TRIP REPORTS TO THE HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE

March 1961- Woodside and Kramer
Sept 1961- Woodside
Dec 1961- Kramer
June 1962- Kramer and Beardsley
Feb 1963- Kramer

assembled by George H. Balazs

A REPORT ON A SURVEY TRIP

TO

THE HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE

JUNE, 1962

by

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ENTOMOLOGICAL REPORT

by

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INTRODUCTION

The following is a report on a trip to the Hawaiian Islands National Wildlife Reservation made by David H. Woodside and Raymond J. Kramer, biologists of the Division of Fish and Game of the State of Hawaii, David Marshall, Wildlife Biologist of the U. S. Fish and Wildlife Service, and John Beardsley, Senior Entomologist of the Hawaii Sugar Planters' Association. Transportation was furnished by the U. S. Navy LST 1141, "Stone County."

PURPOSE OF THE TRIP

The trip herein reported was to include the following activities as time and conditions would permit.

1. General familiarization survey of all the islands of the Refuge excepting Lisianski and Pearl and Hermes Reef.

2. Examination and, if possible, further study of the Nihoa Miller Bird and its habitat requirements in relation to a possible transference of this species to Laysan Island.

3. Examination of islands occupied by the Government HIRAN project personnel for signs of undue disturbance or introduction of unwanted exotic weed seeds.

4. To further photograph significant portions of the vegetation and habitat to be found on these islands.

5. Observation and counts of the monk seals and on Laysan, the teal.

ITINERARY

June 8 - Boarded LST "Stone County" 1141 at 0700. Departed Pearl Harbor. Cruised off Kauai that night.

June 9 - Enroute from Kauai to Nihoa.

June 10 - Landed on Nihoa at 0615. Returned to ship at 1345. Left for Necker Island.

June 11 - Landed on Necker Island at 0630. Returned to ship at 0900. Woodside debark at French Frigates Shoal at 1830 for return to Honolulu. Helicopter hit aerial wire on Tern Island so ship was delayed until repairs effected.

June 12 - Standing-by off French Frigates Shoal during repair, then departure for Gardner Pinnacles.

June 13 - Standing-by off Gardner Pinnacle. No landing attempted by members of our party due to crowded conditions ashore and rough weather.

June 14 - Landed on Laysan Island at 0930. Remained on Laysan Island until June 19 at which time we departed. Arrived at ship 1645.

June 20 - Enroute to French Frigates Shoal. Due to atomic testing, detour was made for eight hours.

June 21 - Arrived at French Frigates Shoal; debarked. Plane flight from Hickam cancelled so Marshall, Beardsley, and Kramer returned to ship overnight.

June 22 - Returned to Tern Island. Boarded Hickam Air Force plane in afternoon and arrived in Honolulu at 1930.

ABSTRACT

General conditions found on Nihoa, Necker, Laysan, and French Frigates Shoal are discussed in this report. Pertinent notes on vegetative conditions not previously noted are recorded, as well as notes on Sea birds, Monk seals, and military activities. Photographs of interest are appended.

An entomological report by J. Beardsley is appended.

CONCLUSIONS

The conclusions of this report are:

1. The Nihoa Miller Bird population is at a considerably higher density than was considered after the December 1961 trip.

2. The breeding and incubation period of the Miller Bird appears to be during late May and early June.

3. Rainfall during the winter and spring months was greater than normal for the entire chain, from Oahu to at least Laysan, with greatly beneficial effects on the plant cover.

4. Military activities continue to cause the introduction of exotic weed seeds, some of which have considerable competitive abilities.

5. The Monk Seals population remains high with, perhaps, a slight increase taking place.

6. The major plant species on Necker Island is Chenopodium; Beardsley found abundant insect life associated with this species.

7. Several newly recorded and potentially dangerous insect species were found to be thriving on various plant species.

RECOMMENDATIONS

1. That, if Miller Birds are to be transferred to any other island, Necker Island be given consideration in addition to the proposed transfer to Laysan.

2. That an entomologist, preferably Mr. Beardsley, be allowed to make further trips in conjunction with our patrol of the area.

3. That both broad and narrow-leaf plant poisons be carried in small quantity on future trips for purposes of eliminating small patches of unwanted exotic plants.

4. That efforts be made to visit Lisianski and Pearl and Hermes reef next summer (1963) with Mr. David Marshall in attendance.

ACTIVITIES AND OBSERVATIONS

NIHOA ISLAND

Vegetation

It would appear that there have been almost continual rains on Nihoa since December of 1961. Every plant species was green except the Eragrostis and Rumex which were becoming rather dried out. Two introduced species of potential pest plants (Chenchrus sp. and Paspalum sp.) were found to be established under the HIRAN antennae and were probably introduced accidently by the military. These should both be poisoned out on the next trip to Nihoa. Sicyos--was found to have spread into the HIRAN camp area at the summit plateau. The following are notes on vegetative stages:

Chenopodium--seed heads ripe, few flowers at lower elevations.
Sesbania--no seed pods noted, flowering.
Sicyos--seeds ripe, no flowers. This species was collected for further identification. Marie Neal of the Bishop Museum identified it as S. microcarpus
Solanum sp.--fruiting, ripeness in various stages; flowering in lower valleys.
Eragrostis--seeds mostly fallen.
Portulaca--flowering.
Euphorbia--no flowers or seeds.
Sida--flowering and seed heads forming. Many new shoots.
*Tribulus--found at bottom of west palm valley; flowering.

Birds

Albatross--No Laysan adults or young seen. Only five black-footed young seen; still downy on head but capable of flight.
Masked Booby--With large downy young.
Red-footed Booby--With young in various growth stages. No eggs.
Brown Booby--With large downy young.
Christmas Island Shearwaters--Very abundant this time of year; on eggs and with downy chicks.
Wedge-tailed Shearwater--Common; on eggs.
Bonin Island Petrel--Common; on eggs.
Grey-backed Tern--Seen on eggs and with downy chicks.
Necker Island Tern--Abundant in cliffs; one dead chick seen. Adults breeding.
Noddy Tern--On eggs and with chicks and immature flying young.
Hawaiian Tern--Seen only on the cliffs.
Frigate Bird--Half-grown downy young on nests. No males seen in nuptial displays.
Red-tailed Tropic Bird--Common, many with eggs.
Sooty Tern--With flying young and eggs. Appear to be limited by lack of nesting habitat.
Nihoa Finch--No nests were found of this bird but the species appeared to be as abundant as it was in the December trip.
Nihoa Miller Bird--Apparently the population of Nihoa miller birds is considerably larger than was estimated on the December trip. Miller birds were seen quite commonly on the summit plateau around the HIRAN camp, in West Palm Valley, and in East Palm Valley by Dave Woodside. Males were seen commonly at the tops of the larger bushes singing very loudly and continually. They appeared to be guarding nests or territories. One miller bird was found on a nest with one egg in it. In the course of photographing this bird considerable disturbance occurred which included plucking branches and twigs from in front of the nest within 3 to 4 inches of the bird, but the female would leave for

* This area not visited in 1961 trip.

only a period of a few seconds and would never venture further than 6 to 8 inches from the nest. She usually remained in a fork immediately under the nest and returned at the first opportunity. This "hold tight" attitude towards the nest would appear to offer maximum protection against predation from such birds as the Nihoa finch. This may be considered as one of positive factors in any consideration given towards the introduction of this species to Laysan.

Military Activities

As mentioned above, at least two new species of plants have been accidentally imported by military personnel. Both of these species are extremely tenacious and definite efforts should be made to totally exterminate the small patches of growth. When the HIRAN activity is abandoned, it is entirely probable that the large tents and full 50-gallon water and gas barrels which are presently on the island will be abandoned. It is perfectly logical to expect this, due to the hazard to the helicopter crew which would arise from unnecessary trips to the island. On the north face of the cliff edge a fair-sized refuse slide has occurred from the throwing of garbage, boxes, cartons, faulty electronic gear, etc., over the side. This is rather unsightly but is the only means of disposing of material these people have at hand. It is assumed that this damage will not be noticeable within the next five to ten years and it actually has no detrimental effect upon the bird population.

NECKER ISLAND

Vegetation

Necker Island, like Nihoa, is a remnant of a volcanic cone. It's much smaller than Nihoa, covering an area of about 41 acres with a maximum elevation of 276 feet. The soil is shallow, coarse, and mixed with great amounts of loose rocks which are basaltic in origin. Of the five species of vascular plants that were recorded in 1923, only four were noted this time. It is entirely possible that Sesuvium portulacastrum is still present on the lower slopes of the island as the species was found on the spray-washed rocky slopes at the base of the hill where we did not have time to explore. Of the four species found, Chenopodium sandwicheum was, as in 1923, the commonest plant on the island. Panicum torridum was, as in 1923, moderately common on the island with most of the plants being in a dead or drying-up stage. Christophersen reports that in 1924 only two clumps were observed; but in 1962 small clumps were found everywhere on the top of the island. Sesbania was much as noted in 1923; primarily along the flat top of the main part of the island, and seems to be holding its own quite well. Portulaca was, as in 1923, common on the flat tops and ledges of the cliffs. Apparently, none of the species planted by Judd in 1923 have survived. In comparing field conditions with photographs taken in June, 1923 by members of the Tanager Expedition, there seems to be at least twice as much vegetation present today.

Birds

Due to the extremely short time on the island no attempt was made to census the birds present but by far the most abundant bird was the Sooty Tern. Noddy Terns, Necker Island Terns, Fairy Terns and Grey-backed Terns were all present and all three species of Boobies were present. Nesting Frigate birds, Red-tailed

Tropic birds, Bulwers petrels; Wedge-tailed shearwaters were noted. Laysan Albatross Young (abandoned?) were abundant, while a few young of the Black-footed Albatross were seen.

Military Operations

It is entirely probable that here, also, the military shall abandon the tents, tent frame works, water barrels and C-ration cartons when the project is finished. This is also an extremely hazardous island to land on by helicopter and the dangers preclude making unnecessary trips. Here also is an unsightly garbage dump down the north face of the center of the island but which could not have been avoided. Unfortunately, one of the main camps was set, no doubt in complete ignorance, upon the site of one of the larger stone terraces of the pre-Hawaiian inhabitants, thus increasing the deterioration of this ruin. The Stone Maraes (basaltic slivers of religious importance) on other parts of the island were left undisturbed and various small retaining walls remain intact. No sign of introduced weed seeds was found.

GARDNER PINNACLE

No landing was attempted on Gardner Pinnacle due to the restricted area on the summit of the island for helicopter approach. Ordinarily, it is only possible for a helicopter to touch its front two wheels to the island and personnel aboard must then jump a considerable distance down. One thing of interest was noted: The several hundred frigate birds seen hovering over this island. Where these birds come from or roost is unknown since there is apparently no vegetation on this island except Portulaca which certainly does not provide the favorite nesting materials of this species.

LAYSAN ISLAND

Monk Seals

On June 16, a circuit of the beaches of the island was made and a total of 261 seals were counted. An attempt was made to break the composition up into adults, i.e., those 7 feet long or longer; sub-adults, those having obtained the adult coloration but less than 7 feet long; and new-born pups, that is, those with the black pelage. Twenty-three pups were seen on the island having been born within the last 6 or 7 weeks. Of unusual note was the large number, 96, of sub-adults seen. The majority of these had left their parents and displayed absolutely no fear or caution towards man, whereas, almost all the 142 adults had at one time or another apparently encountered man and almost invariably rushed for the water when disturbed. Many of the "sub-adults" were covered with considerable algae, indicating a fair length of time spent at sea in the recent past. Of the black pups, all appear to be in excellent condition with some so fat they could not readily get into the water from the beach. Several pups were born while we were on the island. One large dead and decomposed adult was found in the Scaevola. Of interest was the apparent fearlessness and complete unconcern for sharks displayed by the seals. On several occasions, I watched three or four seals swim into a school of 30 to 50 sharks of up to 7 feet in

length. The sharks which were apparently schooled for breeding purposes, would swim towards the seals and then veer off displaying no further curiosity, while the seals completely ignored the presence of these fishes. No tagged seals were seen this trip although not every seal could be examined. No turtles were seen on Laysan.

Vegetation

As with Nihoa, it would appear that rains have been continuous throughout the winter and spring months. Based upon vegetative growth and species distribution it would appear that the past year has been a good one for Laysan. In September of 1961, Woodside reported finding Nama in fair abundance on the windblown slopes on the north and east sides. At the time of the present trip Nama was found island wide, growing everywhere from the lagoon edge to the sea's edge. Much young growth was noted on the north and east shores but whether these small plants will survive without continuing rainfall for the next several months is unknown. The one Messerschmidia tree on the island appeared to be in excellent shape and is making good growth. The one Ironwood tree on the island was thriving well with many new needles; the 20 coconut palms on the island are growing at an excellent rate with the ones on the northwest side of the island now reaching a height of up to 15 feet. The tobacco plants reach a height of four to five feet. They are flowering and spreading along the entire northwest portion of the island. That the rainfall has been great in the past months is also borne out by the fact that the lagoon had risen considerably over past years' observations to the point of killing out great masses of Sesuvium, Cyperus, and Ipomoea at the lagoon edges. Since many thousands of Laysan albatross eggs were found in win windrows at the high water mark, the major rains apparently took place in the months of December, January, and February, the peak egg-laying season for the Laysan albatross. The lagoon waters are still slightly higher than they were in March of 1961, since the photo stake position at the water's edge at that time is now several inches under water.

The Eragrostis is very dense and shows excellent growth. Because of this, most of the photo station stakes could not be located; those that were found are often invisible in the pictures due to the height of this grass. The Scaevola has made great growth on the inner portions of the island and has filled in many of the vacant spots throughout the upper rim of the island. Cyperus pennatiformis was located in two 6 to 7 foot tall clumps at the extreme southeast tip of the lagoon near the 7 palm trees. This is an increase in growth of 3 to 4 feet from the September 1961 trip. In general, such vegetation as Cyperus laevigatus, Cynodon dactylon, Boerhaavia, Sesuvium, Tribulus, Ipomoea, and Pluchea were also growing lushly. Haliotropium curassavicum, while noted on prior expeditions as being common, was extremely abundant and growing well this year. Recorded for the first time on Laysan was Solanum nigrum. Six to eight small fruiting plants were found growing among the Ipomoea on the southwest side of the island between the lagoon edge and old tram tracks. Two different species of Sicyos were found on the island, Sicyos hispidus was common in the tobacco patches on the northwest side of the island, and Sicyos microcarpus was very common over the entire southern half of the island, often spreading over Eragrostis clumps and patches of Scaevola. One sprouted seed of the seabean plant, Mucuna sp. was found on the north beach, but it is extremely doubtful that this plant will survive there. Seeds of this species were also found in 1923 but apparently never survived.

Another member of the Cyperaceae, Fimbristylus cymosa was extremely common along the inner rim of the island, and was bearing mature seed heads. This species was not recorded anywhere in the Leeward chain in 1923, but has been existing on Laysan for some years where it is now becoming a prominent member of the vegetative structure.

An experimental planting of seeds from Nihoa was made in a line across the bare sand from a point just west of the photo stake #C2(3) up to the edge of the Scaevola patch noted in the same photograph (March 1961). The three species planted were Chenopodium, Solanum, and Sicyos microcarpa; this last species has now been identified as being already resident on Laysan.

Laysan Teal

No attempt was made on this trip to census the Laysan Teal due to the lush vegetation. Gross observation indicates that the population has not differed drastically from the past several years. In opposition to the past several years, appearance of these birds were found island wide from the lagoon edge through the dense vegetation to the beach edges. Only one young duckling was seen this year--a downy chick of perhaps two weeks of age, carefully following its mother through a shallow brackish water pond at the north edge of the main lagoon.

Several female ducks appeared to be heavy with eggs, that is, they seemed to experience difficulty in walking and appear to be somewhat heavier in the posterior portion of the body.

Laysan Finch

The status of the finch appears to be comparable to that of the March, 1961 trip when they were reported as being very abundant. Numbers probably have not varied significantly from the past year.

Laysan Albatross

The immature albatross appear to have hatched somewhat earlier than usual this year as evidenced by the size and moult condition of the fledglings. In most cases down was present only around the head and neck regions and many of the birds appeared to be almost ready to take flight. The major mortality was sustained around the edge of the lagoon where high water had destroyed many of the eggs by inundation.

Black-footed Albatross

There seems to have been a wider spread of egg-laying this year since young black-foots were noted in stages from young covered completely with down to recently-flying adults. There seemed to be no particularly unusual mortality this year.

Other Sea Birds

The following is a list of other sea birds noted on Laysan this trip with brief notes as to breeding status:

Wedge-tailed Shearwater: This species was found in its usual abundance. Egg laying had just begun and no young were noted.

Bonin Petrel: Only one pair of this species was noted. No eggs or young were found.

Bulwer's Petrel: Only one pair of this species was noted. No sign of eggs or young was found.

Red-tailed Tropic Bird: This bird was extremely abundant on the western shores of the island. Young were noted in all stages of growth and nuptial flights were occurring overhead daily.

Masked Booby: Eggs were found on several occasions but most of the chicks were one-half to three-quarters grown.

Brown Booby: More brown boobies were noted this year than in the past. Majority of the boobies had nested with the young being still naked.

Red-footed Booby: Found in their usual abundance on the Scaevola. Eggs and downy young.

Frigate Bird: Majority of these birds were with downy chicks.

Sooty Tern: By far the most abundant bird on the island. Various colonies had been established periodically, with some colonies almost entirely on eggs and others almost entirely with downy chicks. In several colonies, no breeding activity at all was noticed.

Common Noddy Tern: Abundant and with downy chicks.

Hawaiian Noddy Tern: Common, with eggs and chicks.

Fairy Tern: Common, with eggs, downy chicks, and fully feathered young.

Migratory Birds

Golden Plover: Common throughout the island.

Ruddy Turnstone: In large numbers this year.

Bristle-thighed Curlew: Very common at this time of year, scattered randomly across the island.

Wandering Tattler: Least common of the migrant birds but still numbering in the hundreds.

Military Operations

Two Air Force and two Army men landed with us on Laysan to re-establish their camp. The camp area has been expanded considerably in the past with four large tents set up and approximately 30 fuel and water barrels stacked neatly to the west. Just northeast of the ironwood tree a five-foot high concrete block has been permanently installed. It has been set up for engineering purposes of the project and should serve as a permanent photo station location. In general, the camp was quite clean and former garbage accumulations had been buried; however, the constant trade winds had blown away much of the loose sand over these garbage dumps and had re-exposed the upper portion of them. It is believed that when this station is dis-established, the military will leave the tents, cook shack frame, and the 55-gallon drums behind. If on the next trip, such is the case, efforts should probably be made to clean the island or have it cleaned by military personnel. Of interest was the fact that the common potato and garden variety onions were noted to be growing next to one of the larger garbage dumps. All plants that could be located were torn up and their roots exposed to the sun. Further efforts to assure complete destruction should be made on the next trip although it is doubtful that these plants would survive a season of drought.

FRENCH FRIGATES SHOAL

A helicopter survey was made of all islands of this group; to date, the island situation remains "status quo," with personnel still being based only on Tern Island. Aerial photos were made by Marshall showing the ramshackle condition of East island's abandoned station. An aerial count of monk seals revealed 26 adults and one black pup throughout the shoal. Rainfall records were consulted and the following learned: From September, 1960 through December 1960, 17.03 inches of rain were recorded. From January through June, 1961, 39.18 inches were recorded. From July through December 1961, 12.61 inches were recorded and from January through June, 1962, 30.54 inches of rain were recorded. This is almost double the rainfall quoted by Richardson in 1953 and 1954 when records for this island group were 18.03 and 28.41 inches, respectively. Observations indicate that more plant exotics have become established within the last several years on Tern Island; but due to human activity on the island by Coast Guard, Army, Pacific Missile Range, and Atomic Energy Commission people, it is felt that this particular island should be "written off" as a productive bird breeding area. A considerable number of turtles was noted throughout this chain and evidence of egg-laying was noted on East Island where the turtles were digging "nests."

Bird Observations on Tern Island

One nesting Red-tailed Tropic bird was found on an egg under Pluchea brush. Thirty-four young and two adult Laysan Albatross were counted. Six fairy terns were hovering about and landing in the ironwood trees near the Mess hall entrance but no eggs have been reported.

APPENDIX

LAYSAN ISLAND (c) JUNE, 1962

Planting Chenopodium, Solanum sp. and Sicyos microcarpa just west of stake C2(3). Note Scaevola patch for reference.

Domestic potato (left) and domestic onion (right) growing at military campsite, Laysan.

LAYSAN ISLAND (c) JUNE, 1962

Station C1 - (1)

This photo matches the extreme left shot of the "C Panorama" from North bench mark of 9/61.

LAYSAN ISLAND (c) JUNE, 1962

Station C2 - (1)

Station C2 - (2)

LAYSAN ISLAND (c) JUNE, 1962

Station C2 - 4

Station C2 - 5

LAYSAN ISLAND (e) JUNE, 1962

Station C2 - (6)

Station C4 - (1)
Compare to 9/61 photo. Note Eragrostis growth

LAYSAN ISLAND (c) JUNE, 1962

C7 - (1) Winter rains raising the lagoon level have destroyed much prime Laysan duck nesting habitat. Compare to 9/61 photo.

C7 - (2) Due to high, hypersaline water of the lagoon. Compare to 9/61.

LAYSAN ISLAND (c) JUNE, 1962

Cyperus pennatiformis growing to a height of seven feet at the southeast edge of the lagoon.

COPY

REPORT ON AN ENTOMOLOGICAL SURVEY OF NIHOA, NECKER, AND LAYSAN ISLANDS, DURING JUNE, 1962

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Honolulu

This report is based on insect collections and observations made by the writer on the islands of Nihoa, Necker, and Laysan during June, 1962. Only the more important species of insects observed have been mentioned below. Much additional material was collected but has not yet been completely identified. A more complete listing of the insects taken during this survey will be prepared at a later date. All species identifications cited below were made by me.

Nihoa, June 10. The short time spent on Nihoa was insufficient for a detailed insect survey. However, the insects collected included a number of species apparently not present in 1923, at the time of the last reported insect collection on the island. Of particular interest among the plant feeding insects were five species of leafhoppers not reported in 1923. Several of these are agricultural pests in Hawaii and elsewhere. These are listed below with their host plants.

1. Empoasca solana DeLong; on Chenopodium oahuense and Sesbania tomentosa.
2. Deltocephalus sonorus Ball; on Panicum torridum.
3. Scaphytopius loricatus (Van Duzee); on Sida, Chenopodium and Sesbania.
4. Circulifer tenellus (Baker); on Chenopodium. Commonly known as the beet leafhopper, this species is a serious pest in Western North America, and was first found in Hawaii on Oahu in 1960.
5. Chloriona kolophron (Kirkaldy); on Panicum. This species is a rice pest in Fiji, and was first found in Hawaii on Oahu in 1961.

Two species of plant feeding bugs; Liorhyssus hyalinus (Stal) on Sida, and

Hyalopeplus pellucidus (Stal) on Sida, Chenopodium and Euphorbia; were found for the first time on Nihoa. Other new records for the island include the bean butterfly, Lampides boeticus (L.), larvae of which were found in Sesbania flowers; and two species of scale insects; Odonaspis ruthae (Kotinsky) heavily infesting stems of Eragrostis, and Platycoccus sp., abundant on leaves of Pritchardia remota. The latter species is probably native to the island.

Among the more abundant insects found on Nihoa were several species which were also taken at the time of the 1923 survey. Adults and feeding damage of a small leaf-feeding beetle, Epitrix hirtipennis (Melsheimer), were found abundant on Solanum nelsoni; and larvae of two day feeding caterpillars, Hymenia recurvalis (Fabricius) and Heliothis sp., were found on Chenopodium foliage. A parasitic wasp, Apanteles marginiventris (Cresson), was reared from a Heliothis larva. Plant bugs, Nysius spp., were plentiful on Chenopodium as were adults of the endamic Nihoa weevil, Rhycogonus exsul Perkins.

Due to the short time spent on the island, little could be done toward determining what insects are eaten by the Nihoa miller bird. These birds were seen frequenting Chenopodium bushes, and it seems likely that insects such as day feeding caterpillars, plant bugs, and leafhoppers which infest that plant are eaten by them. In general, such insects appeared to be fairly abundant on Nihoa at the time of our visit, but this may have been a temporary condition due to the presence of much flush vegetative growth as a results of heavy rains during the past winter and spring. In periods of drought, populations of plant feeding insects are probably at much lower levels.

Necker, June 11. In the very brief period, about one and one-half hours, which was spent on Necker Island, several species of insects were collected which were not found there in 1923. These included two of the five species of leafhoppers taken on Nihoa: Empoasca solana very abundant, and Circulifer tenellus moderately so, both on Chenopodium oahuense. A scale insect, Hemiberlasia

lataniae (Signoret), was abundant on Chenopodium stems and was apparently killing some plants. A mealybug, Rhizoecus sp., was found abundant on the roots of one Chenopodium plant. Neither of these species was found in 1923. Heliothis and Hymenia caterpillars were also found feeding on Chenopodium on Necker but these were recorded from the island in 1923.

Laysan, June 15-19. Dr. George Butler of the University of Arizona made an insect survey of Laysan in 1960, and reported his finding in a paper published in the "Proceedings of the Hawaiian Entomological Society" in 1961. A copy of that paper is appended here for your information. An additional survey was made by Butler and Dr. R. L. Usinger in 1961, the results of which have not yet been published. During the five days spent on Laysan in June a number of insect species not reported in Butler's 1961 paper were found. However, several of these were collected in 1961 by Butler and Usinger. Among the more important of these new records are two species of day feeding caterpillars, Heliothis zea (Boddie) and Plusia chalcites (Esper). The former is known in Hawaii and U. S. mainland as the corn earworm and is a pest of corn, tomatoes, tobacco and numerous other plants. On Laysan it was found feeding on flowers and fruit of tobacco. P. chalcites is commonly known as the green garden looper in Hawaii and is known to attack a wide variety of crop and garden plants. Several adult P. chalcites moths were collected on Laysan, but no larvae were found. On Tern Island, French Frigate Shoal, a larva of this species was found feeding on Tournefortia foliage. Adults of two other moth species new to Laysan, Elaphria nucicolora (Guenee) and Pyralis manihotalis Geunee, were collected at electric light at night. The larva of the first of these is a plant-feeding cutworm type, while that of the second feeds upon vegetable debris. The Heliothis and Plusia larvae, provided they do not become so abundant as to materially damage the vegetation of Laysan, might prove of value as food material if miller birds were introduced to Laysan.

Other new insects collected on Laysan include several species of flies; a leafhopper, Deltocephalus sonorus; and several species of small wasps which are parasites of the immature stages of various other insects.

In general, insects were quite abundant on Laysan. Judging from conditions at the time of this visit, it appears that there would be abundant insect food for the Nihoa miller bird if it were to be introduced to that island. Whether insects would remain in sufficient numbers to support a sizeable bird population following periods of drought or severe storms is, of course, unknown.

General Comments

It is obvious from the results of this brief survey that new insect species are continuing to establish themselves on the remote islands of the Leeward Hawaiian group. Most of these new insect immigrants are probably transported through the activities of man, although some, such as the new leafhopper species so evident on Nihoa and Necker, May be carried by air currents from some of the larger islands of the Hawaiian chain. Aerial dispersal of such insects in other parts of the world is fairly well documented, and leafhoppers such as these have been taken in insect traps operated on vessels at sea in the vicinity of the Hawaiian Islands.

New insect species, particularly phytophagous forms, which become established on islands in the absence of the natural enemies which normally hold their populations in check in other areas may sometimes do extensive damage to vegetation. The large leafhopper populations on Chenopodium and the apparent dying of some plants due to infestation by the scale insect Hemiberlesia lataniae on Necker Island are indicative of what may occur when new immigrant insect species become established. Such insect infestations could easily result in profound changes in the nature and distribution of the vegetation of these islands, and thereby affect the stability of bird populations as well as the

plant communities. For this reason I recommend that whenever practical an entomologist be included on field trips to these islands in order that the kinds and abundance of insect species present may be checked at reasonably frequent intervals.

If serious insect infestations are found developing on any of the islands it may then become advisable to import parasitic or predatory species capable of reducing populations of the pest species before irreparable damage is done to the island biota. For example, the scale insect referred to above on Necker Island is well controlled on the major islands of Hawaii by a complex of several species of purposely imported natural enemies. These beneficial species are not present on Necker, although their introduction there might well be considered.

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