supported no vegetation and the only birds on it were a few noddies and Hawaiian terns resting here for an hour or so and a Frigatebird or two.



Specimens shot had to be protected from sharks...

Palmer is making a new map of the Shoals in which he is locating the various spits. The names bestowed upon them have been more or less fanciful and the islands themselves are not permanent but seem to shift in form and outline. The one visited today was near the outer reef and had much coarse coral and shell thrown up on the beach in lumps as large as my fist.

Here while loading into the launch we caught a sand shark six feet long entirely dark above. I save the head and had the jaws cut out to show the teeth.

Anderson tells me that on Washington Island ducks come to the fresh water lake in large numbers from November to March. Several species are represented among which is the Spoonbill and one known as the "canvasback", that may be a Scaup. The lake is a mile and a half long and has a peat bog at one end with bulrushes growing in it. Ulua (Carangus) are found in the lake, a fish known as "awa" and a large eel. On one occasion a canoe eleven feet long was dug out at a depth of eight feet in the bog. June 26

June 26--...Tern Island where the camp is located...The water was calm and travel pleasant, This western part of the lagoon is shallower than the eastern and has many coral heads and small reefs that almost reach the surface so that navigation is more difficult. Our first call was at an island, 2 miles east of the camp, called Trig Island, This island was 225 yards long by 125 yards wide and was nearly circular in form. It rose from 8 to 19 feet above the water and had the summit covered with a fair growth of grass, Portulaca and Boerhaavia.

On the western end of this island I found from 1000 to 1500 dead Sooty Terns, all young birds still unable to fly. The carcasses were old, apparently those of last year's birds. They lay in little piles in slight hollows at extreme high water mark as though they had been washed in here by a heavy storm. I

believed that Tern Island had been swept on its low eastern end by a heavy gale and the young tern from the colony drowned and washed ashore here.

On Trig Island I found the following birds:

Sooty Tern 2000 pairs

Noddy 150 pairs

Laysan Albatross 1 young'

Black-footed Albatross 50 young

Blue-faced Booby 20 pairs

Wedge-tailed Shearwater 50 pairs

There was considerable turtle sign on the beach.

From this point we continued east and north to two small islands near the outer reef. These two were separated by a channel 150 yards wide but are probably joined at times by the shifting sands as the water was not deep.

The first of these, named Skate Island, was 200 yards long by 100 yards wide and rose 8 to 10 feet above sea level. Its surface was of coarse coral sand with scant vegetation of grass, Portulaca, Boerhaavia and Tribulus. Humus was slight and plants low and scattered.

Remains of a number of large turtles lay scattered about here...

On this island were the following birds

Wedge-tailed Shearwater 30 pairs

Blue-faced Booby 40 pairs

Red-footed Booby 1 pair

Black-footed Albatross 30 young'

Laysan Albatross 1 young

Sooty Tern 800 pairs

Gray-backed Tern 15 pairs

Noddy 200 pairs

Tropicbird 1 pair



French Frigate Shoals - Whale Is.  
La Perouse Pinnacle

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I crossed to the next island called Whale Island in the skiff. It proved to be somewhat surved in form 400 yards long by 125 yards high and rose 10 to 12 feet above the sea. It appeared to be the oldest island in the entire group and had the upper surface covered with fine gray soil. Plant life was more abundant here and consisted of Chenopodium, Portulaca, Tribulus, grass and Boerhaavia. In general conditions suggested those found on King Island but there was less sand mixed with the soil. Some flat blocks of coral rock had been built into a fireplace about which were turtle bones. On the highest portion of the island I found remains of a shed apparently of Japanese construction. It had fallen over and was evidently ten or twelve years old if not more.

On this island I found the following:

Red-footed Booby 15 pairs  
Blue-faced Booby 70 pairs  
Black-footed Albatross 90 young  
Laysan Albatross 25 young  
Wedge-tailed Shearwater 500 pairs  
Frigatebird 60 pairs  
Noddy 300 pairs  
Gray-backed Tern 15 pairs  
Sooty Tern 125 pairs

Skeleton of a small whale was cast up on the beach here. and I

June 27--[rock called La Perouse Rock],, is about 150 feet high by 150 yards long. A smaller rock 75 by 25 feet 15 feet high lies 75 yards west of it. There are rock shelves on both north and south sides of the main islet. We landed...on the south side without difficulty. Large Ophiis covered the rocks and I found one pool literally filled with several hundred anemones.

The rock was volcanic coriaceous in nature, black in color. In places it was encrusted with mineral matter, yellowish or whitish in color washed down from

La Perouse Pinnacle  
French Frigate Shoals - Tern Is.

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the guano above that at times formed small stalactites.

Sloping shelves gave access to the lower portion but the top was inaccessible because of the loose nature of the rock. The island can be scaled on the western end but we busied ourselves with collecting and did not attempt it. The rock rises in two rounded points with a slight saddle between. It is only about 150 feet wide at the widest point. The summit is white with the excrement of birds.

Following are the birds noted:

Blue-faced Booby 20  
Red-footed Booby 30  
Common Booby 30  
Wedge-tailed Shearwater 50  
Bulwer's Petrel 1  
Frigatebird 5  
Tropicbird 6  
Noddy 800  
Hawaiian Tern 150  
White Tern 300  
Necker Island Tern 20

June 28--Following is the list of bird inhabitants of Tern Island:

Black-footed Albatross 8 young  
Bulwer's Petrel 1 pair  
Wedge-tailed Shearwater 250 pair  
Blue-faced Booby 8 pairs  
Noddy 500 pair  
Sooty Tern 3500 pairs

The island is about 600 yards long by 150 yards wide. The eastern half is a long curving sandspit, from 6 to 8 feet above the sea which is swept in time



French Frigate Shoals - Tern Is.  
Necker

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of storm. The western half which is the site of the bird colonies is from 10 to 12 feet above the sea and has a soil of fine coral sand on which grows grass, Boerhaavia, Portulaca and Tribulus.

The Sooty Tern occupy the entire eastern of the this section and the shearwater are found in an area of loose soil near the center. The noddies nest at the west and on the borders of the Sooty Tern Colony.

Following is a list of seeds, etc., planted by Judd on this island June 26:

Cocos nucifera--coconut 5 sprouted nuts  
Hibiscus tiliaceus Hau 30 slips  
Calophyllum inophyllum Hawaiian Kaniani seeds  
Thispusia populnia mile seeds  
Casuarina equisetifolia Ironwood seeds  
Pritchardiaa pacifica Fiji Fan Palm seeds

...which we name Disappearing Island. As it alternately appeared and disappeared amid squalls of rain. It was apparently a bare sand spit 300 yards long with no indication of vegetation.

June 29-- Necker: Judd, Cartwright, Anderson, Caum, Palmer, Bryan, Schlemmer, Wetmore...The first cave, one located by Caum during his work here, faced the west and was under an overhanging ledge in a steep rock face. For a space 18 x 6 feet the cave was paved with flat stones against a wall built across the front. The sea lay 60 feet below.

...to the cave located by Anderson which lay on the eastern slopes 70 feet above a broad ledge barely exposed above the sea. This cave was 40 feet long by 10 wide. The approach was along a series of narrow ledges with poor footing...We excavated and sifted all the earth in the floor of this cave at one end digging down three feet while the other rock shelves up until it was exposed. The cave had been paved and was evidently used as a habitation. A wall had been

Necker Is.  
Kaula Is.

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built up along the front and earth and rock had been filled in behind.

[Necker Island discovered November 4, 1786, French Frigate Shoals later in Nov. 1786.]

Among the first finds were a human femur and two tibiae in good state of preservation. An end of one of the bones was charred by fire, perhaps significant of a meal of "long pig". A fire place had been made against a large upright stove below which were bits of charcoal and considerable ash cemented into a firm mass. At depths from one to two feet we found parts of three or four broken stone bowls and by sifting discovered three of the curious grooved stones said to have been used in catching squid, two of them 3 to 4 inches long and two inches wide and one only a little more than half as large. Also some little adzes sharp at either end, smooth and polished and some large flattened stones with polished surface. Scattered through here were many water worn pebbles two to four inches in diameter.

Also found quantities of sharp edged rock slivers probably used in making brine fish hooks.

July 1--The Kaula on the chart is marked as 940 feet high. I was astonished to find it a rounded mass rising somewhat less than 500 feet above the sea, a visitable turtle shell of volcanic with its rounded summit and high sides. The island was steeply precipitous for three-fourths of its circumference the cliffs rising almost sheer for 200 to 300 feet with nothing more than shelves barely above water level at the base. On the east southeast there was a slight indentation that formed a bay with precipitous walls, not quite so high as elsewhere. From close examination I was convinced that the summit could be scaled at the southern extremity of this bay where the cliffs were not more than 100 feet high and their front was broken by a series of ledges.



Once over the cliff there is a long slope to the summit. The upper surface of the island is rounded and has considerable soil. It supports much vegetation, partly herbaceous and partly shrubby. There is a clump of dark green bushes on the northern summit. The island is one third of a mile long by half as broad.

On the northern face is a huge cave sixty feet in diameter by nearly 200 feet deep, the famous caves of Kuimoana, largest shark god of the islands whose form turned to stone may be made out at the entrance. White terns nested above its dark entrance...At the southeast point there is a submerged ledge over which surf breaks heavily. With the wind blowing directly on it landing is impractical.

Following is a slight attempt at an estimate of the birds as seen from the ship:

Wedge-tailed Shearwater 2000++  
 Bulwer's Petrel 100+  
 Blue-faced Booby 500  
 Red-footed Booby 2500  
 Common Booby 200  
 Tropicbird 100  
 Frigatebird 5000  
 Noddy 5000  
 Gray-backed Tern 4000  
 Sooty Tern 10,000  
 Hawaiian Tern 1000  
 White Tern 100  
 Necker Is. Tern 25 .

July 10--

July 10--[Johnston Island]The soil inland, where it was grown with grass, was badly cut by Shearwater holes so that I located camp in the highest part of the only available stretch of beach, which was on the southern side, just east of the extreme western point. By placing the tents back against the grass we were able to put them four feet above ordinary high tide.

A lagoon island (or 2 islets),  $3 \frac{1}{2} \times 3 \frac{1}{4}$  miles, possibly 100 feet high; bare, and has (or had) guano; said to belong to Pacific (later American)Guano Co.; of San Francisco.

"Sea" birds probably nest there, or did so formerly.

Party on Johnston Is.; A. Wetmore in charge, E. Sclemmer, assistant; C. H. Edmondson, biologist; E. H. Bryan, entomologist; J. B. Pollock, botanist; C. Grant, assistant; W. G. Anderson, assistant; O. Cheatham, assistant; George Higgs, cook.

July 11--Schlemmer walked around the beach collecting a tropicbird, a tattler, and some young petrels. Also Frigatebirds.

July 12--The sand in early morning is dotted with myriad pointed dots and impressed lines, tracks of the multitudinous crabs that emerge from holes blown smoothly over during the day time, and wander over the entire beach covering it systematically in their search for refuse.

...Blue-faced Boobies and Red-footed Boobies roosting...

The light revealed thousands of scavenger beach crabs that watched intently or scurried away as we approached. These varied from white to deep ruddy in color. Larger water crabs scuttled out over the rocks into the water. It was interesting to throw the light into the cavities and cracks of the higher rock ledges where large cockroaches were brought out in sharp relief or Bulwer's Petrels old and young were brought into view.

Johnston Is. is approximately a mile long by one-fourth of a mile wide with



its long axis running slightly south of west and north of east. It is roughly rectangular with one or two small indentations cut in the shore line. The Greater part of the island lies from 10 to 15 feet above sea level with a conical elevation at the eastern end 40 feet high below which the slope drops steeply to the eastern beach. The beach is made of fine coral sand and the soil of the island is of the same material with comparatively little humus. A heavy growth of tussock grass covers the entire island with considerable amounts of Tribulus cestoides scattered through it and occasional plants of Boerhaavia bordering the beaches.

The island is built on a low platform of a fine grained rock (apparently a sandstone elevated at its high point about seven feet above sea level). This rock, gray in color, is exposed in worn ledges in the east and north and elsewhere appears as level shelves from which project low pyramidal points or curiously eroded columns. It is firm and hard in texture. The ship can anchor safely 750 yards from the outer coral heads to the south of the island, inshore from this are broken coral heads and finally a flat reef that is exposed at low tide. Small launches may run in to about 1/3 of the mile from the beach on the south. Boats of two feet draft may pass to the beach at high tide. Inside the inner reef is a shallow area sprinkled with small coral heads.

There are a few logs of fir cast up on the beach, one with roots attached. A crude hut with a cast iron roof has been erected on the shore south of the eastern hill. Lumber and some barrels lie scattered about, said to have been brought here by Ai, a Chinaman from Honolulu who intended to establish a fishing station here. His crew revolted, however, after landing the supplies and the project was abandoned.

In a slight hollow below the western side of the hill I found remains of a much older hut erected by a white man who lived here at one time. On the summit of the hill is a headboard that may mark a grave.

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July 13--The flattened sand louse recorded at Nihoa and French Frigate Shoals is very abundant here and is a decided nuisance as at night it invades our coats, crawls over us and sucks our blood. The bites swell, turn red and itch severely, the burning sensation and swelling continuing for several days.

Necker Is. and Gray-backed Terns. Bryan on Sand Island reported White-tailed Tropicbird--identification doubtful.

In a hollow southwest of the hill I found remains of several thousand Sooty Tern, Wedge-tailed Shearwaters, and Christmas Is. Shearwaters that had been killed by plume hunters and the bodies thrown in a pile, after the hands carrying the primaries had been cut away...

July 14--Out in skiff--many Shearwaters--I could hear sea birds calling on island one mile south...Corals of half a dozen species were growing in abundance over a broad platform in shallow water. Jagged holes five or six feet deep were natural aquaria in which swam brightly colored reef fishes. Huge holothurians twelve inches long lay sprawled everywhere. Nooks and crannies were occupied by sea urchins, two species with sharp spines to be handled with caution. When feeding the spines were thrown together in clumps that spread to bristle as a protective armor whenever the animal was touched. Two other species had long blunt spines that were strong and heavy. The larger of these lived in the wash on the outer reef.

At dark the reef was bare in the tide. Strange fishes darted out among them many eels. Anderson today killed a huge eel--5 feet 4 inches long and 8 inches in diameter. He struck at a fish with his spear but missed when the eel struck quick as a flash at his harpoon point. The great creature was enticed out of its crevice in the coral bank by some bits of fish. After several attempts he succeeded in thrusting a spear into its thick hide but it was nearly half an hour before he was able to lift the writhing beast into the boat. It had sharp pointed teeth and heavily muscled jaws.



Johnston Is.

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We found several beautiful Cypraea tigris in holes in the outer reef and a few Tonna. Spiny libsters were common. When speared they made a squeaking noise.

July 15--Sand Island lies a mile north of east of the main island. It is about 300 yards wide by 400 yards long with a small peninsula projecting toward the northeast. It rises fifteen feet above high water at the highest point. The island rests in a shelf of sand rock that is laid bare at several points on the beach. On the east the exposure is about 4 feet high. On the north at one point it is 8 feet above the water. As on the main island there is a soft layer of rock covering a harder one. The soil of the island is sand with a small mixture of humus. It supports an abundant growth of grass, Tribulus and Boerhaavia. I found the skink, and collected one. The bird tick was abundant.

Bird Life was estimated as follows:

Gray-backed Tern 25

Sooty Tern 2000 birds

Noddy 800 birds

Wedge-tailed Shearwater 500 birds

Christmas Island Shearwater 100 birds

Blue-faced Booby 20 birds

Tropicbird 4 bird

Frigatebird 100 birds

A few common boobies and red-footed Boobies rested on rocks off shore. Two turnstones and two Golden Plover were noted. The sooty and Gray-backed Tern had young on the wing. Blue-faced Boobies and Christmas Is. Shearwaters were well grown about half the noddies were ( ). Frigatebirds and tropicbirds were not now nesting.

On the western half of the island were deposits of guano part soft and a part consolidated. Someone had excavated some of the solid rock and made a pile of it.

Johnston - Sand

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I found one bird bone, some crab claws and many shells in fragments of the rock. This guano is simply the consolidated sand and earth of these islands where it is mixed with the excrement of birds. In these islands the deposits are due mainly to albatross, frigatebirds and boobies. Terns and Shearwaters are too small to produce excrement in sufficient quantities. Nest sites of the three species mentioned are covered with solid masses of their dung sometimes of considerable amount.

Between Johnston Is. and Sand Is. are lines of reef running northwest and southeast from 25 to 50 yards apart with from one to six fathoms of water between. The aviator informed me that three miles west of Johnston is an extensive rock flat bare at low tide. It is my belief that Johnston Is. formerly was much more extensive and that probably covered all this area but has been eroded away. My belief in its antiquity is based on the formation of the base rock and the manner in which it is plainly being cut away and on the presence of guano.

There were several red wood logs on the shore of sand Is. and a board erected on the highest point similar to one found on the hill at the main island.

July 16--A tick that lives in the sand is very bad in this camp...bite severely the spot itching and swelling and giving trouble for several days...killed 92 of the animals on my blanket.

July 18--Following is a bird census of the main island:

Laysan Albatross 1 young

Wedge-tailed Shearwater 2500

Christmas Is. Shearwater 300

Dulwer's Petrel 400

Red-footed Booby 250

Blue-faced Booby 200

Common Booby 75



Johnson said

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Gray-backed Tern 25

Sooty Tern 3500

White Tern 40

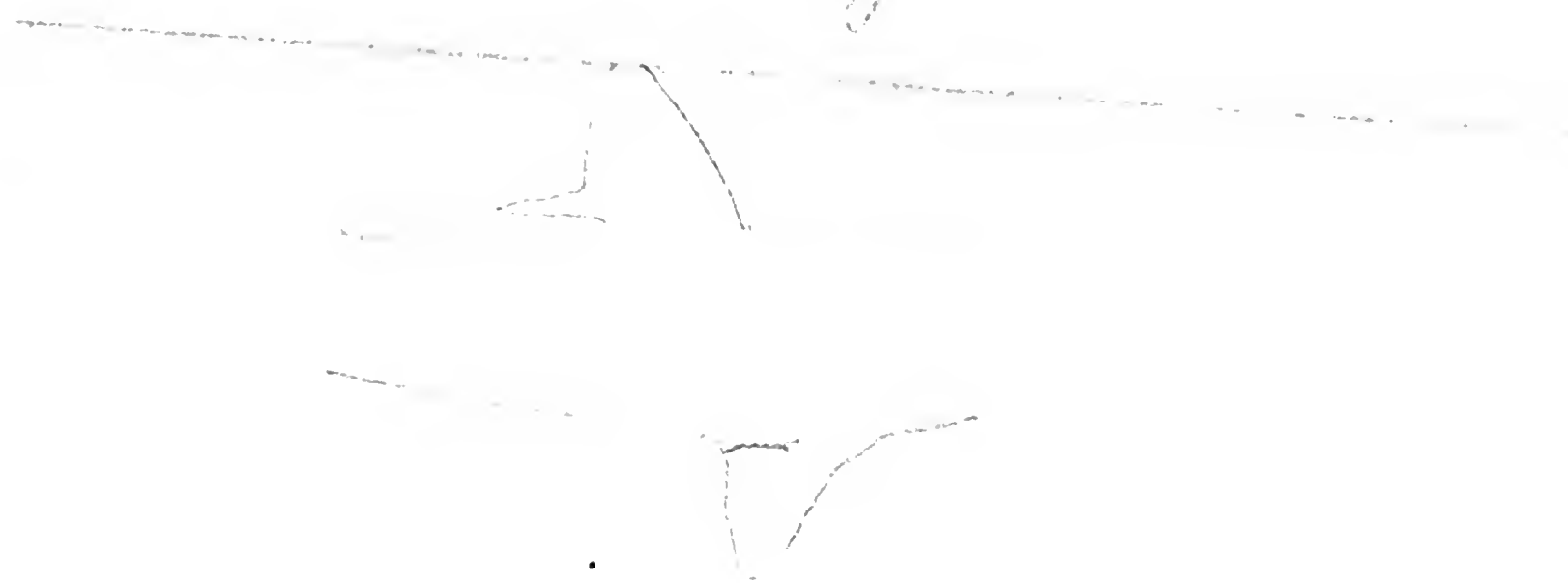
Noddy 1500.

Necker Island Tern 3

Frigatebird 800

Tropicbird 8

sand shark from  
lagoon at Johnston



[airplane used to survey the island on this trip]

[H. Palmer, geologist; Orme Cheatham, a young man to serve as assistant to Pollock and to make himself generally useful; J. B. Mann topographer]

There was a pile of rock here that perhaps marked the site of a flag pole indicated on the chart.

Mann made a topographic map of the island with Bryan's assistance.

Anderson tells me that Sooty Tern, Petrels and Shearwaters do not occur on Washington or Fanning Is.

Following are the birds that he knows to occur on the two islands:

Fanning--Red-tailed Tropicbird (few), White-tailed Tropicbird, 3 sp. of Sula, Frigatebird, Noddy, Magalopturus, Procelsterna, Tatare, Gygis, Parrakeet.

Washington--White-tailed Tropicbird, 3 sp. of Sula, Frigatebird, Noddy, Megalopterus, Procelsterna, Tatare, Gygis, Parrakeet.

The two species of Shearwater cuneatus and nativitatis are found on Christmas Is.

Cheatham caught three small sand sharks in the evening, the first we have seen in the lagoon.

July 21--Seen: White-tailed Tropicbird, P. rubricauda, Bulwerss Petrels, and Wedge-tailed Shearwaters.

July 27--Wake Island 19°10'54" (Hydrographic Pilot)

19°25'N., 166°30' E (Brigham)

19°10'22" N., 166°31'30" E. (Hydrographic chart).

annexed by U.S. in 1893 or 1900.

A coral lagoon island, "20-25" miles long (Brigham), or about 6 miles long (hydr. chart); 8 feet high; covered with a "low and sparse vegetation" when Brigham saw it in 1865. He did not land.

Said to have "large heavy brush" in places, at E. part of the island (Hydr. Pilot)

Wilkes visited the island December 20, 1841. Peale (MS journal in L.C.) estimated the island was about 3 miles long, and 12 feet high; no fresh water; no trees (other vegetation not mentioned by him); some large blocks of coral had been thrown up on beach

Peale says "Rats were common" his Mus exulans.

The following birds were found by Peale, on December 20, 1841:

Diomedea brachyura breeding, with eggs.

"Sula bassanus" With eggs. "The bassanus always lays on the ground."

Sula (red-legged species) "Just building on trees, but had not begun to lay." [Peale, 1848, p. 336, records his S. rubripeda from Wake Island.]

"Sula fusca" Same remarks as under the preceding.

Cygis alba

Onychoprion fuliginosa

"Pelidna"

"Scolopax"

Phaethon phoenicurus

Fregata "aquila"



Marcus Island (24°14' N., 154°00' E.) (Minamitoroshima of the Japs)

About 4 miles in circ., with area of about 740 acres; 60 ft. high; wooded; bordered by white sandy beach; landing difficult.

Claimed by Japan and "leased to a Japanese who exports albatross" etc.

"From October to January is the season for obtaining the birds, and at that time about 50 laborers are brought from Arzobispo or Bonin and Hachijo-ga Is."

W.A. Bryan visited Marcus early in August, 1902. At that time the two species of albatross had been almost completely exterminated, and several other species were reduced in numbers. He recorded 18 spp. of water birds and waders, but others probably occur later in the year. No land birds were seen, *Micranous marculi* Bryan was described from here.

The Japs would not permit Bryan to take a gun ashore, and his collection was obtained by trapping, etc. The Japs netted the birds used by them.

Bryan thought there would prove to be an island 50-75 miles north and east of Marcus, indicated by the direction of flight of the birds.

...The island appeared as a low level line, light near the water's edge and dark from heavy brush above. Large blocks of stone appeared at intervals along the beach. The ship worked along until we sighted the passage on the south leading into the lagoon...A small cove marked the entrance into the lagoon and here we found calm water.

I found a rough rocky beach with no sand and spent an hour in looking over the small western island and the western end of the central island for the most suitable camp site. A place was chosen 150 yards west of the lagoon entrance on the small island where a little flat outside the bushes offered a surface of coarse coral and sand mixed with boulders.

...rowed to the third island where there was an old Japanese camp and investigated it. I collected a rat or two.

Thaxton and Grant reported a land rail seen on the large island this evening.

...waded the channel to the large island and entered the brush on the opposite bank. We walked slowly and cautiously through small openings that led between dense thickets. There was much dead stuff banked up on all sides some of the gnarled logs being 12 or 14 inches through. Land rail near center of the island.

At short intervals I paused to squeak watching closely on all sides. After fifteen minutes when well in toward the center of the island my eye caught a slight movement at one side and an instant later I saw the trim form of a land rail somewhat larger than a Virginia Rail. Three were taken here about one small opening in the space of two or three minutes and in all I took eight during the morning. The birds were alert and inquisitive and came walking out with head and neck erect and jerking tails. Though not averse to crossing open spaces they walked ordinarily under cover apparently through a desire to keep out of the intense rays of the sun. Often while sitting down one came within three or four feet of me peering curiously with outstretched neck and jerking tail while it uttered a low cluck. They took care to keep well out of reach though I did knock one over with a slight twitch. The birds are now in breeding condition and Bryan noted a pair in copulation today. A light brown band faintly indicated across the breast is reminiscent of Hypoc. india (sp?). The keel (?) of the sternum is very low and the breast muscles slight.

Aside from the Sooty Tern colony on Peale Is. I have found no extensive bird colonies today. Noddies and Megalopterus are scattered through the trees everywhere and I presume that the Red-footed Boobies and Frigatebirds nest in the



scenic way. The two latter perch to rest anywhere that is comfortable place is found.

July 29--Huge blocks of a consolidated conglomerate of coral and coral sand have been thrown up at intervals, some of them from eight to fifteen feet in diameter. The beach is a band 150 yards wide of coarse lump of corals from six to twelve inches in diameter with only a small quantity of fine material with it. The cat-eye shell Turbo, a large species, is abundant and I find the calcareous operculum in abundance.

The margin of main shrub growth is sharply defined but scattered trees of Tournefortia argentea get a foothold on the rough coral of the outer beach. On land there is more or less fine soil mixed with the coarser material.

In the trees are many collections of dead branches and tree trunks swept together in windows with large blocks of coral strewn in and over them. Apparently these have been washed in by waves and wind. Occasional old stumps of large size are found. It appears from this that the island has been swept by a typhoon from the south perhaps 20 years ago that lose up much of the vegetation and threw the huge blocks of coral on the beach.

Rails were much noisier today during the rain than yesterday...They utter a low chattering call, a clattering note that is easily recognized as a rail call and also a low cluck that is audible only when near at hand. On feeding they dig up leaves and soil with a quick thrust of the head in search of shells or insects.

Today I dug two geckos from rotten wood in a large dead log. A skink is abundant and is very quick and active. They are found in or near the brush where they run over stones or branches. It is swift and hard to catch.

A hermit crab that houses in Turbo shells is exceedingly abundant. When the weather is hot they house at the bases of trees under stones, or in hollow logs,

wherever there is shade. At nightfall or when the sky is overcast they wander in search of food. They are into everything and it is not safe to leave birds exposed at all. I have found it practically impossible to trap the abundant rat as the crabs spring my traps by night or day, or if a rat does chance to find the bait first its mangled carcass with two or three crabs at work in it is all that remains in a short time. The crab climbs trees or rocks with the greatest facility so that nowhere are traps secure from them. The rats taken so far have been secured by shooting or by hand.

July 30--Peale Island has a soil of sand along the beaches that becomes a loose sandy loam in the interior. On the north, the windward side is a level flat of conglomerate that is mainly bare at low tide. At one place for a considerable area there is a surface two hundred and fifty yards wide that is almost level. In from the sea breaks heavily on our outer reef. Behind there is a rock exposure with an upward slope toward the interior of the island with masses of coral many of large size thrown up into a steep faced beach 25 feet high that forms a regular level surfaced wall. This is near the center; at either end of this island is a beach of fine sand.

Founefortia argentea is evenly distributed over most of the island. This tree grows openly so that it is not difficult to walk through it. Occasional small meadows were grown with grass. Toward the upper end (west) were extensive growths of Ipomoea pes-caprae that in places had smothered low trees. The Founefortia averaged 10 to 20 feet high.

Noddies nested through here and I was pleased to find a small colony of Wedge-tailed Shearwaters. Near them we caught two Christmas Is. Shearwaters.

The rat was common through here and I shot four. These animals are active both by day and night as I see them running about after dark when I am out with a flashlight. They are small in size and distinctly reddish brown in color. They run about rather heedlessly as they have no apparent enemies unless a

a frigatebird picks one up occasionally, but see well and take refuge in holes so that it is difficult to catch them by hand. I saw one today in the upper branches of a Tournefortia fifteen feet from the ground. Others were seen eating the stems of Portulaca in little openings. They make nests, under logs or in hollow trees of leaves, bits of grass and birds' feathers. Their tongues are stained dark by some food that they eat.

I investigated the old Japanese camp thoroughly. There is no question but that it was built by man here to collect birds for millinery uses. One building 15 by 30 was evidently used for housing. A few dishes, two pairs of wooden clog shoes, some fishing tackle and other odds and ends were strewn about. Another shed somewhat larger was a workshop. In this were three or four low tables made of boxes, two by five feet on top with a tray at either end 6 x 12 inches, one for plaster of paris, the other perhaps for arsenic or some other preservative. A short string with a long hook tied at one end was fastened to a nail at the back and probably served to hold the birds body during skinning. An apron at the front covered the lap of the laborer.

There were large numbers of trays 18 inches by four feet to dry birds and a rack of bamboo at one side to support them. Barrels and boxes of plaster paris were found and a bale of wadum. In one box were several hundred small sticks with oakum wound about them suitable for necks for birds. Scattered among the trees behind were great layers of bones, witness to the slaughter that had taken place. The majority were those of terns with many boobies and larger numbers of man-of-war bird. Many thousand birds had been destroyed.

The houses were built of half inch boards in a light frame with roof of galvanized iron. The living quarters had windows of glass. A small storehouse was set on poles six feet from the ground with tin guards around the poles to prevent marauding rats and crabs from climbing up. The smaller buildings had



Wilke [Wilke]

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fallen over on the ground. Two wooden cisterns of small size were noted, several large water jars, and similar things. A stay of several months had been made made without doubt. It is my belief that the camp is 14 or 15 years old. In other words that the work had been done at the same time as in Mysan and probably as in Lisiansky. It is possible that one firm arranged for the taking of birds on all three island.

The huts are unquestionably of Japanese build as they show Japanese workmanship, Japanese material and many boards are marked with Japanese ideographs.

July 31--Wilkes Island has some fine sand on the inner face at the western end but for most of its circumference the shores are of course broken coral worn into more or less rounded lumps with comparatively little fine material. The coarse lumps of coral extend inland through the trees clear across the island and in many places are mixed with broken limbs and trees. Many extremely large lumps lie thrown up in the beach. Apparently this island bore the full brunt of the typhoon that swept the atoll. Large trees were entirely destroyed only an occasional stump remaining, gnarled and twisted. The Fou growth here is smaller and less dense than on the main large island across the channel. The soil is rather scant and heavy blocks of coral extend clear across to the inner beach.

Strangely enough no rail have been found in Wilkes Is. though the birds are common on Wake Is. across a narrow channel.

In a little opening at the eastern end of the island is a curious shrine that I suspect is of Japanese origin.

A north and south line extends for a distance of 50 feet between two large stones, made by placing small flat stones on edge. At the center in the west is

Wake

Wake Shrine

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Wake Shrine is a rock four feet square by five high. West of it are four smaller columns of rock about two feet high. East of it are twelve more small columns perhaps more. Some of the columns have a square wooden post at the center, four inches square by 4 or 5 feet long with three notches cut around at the top. Others have three thin boards with angular pointed ends stuck in them. The three largest boards are in the largest shrine, one of them having a series of Japanese ideographs on it. A few bottles and bits of porcelain dish and Gridaoria shells placed at the bases of the shrines may have contained offerings.

Though evidently rebuilt by Japanese perhaps for survival of some tremendous storm it is possible that the site was originally built up by some natives drifted here from the south.

August 1--I walked east along the beach of Wake Is. as far as the eastern point. For a mile the broad beach, at least 250 yards wide was composed of large lumps of rounded coral; beyond this point for another mile the washed-up material was finer but still there was very little sand. In walking it was necessary to step from one piece to another picking each step, a rather fatiguing process.

On the actual beach, at tide line, there was an extensive exposure of conglomerate sloping at a considerable angle into the sea. The elevated inner margin was broken away and the broken coral in places washed out in front of it leaving an exposed ledge, on the landward side from three to four feet high. One rock 20 feet long by ten feet had been rolled up a hundred yards from the present water line.

Occasional trees of Soursea grew out on the rounded coral and here where not restricted by other growth assumed a beautifully symmetrical rounded form. I saw one or two plants of the slender leaved shrub out here also.

For half a mile at the eastern end of the island was covered with a low rather

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heavy growth of Tournefortia bound together with many creeping Ipomea pes-caprae.  
...the way the first leaved tree alternated with Tournefortia in making  
dense thickets with small openings leading through them. Here I secured eight  
rails.

...the eastern end had broad shallows with sand bottom [lagoon] and a shore  
of fine sand interspersed with rock. A fire had swept this end of the island many  
years ago as was shown by the blackened roots.

At one point was a pool of salt water and a considerable growth of a long-  
leaved Sesuvium that covered a considerable tract.

A small migration of shorebirds had begun from the northward.  
I noted several curlews today, one Tattler and a number of Turnstones. All  
are very wild.

August 2--6 a.m. temp. uniform ranging from 76° to 81°.

The western portion of the north side of Wake Island is level rising about 20  
feet above the sea. Along the outer beach is a level stretch 100 to 250 yards  
wide of coral lumps stained gray from exposure. At the outer edge of this  
is a steep slope to the water with a level expanse of conglomerate extending to  
the edge of the reef 150 to 250 yards distant. Conglomerate in place is exposed  
as a low ledge, with strata sloping toward the sea.

Inland coral rock or loose sandy soil alternate in forming the surface  
of the island. Tournefortia is the most abundant tree over this.

On the lagoon side there are also exposures of level bedded conglomerate  
with sand or pebbles beach below. At the head of the lagoon the water is very  
shallow as it is filled in by fine sand that covers the rough coral below. One  
or two bays here are stream with broken bits of trees but I believe this is due to  
wind action not to subsidence as none of them seem to be rooted.

At the upper end of the lagoon inland are broad stretches of sand, low lying



The surface are grown with a heavy stand of Sesuvium.

In land from the lagoon the boxlike tree Pemplus is common growing in scant red clumps that stand out as dark patches against the light sand. Near the center of this end of the island is an extensive stand of Cordia. A large grove of old trees has individuals whose gnarled and twisted trunks are two feet through. They writhe prostrate near the ground with short thick limbs supporting the growing branches. Beneath them is a heavy shade. Bordering this heavy growth is a dense stand of low Cordia six or eight feet high bound together with creepers through which progress is difficult.

Open areas in the Tournefortia are often grown with Portulaca. Along the open Tournefortia the rat was common. The animals hid on the Portulaca stems in the open and as we approached ran quickly to cover among the low trees where they took refuge, either in hollows or in crevices among the coral. I found four in one among the rocks at the foot of a tree where they had refuge with several hundred hermit crabs.

Colonies of Frigatebirds and Common Boobies nested here and Red-footed Boobies were preparing to mate again. A White-tailed Tropicbird passed high overhead.

These islands are absolutely clean of all refuse from the activities of the hermit crabs. I see no carcasses of land birds at all, there are no flesh-flies and we saw as yet no flies. These scavengers have been eliminated by the crabs that eat everything at all edible. During the heat of the day, they are inactive and seek shade at the bases of the trees, under rock ledges or stones where a hundred or so may collect in one place. As the sun sinks they come walking slowly on, with some suggestion of turtles in their lumbering gait with shell held on the back. At this time it is not safe to

to leave birds or other specimens exposed as inevitably the crabs will be at them and destroy them. They were stealing our soap and eating it. Their total number here is many thousands. I suppose that some of the Turbo shells that serve them as homes have been used by generations of the animals as they appear old and worn.

August 3--The channel near camp that leads into the lagoon is shallow at either end and deeper in the middle. While it is 80 or 90 yards wide the boat channel through is narrow because of obstructing coral heads and is practicable only for small boats. Through the middle in places it is 3 or 4 feet deep but at either end there is only one to two feet of water. As the tide lowers the current through here is strong.

The lagoon itself is very shallow at the eastern end. A shallow shelf extends out for some distance from either shore while through the center there are depths of ten feet. The bottom is of fine sand with many coral heads some of them awash.

On the inner side of Wake Is. a conglomerate exposure with much loose broken coral rock lying in it forms the shore for a distance of a half mile from the channel. Beyond this point the shore is of fine coral or sand with large blocks of conglomerate distributed irregularly through it.

About three quarters of a mile east of the channel a level low sandy area is grown heavily with *Sesuvium*. The low area extends inland practically across the island and probably marks an old channel from the sea to the lagoon. Near the lagoon is a salt water pond and inland from it are two other small pools of brackish water. Beyond the low tract is constricted to a dry gully two or three feet deep that merges finally with a broad coral ( ) flat that extends across to the beach. The small-leaved *Perphis* and the umbrella tree *Tournefortia* grow on either side.

Waka

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About fifteen rails were seen at different times in the shrubbery or at the edge of the Sesuvium. They ventured out ten or twelve feet from the edge when they walked about unconcernedly so long as I was quiet but skipped rapidly to the protecting shelter of the low growing trees at any suspicious movement. Ordinarily their motions are deliberate and they pause frequently to dig with sidewise thrusts of the bill in the loose soil to expose shells, insects, or other desirable food. When I squeak they reply with a rattling chatter that is unmistakably a rail call and come running toward me under the brush. Near at hand they give a low clucking call. Should one chance to see me before I call it seems greatly startled and with head erect runs swiftly away dodging behind stumps or other cover until far beyond reach. Pursuit at such times is useless as the birds travel rapidly under the thick cover where they may not be seen. As they walk about the tail is held down but at short intervals is jerked over the back. Though they come within three or four feet of me in the heavy brush I find it difficult to get pictures of them as they are always concealed by a screen of twigs. They are fairly fat and in good condition. The breeding season is at hand as males have enlarged testes and in some females the oviduct shows development. None seem to have laid as yet. The birds seem to have very limited ranges.

Also seen: Tropicbird, love birds, Frigatebirds often accompanied by Red-footed Boobies. Many of the latter intent on mating wheezed or clucked from perches in the trees. Also frequent Noddies and Sooty Terns.

Rats were observed frequently among the bushes or running through the Sesuvium.

The beach conglomerate contains many corals and shells.

August 4 -- Under Palm in the direction a well eight feet deep has been dug at the highest point on Wilkes Is. The small amount of water in the bottom is saline. The walls of the excavation show a layer of rock mixed with humus to the depth of a foot, then a layer of sand mixed with coral lumps one to three inches in diameter



Wake

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to a depth of three feet and then coarse lumps of coral, Tridacna shells and other large fragments up to 18 inches in diameter to five feet.

The whole is bedded on a layer of fine grained conglomerate, the old beach sand consolidated.

Two other wells dug near the Sesuvium patch on Wake Is. at my suggestion, yielded salt water at three feet. The sand and other material is so coarse that apparently salt water seeps through unchanged. It is possible that fresh water might be obtained in the finer soil at the eastern end of Peale Is. Dependence may be had on rain for a certain amount of drinking water.

Palmer and I cut a limb of Tournefortia two inches through on which I counted 12 growth rings of varying thicknesses. I was uncertain however as to whether these were annual or merely indicated rainy seasons of which there may be more than one in a year.

August 5--Later I visited the site of an old Japanese camp on the lagoon side of Wake Is. near the channel separating that islet from Peale Is. A clinker built boat 35 or 40 feet long that had been sawed straight through into three nearly equal parts lay partly buried rotting in the sand. English letters were indicated across the stern but the paint had scaled so as to make them illegible. Near at hand was a stone fireplace and a few upright sticks that had supported some form of shelter. Scattered about was the usual camp refuse, some broken bottles, chipped and broken bits of dishes of Japanese design and bits of metal. The camp apparently was eight or ten years old if not more. It might appear that men had desired for some reason to conceal their boat and had to cut it to make it possible to draw it out of the water. It was hauled back among heavy bushes nearly 100 yards from the shore.

August 7, 8, 9--Wedge-tailed Shearwaters seen from ship.

August 11--Blue-faced Booby, Sooty Tern

August 12--Bulwer's Petrel, Red-tailed and White-tailed Tropicbirds

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August 13--White-tailed Tropicbird seen in a.m.

August 20--[Popoia] Three hundred yards off shore a low island of coral rock of about 3 or 4 acres in extent, whose level surface, rising 8 or 10 feet above the sea is eroded away into many pits and crevices. Milo (Thespesia populnea) formed a thicket at one end and other low vegetation was common.

The Wedge-tailed Shearwater nested in cracks and dug burrows and I found young a week or ten days old that when handled squeaked like the tin whistle in a child's rubber toy. A few burrows contained eggs.

Minah birds came across to roost here at night and I saw one Frigatebird.

I set a dozen traps in the Milo and under rock ledges and returned after dark to find two specimens of the Hawaiian rat. Many shearwaters about.

August 21--From the beach we crossed in a launch to Manana Is. also called Rabbit Is. This is an old crater with walls of volcanic ash surrounding it rising on one side to 800 feet and on the other to 75 feet above the sea. The island is about half a mile long and the inner depression of considerable extent.

Belgian hares have been released here but are kept under control by hunters.

Several Hundred noddies nested on the rocky slopes and minah birds fed on the fruit of a wild tomato.

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cause of the extinction of the land birds. The prying eyes of these thieves cover every spot of the island and any sort of suggestion of a nest is an excuse for an immediate side trip of investigation. Once a nest was located the smaller land birds would be defenseless in the face of these powerful marauders. As I see it the introduction of the rabbits was of course the primary basic cause of all of the island birds' troubles, but the consequent extirpation worked to my mind rather to prevent the small birds from perpetuating their sps. through lack of cover from bird bandits <sup>the adult individuals</sup> than to actually exterminate themselves. Reno's report of finding 3 specimens of Himantide alive and thriving today in the tobacco patch So.W. of the lagoon makes me all the more certain that the species could all have adapted themselves to the changed conditions and gained a livelihood had they only been granted nesting cover to guarantee new recruits to take the place of the older birds as they died off. This tiny Honey Eater was probably the most specialized in its feeding habits of all the endemic land birds on the island. God knows when the last flower bloomed on this barren waste. Yet here are at least 3 individuals of this specialized form persisting as a sort of heritage from the last nest of the sp: that was built in sufficient cover to survive. But, as it seems to me, old age and death now inevitably stalk this childless remnant of a vanishing species.

Wetmore took a Sanderling today - an island record, I believe.

As the sun finally crashed through we shouldered the outfit and started back toward the tern colony at the south end of the island.

Made some movie of a flock of Noddy on the shore & a bit more turtle stuff.

As we started home for lunch after working the terns, a bird attracted my attention floundering on the beach in the edge of the waves. When I got