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THE DIET OF THE 'I'IWI *

By Ernest Pung
Division of Forestry

A remarkable feature of the 'i'iwi, Vestiaria coccinea, is that this endemic Hawaiian bird appears to have learned to gather nectar from an introduced plant, the banana poka, Passiflora mollissima HBK, Bailey, in a highly original manner and is making extensive use of this food source.

The bird formerly occurred on all the major Hawaiian islands. It is small, only $5\frac{3}{4}$ inches in length, but its bright red-orange head and body with a white patch on the upper section of the black wings gives it an attractive and conspicuous appearance. The tail is black. The unusual salmon-pink sickle-shaped bill makes the species easy to identify. The younger birds are greenish-yellow. Except for the sickle bill, it could be easily mistaken for other honeycreepers. The harsh, squeaky call is also distinctive, sounding somewhat like a rusty hinge.

The 'i'iwi supplied a very important element in early Hawaiian culture. Its feathers, especially from the breast, were extensively used in the capes and other feather work for which anicient Hawaiians were famous. After the feathers were selectively plucked, the birds were killed and eaten because they were believed likely to die anyway.[1] In Munro's BIRDS OF HAWAII, originally published in 1944, he states that it had apparently disappeared from Molokai and Lanai around 1935-37 and populations elsewhere were reduced.[2]

The early immigrants who began coming around 1825 brought with them not only the enthusiasm to work and settle on the land, but also many kinds of plants. Numerous exotic plants not only adapted readily to their new environment, but also gave a new look to the land. Unfortunately, some of the more aggressive foreign species escaped from cultivation. Presently, a number have become widespread and are now considered noxious plants. One of these is the banana poka, Passiflora mollissima HBK.

The banana poka is a climbing vine which works its way up to the tops of tree crowns. The large, attractive, pinkish flowers, which develop into fragrant, banana-like, edible but rather insipid fruits, are found year-round with a heavier bearing season from late spring until autumn. It is closely related to other passion flowers, some of which produce very palatable fruits. For example, Passiflora edulis f. flavicarpa Degener is grown commercially in Hawaii for fruit juice.[3]

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* Reprinted from ALOHA AINA (Love of Land), a publication of the Department of Land and Natural Resources, State of Hawaii, Vol. 2, No. 2, October 1971, pp. 3-5.

L.W. "Bill" Bryan, retired former Associate Forester for the Island of Hawaii, has stated that when he first came to the islands in 1921, the banana poka was already well established on the Waihou section of the Puuwaawaa Ranch. He also reported that in 1930, specimens from the Puuwaawaa location were planted at Keanakolu on the east slope of Mauna Kea and others at Honuaula on Mt. Hualalai. Since then, wild pigs have distributed the plants extensively. Pigs eat the ripe fruits and the seeds pass unharmed through their digestive tracts. They germinate after being dropped with fecal material. Presently, about 12,000 acres of 'ohi'a lehua-koa native forest have become infested in the Keanakolu area from the plants brought there in 1930. In Honuaula, only about 1,000 acres are infested. In 1958, a plant from Keanakolu was taken to the Volcano district where the species is now becoming well established on the Wright Road section of the Hawaii Volcanoes National Park.

Banana poka has invaded some of the best koa stands in the State. In relation to native vegetation it is a serious pest. The viney foliage hinders sunlight from reaching the leaves of the plants it covers, thus reducing photosynthesis. Also, vine-laden branches of trees, especially koa, are very susceptible to breakage, particularly during rainstorms. Open wounds created by such breaks serve as entrance courts for insects and diseases, many kinds of which attack koa.

The 'i'iwi somehow has learned to peck a small hole through the calyx and corolla at the base of the fully mature flower in order to gain access to the nectar which is produced there. Such a hole can be seen in the accompanying photograph * of a flower. Another photograph * shows an 'i'iwi in the very act of inserting its beak through a hole at the base of the flower. The writer has seen 'i'iwi do this many times and has examined hundreds of the flowers, most of which bear the tell-tale peck holes.

More details are illustrated in the drawing* of the longitudinal section of a flower. The banana poka flowers normally hang "face down" as shown. Presumably the nectar seeps down to the open end of the corolla tube where its odor attracts insects. In crawling about, the insects are "contaminated" by pollen. Then, as they move from flower to flower, some of the pollen is rubbed onto the sticky surfaces of the stigmas on the female organs. Thus, insects unconsciously assist in the cross-fertilization of the flowers. This process is commonly performed on many kinds of flowers by numerous types of insects.

The beak of the 'i'iwi is not nearly long enough to reach up the corolla tube to gain access to the source of the nectar. Instead, it makes a "back door" by pecking through the thin and tender tissues at the base of the flower.

The author first observed an 'i'iwi extracting nectar from a banana poka flower in 1956 on Mt. Hualalai. The 'i'iwi was noticed hanging on the poka vines and pecking at the bases of the flower tubes. After the sickle-like beak penetrated a tube, the bird would pause motionless. The actual extraction of the one or two large drops of nectar must occur during the momentary pause after which the bird immediately leaves. The total time involved to complete the cycle is not more than five seconds.

In September, 1970, the same phenomenon was witnessed at the 4,000-foot elevation above Laupahoehoe more than 40 miles away from theoriginal observation. Here, not only the 'i'iwi was utilizing the poka flowers, but also other Hawaiian honeycreepers including the 'akepa, and an introduced bird, the white-eye or mejiro (Zosterops palpebrosus japonicus).

It is a mystery how the birds determine which flowers are sufficiently mature to tap for their nectar. No pecking was noticed on immature blossoms. The birds do a thorough job of checking all flowers for it is difficult to locate a mature one which has not been tapped. The removal of the nectar has no ill effect on development of the banana-like fruit.

This is not the only instance in which endemic Hawaiian birds appear to be utilizing introduced plants. On Maui, it has been reported that in the Kula Forest Reserve, the flowers of fuchsia (Fuchsia spp.), a South American vine, are used by 'apapane and 'amakihi. District Forester Korte has seen 'apapane using fuchsias

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* Photographs and drawing were not reprinted.

at times when no other blossoms were in the area and he quotes Wildlife Biologist Joe Medeiros of the Division of Fish and Game,"'Apapane and 'amakihi depend on fuchsias for survival during periods when 'ohi'a and mamane flowers are not available." Mr. Hans Hansen of Kauai has specifically noted 'apapane, 'amakihi, and 'anianiau frequenting Streptosolen jamesonii, a member of the tomato family from South America. At his Koke'e cabin lot he propagates it on a small scale as food plant for these birds. District Forester Ralph E. Daehler, Kauai, has observed that more native birds seem to be found in eucalyptus plantations than in nearby mixed native and weedy exotic vegetation. Eucalypts, which have flowers closely similar to those of the native 'ohi'a lehua, are believed to serve as an alternate source of food for some of the nectar-eaters both on Kauai and other islands. However, the pecked holes in the flowers of banana poka are the only known instance in which the bird has "invented" a new technique.

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1. Te Rangi Hiroa (Peter H. Buck), Arts and Crafts of Hawaii, Section V, Clothing, pp. 217-218, Bernice P. Bishop Special Publication 45, Bishop Museum Press, 1964.
2. Munro, George C., Birds of Hawaii, Revised 1960, p. 94. Orig. published 1944.
3. Neal, Marie C., In Gardens of Hawaii, Revised 1965.

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This unusual finding was reported in HONOLULU ADVERTISER, 26 November 1971, page C-7, titled: 'Noxious Plant' is Nectar to Tiny Hawaii Bird with pictures of the banana poka flower and the 'i'iwi nectar tapping.

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NOTES FROM HILO
By Charles G. Kaigler

Reports of conferences attended because I thought our Audubon Society should be represented.

The Second Annual Symposium of the Hawaii Chapter of the Wildlife Society - 12 May 1971.

A good meeting with good speakers covering a number of important subjects. Win Banko, U.S. Sport Fisheries and Wildlife, reported on "Rare and Endangered Species" recommended more study, more effective protective regulation and perhaps breeding in captivity such as has been done with the nene, koloa and Laysan duck in order to prevent the total loss of our endangered birds. The Hawaiian crow may be down to less than 25 individuals at present. Russ LeBarron of the Forestry Division covered "Forestry Natural Areas," pointing out that Hawaii has 185,000 acres of forest of its 4 million total acres and that 20 natural areas have been selected for protection and study though not yet formally designated. These total 10 on Hawaii, 3 each on Kauai and Oahu, and 2 each on Maui and Molokai. This is an encouraging move, I believe. Gene Kridler, U.S. Sport Fisheries and Wildlife, gave an extensive slide program on the "Hawaiian Island National Wildlife Refuge" and Ron Walker, Division of Fish and Game, covered his survey of "Bird Life of Keehi Lagoon" which he and Andy Berger carried out in connection with the proposed new reef runway for the Honolulu airport. Jon Giffin, Fish and Game biologist, reviewed his "Big Island Feral Pig Study." To date there is no guess as to the total number of pigs or their effect on native plants. They apparently do spread the banana poka, as do game birds, and they are carriers of brucellosis. James Blaisdell of the National Park Service talked at some length on "Objectives of Wildlife Management in the National Park System." The National Park people do not consider the goat a "wild" animal, to be protected or managed for a sustained yield but rather feel that the goat, as an intruder through no fault of his own is a menace to the endemic species of flora and fauna of the park, and certainly favor the reduction of its numbers within the park area or its elimination, if possible, within the area.

(Note: All of these comments are my interpretation of what was said as I do not have written reports or transcripts for reference.)

One must also comment favorably on the welcome by President Jerry Pratt, the introduction of President-elect Dr. Quentin Tomich and the excellent barbecue of sheep and pig provided for the attendees, as well as the organization and handling of the program.

The 13th Hawaii Forestry Conference, 13-14 May 1971.

The general topic was stated as "Some Current Crises in Forest Resource Management," and there are obviously more than enough. Wesley Wong, Jr., of the State Division of Forestry spoke on the real threat of the rapidly spreading banana poka, one of the passion fruit vines, to the koa forests. The vine, which is spread by both pigs and game birds, apparently smothers the koa and destroys it and when the tree falls, spreads over the area covered by the fallen tree and affects the growth of the seedlings. The koa is,of course, one of the endemic trees upon which the honeycreepers feed. However, Wong did have photographs of honeycreepers apparently feeding from the flowers of the banana poka although he was certainly not presenting them as an argument for the substitution of the poka for the koa. The threat is under study at present as is the problem of the dying 'ohi'a forests. Robert Burgan of the U.S. Forest Service spoke on this problem which is actually not new. There were blights in 1907 and 1946, but the present disease affects some 600,000 acres of 'ohi'a and koa, including 10,000 in the National Park and can ultimately affect water supply and bird life as well as being an economic loss. Possible causes are frost, scale insects and borers, but most probably it is due to a fungus (Armillaria mellia) which attacks the roots.

Fred Bianchi,a retired entomologist of HSPA, spoke on the necessity for the preservation of the mamani forests on Mauna Kea. The mamani, which is necessary for the continued survival of the endangered palila, is also necessary for the continued life of all other plants, birds and mammals of the area as the leaves collect the fog and supply the drip necessary for survival of the slopes in any form other than desert. Bianchi describes the young plants as "ice cream" to the feral mammals and strongly recommends fencing off of the mamani area and elimination of feral mammals within the area as a necessity for rehabilitation and continued survival of the mamani forest.

Donald Reeser of the U.S. National Park Service covered resource protection problems within the park and also emphasized the feral goat as the primary threat to the native flora of the park.

William Thompson, Deputy Chairman of the State Department of Land and Natural Resources, covered "Forestry Research Planning for the Seventies" and emphasized the increased percentage of effort and money going into research and protection over production in the future.

Libert Landgraf of the Forestry Division spoke on fire protection planning and demonstrated their operations against this sometimes underpublicized danger to and destroyer of Hawaii's forests.

And Earl Pacheco, president of the Hawaii Island Fish and Game Association, made a strong plea for the provision of a sustained yield of feral sheep on Mauna Kea as a game resource for recreational use. Mr. Pacheco sees man, too, as an "exotic animal" here in the islands, as well as the sheep which he prefers to consider as "wild" game to be sustained on at least a limited basis rather than a mammal to be eliminated. Mr. Pacheco also disputes the effect of the sheep on the mamani, claiming that there were many more sheep on Mauna Kea in past years (as many as 50,000) than at present (about 2,000) and that the mamani are still there. Mr. Pacheco did not comment on goats or pigs.

There were other speakers too, and good ones, but the comments listed above were about all that I could absorb at one conference.

There was also a day-long field trip through the dying 'ohi'a forests along the Saddle Road and into the Laupahoehoe forest where the abundance of banana poka was quite evident, but there wasn't time because of the distance involved for a real examination of the threats by the participants.

The whole conference was well run, extremely informative and presented valuable

information even though most of it was not encouraging, and it is my opinion that at least one member of the Audubon Society should attend most conferences of this sort.

On the next day I took a field trip of my own through the National Park area and found two creepers at the end of the strip road, goodly number of 'i'iwi and 'amakihi and a fantastic number of 'apapane along the road. The birds were particularly numerous at the 3-mile and 7-mile points measuring from the entrance at Bird Park. Bird Park provided 'elepaio, white-eyes, linnets, and leiothrix; three white-tailed tropicbirds sailed over Halemaumau and at the Thurston Lava Tube, late in the afternoon, I had the best view of the 'oma'o one could wish for. The bird was in plain, unobstructed sight within 10 feet for some seven minutes or more, cocking its tail and shivering its wings just as a young bird begging for food might. This, of course, was an adult. It was a fine day.

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Letter from Drs. Otto and Isa Degener, 2 December 1971: 'Ohi'a Infection

We should like to alert especially residents of the "outside Islands" to a danger to which they are presently exposed by a devastating infection that has dug deeply into the forests of the Island of Hawaii. We never realized the importance of this plague, probably caused by a root rot, until we drove from Hilo to Kona over the Saddle Road. As we looked ahead while driving, we noticed the skyline punctuated by dead, erect trees. All these skeletons were 'ohi'a-lehua (Metrosideros), the tree that produces elegant pompons of scarlet flowers upon which so many of our native, nectar feeding birds depend for food. Whether this virulent organism gained entrance to our island by means of some infected plant smuggled from abroad by a garden enthusiast or in a clod of dirt on the shoe of some unsuspecting tourist, is any one's guess. This infection of the 'ohi'a-lehua, so far as we have noted, apparently extends from the vicinity of the Saddle Road to both sides of the Belt Road in the Glenwood-Volcano area.

The 'ohi'a-lehua, the host of this disease that now threatens the forests of our archipelago, is famous for germinating on hapuu or treefern (Cibotium) trunks. As the seedling grows, its roots enter the treefern "trunk" and embrace it more and more, causing the fern's eventual death by starvation and strangulation. Hence larger hapuu trunks may be riddled with live, dying and dead 'ohi'a-lehua roots. How many of these are infected with root rot?

If we are not to bid "Goodbye to you, green Maui, Molokai, Oahu and Kauai," we must prevent the spread of this plant plague from island to island. The only way we know of controlling this infestation NOW is to slap a stringent embargo on the export from the Island of Hawaii of all soil, of plants of the Myrtle Family (to which the 'ohi'a-lehua belongs), and of all hapuu logs and fragments unless these have been steam-sterilized or fumigated with a penetrating fungicide. Hapuu, apparently, is the ideal vector for distributing this disease.

When next you drive between Hilo and Kona, take the Saddle Road for a change, and see for yourself the devastation. Please, then, suggest to your Legislators how better to save our few remaining, native forests and the native animals depending upon them. We personally know of no method of checking this holocaust except that of imposing an embargo for the present emergency until some one can devise a superior method of eradication or control.

If you have any information or comment, please share your experiences with other members by writing to Kojima, 725-A 8th Avenue, Honolulu, Hawaii 96816.

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Field Notes from Charles & Hilde Kaigler:

20 November 1971. Nuupia Ponds, Kaneohe Marine Corps Air Station. 10:30 a.m. Two ospreys flying low over the pond nearest the ocean. In good view for 15 minutes or more. Moku Manu and the air above it had more frigatebirds than we have ever seen

there, easily in the hundreds and even seemed to outnumber the red-footed boobys on Moku Manu. A number of immatures observed as well as a few adults with inflated gular pouches. We also found both the brown booby and blue-faced booby and a large number of noddys (young Hawaiian noddys?) 200+ were assembled on the sand beach making short flights.

1 December 1971. 9:30 a.m. Two pair of lesser scaup were swimming in Salt Lake. Over 30 stilt feeding off Ft. Kam. at low tide. One Bonaparte gull observed at 20 feet.

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Field Trip to Poamoho, 14 November 1971 by Charles G. Kaigler

We had a very good turnout for the November field trip to Poamoho to observe the forest birds. Almost 30 members and guests started on the trail and those that didn't mind the rain saw a satisfying number of birds, mostly 'apapane and white-eyes, enjoyed beautiful scenery and, as a bonus, had the benefit of off-the-cuff observations of the botany of the area from Wayne Gagne. But it was wet, and at one period it really poured, which made the going somewhat slippery in places. In addition to the 'apapane and white-eyes, we all saw doves, cardinals, golden plovers and ricebirds and a few heard 'amakihi and saw them fly. There was one report of a Japanese bush warbler singing, but strangely enough, no one saw or even heard the 'elepaio. Despite the rain it was a good day for mos of us.

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Book Reviews by Wayne Gagne, Entomology Dept., Bishop Museum

Hawaii, a Natural History: Geology, Climate, Native Flora and Fauna above the Shoreline by Sherwin Carlquist. 1970. Natural History Press, New York. Illustrated by Sherwin Carlquist & Jeanne R. Janish. 463 pages. $19.95.

This is essentially the first general natural history text since W.A. Bryan's Natural History of Hawaii (1915), now a collector's item and generally unavailable except in libraries. This differs in that it doesn't treat the Hawaiian people in the natural scene, nor, as the subtitle indicates, the marine life. The book has the same format as Carlquist's recent Island Life and is as profusely illustrated. The multitudinous photographs, particularly of plants, are generally excellent, excepting those of insects which are often of poor, broken specimens and are sometimes contrived. The book could be recommended for its photographs alone; most of them have never been published before.

The book is divided into 6 sections which group the 30 chapters. It begins with a setting of the Hawaiian scene in two excellent chapters on geology and climate. Then follows 7 chapters grouped under the theme of insular biology, covering such topics as dispersal, problems of island existence, adaptive radiation, arborescence or the tendency for Hawaiian herbs and shrubs to become tree-like, flightlessness in birds and insects, and loss of dispersibility and competitiveness. The land shells, honeycreepers, lobelioids (a plant group) and the silverswords are treated in some detail in a chapter on each, under "Special Hawaiian Groups." The biological regions of the main islands are treated in 6 chapters. This is mostly the standard treatment here except that the epiphytic vegetation and the bogs are singled out in separate chapters. Then come 8 necessarily short chapters on each major island group in the Leeward Chain. The last three chapters include one on field trips one takes to see these biotic wonders, a selected bibliography and a short section on the pronunciation of Hawaiian words. There is an index.

There are numerous small errors of commission in the text, especially in those chapters, i.e. the non-botanical ones, that are not Carlquist's area of expertise. It would not be profitable to list these here except to say that the book should not be taken as gospel. The author apparently did not submit to outside reviewers before the book went to press which could have eliminated most of the annoying, erroneous details. Carlquist is at his best when treating his favourite subjects--oceanic island dispersal and insular evolution. Of special interest to birders in this respect is the emphasis on the role, real and imagined, that birds are claimed

to have played in the dispersal, constitution, and evolution of the Hawaiian biota.

The forest birds are dealt with in a chapter including a lucid portrayal on the evolution of the honeycreepers and a table summarizing their past and present nomenclature, Hawaiian name(s), distribution and diet of extant and extinct species. Here Carlquist has borrowed heavily from the Aves Hawaiiensis for his illustrations. The shore and water birds are also briefly treated here, and in the context of other topics in succeeding chapters.

The book is a timely addition to the literature on Hawaii's natural history. Unfortunately the comparatively high price will detract considerably from its potential as a text for high school and college courses in natural history that are belatedly making their way into the State's curricula in education. This text, in conjunction with his Island Life, gives a firm, broad footing for the biologist interested in the biology of oceanic islands.

Hawaiian Land Mammals by Raymond J. Kramer. 1971. Charles E. Tuttle Co., Inc., Rutland, Vermont, and Tokyo, Japan. Illustrated by Khan Pannell. 347 pages. $12.50.

This book complements Tomich's Mammals in Hawaii: A Synopsis and Notational Bibliography (1969) from which Kramer has admittedly borrowed heavily. This treatment though, is more anecdotal from the author's first hand experience with many of the larger mammals as a former State Fish and Game employee. The book contains several photos, figures, and tables, plus sketches of each animal. The latter though fairly crude are quite adequate to identify all but the rats. Here I think Kramer could have better shown the differences in keys and/or photos, for our three rat species are the only mammals the layman is likely to confuse and little is known of their present altitudinal distribution in the islands. There is an index and several appendices, one of which gives the Hawaiian names of mammals.

I was surprised to read that there are still supposed to be axis deer on Oahu in the Salt Lake area (less than 20) and about 90 on Maui in 1968. Persons looking for a review of the controversy which swirled about the introduction of this mammal, proposed and otherwise, will be disappointed. There is no mention of this problem even in passing.

Kramer sometimes treads on thin ice particularly in his statements on the effects of introduced mammals on native vegetation, for example about the pronghorn antelope on Lanai (p. 253). This is actually speculation, as he often admits, and he rightly takes the State to task for not following up on the food habits of recent introductions. More good insight into the State's handling of introductions is detailed in the case of the black-tailed deer to Kauai in the early 1960's. Only a decade ago introduced mammals were held in "gentle release" pens, not to see if they would feed on important native plants, e.g. koa,-which one might expect would preclude their introduction- but for the concern that they might get digestive upsets from eating it for the first time, so they were babied on "Calf Ration, dry and green alfalfa." Hopefully this is now history with last year's enactment of the Animal Species Advisory Commission to protect native biota. Kramer says (page 228), "The primary purpose of the introduction was -and still is- the hope that, by providing a sporting and aesthetically pleasing 'big game' species, the hunting public would eventually would come to prefer this type of animal to the forest-damaging feral goat, which could be eliminated from many, if not all areas of present establishment, without arousing the ire and subsequent political pressure that would occur if no substitute species were provided." There is no data showing that the black-tailed deer isn't forest-damaging also. In any case the hope is far from being realized for efforts are now being made to reduce the goat hunting season in the Na Pali Coast area of Kauai in order to ensure an undiminished supply of these vermin, a case of having one's cake and eating it too. Kramer summarises the whole game management fiasco nicely (page 325) with "...until such time as professional biologists' opinions are heeded, and the herds kept in control, the sheep situation /on Mauna Kea/ must be regarded as forceful evidence of the Hawaii citizens' lack of interest in their own physical landscape."

The format for each species is quite uneven, but the book is a worthy contribution and a good inside view of mammalogy in Hawaii, although somewhat overpriced.

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The Hawaiian Islands National Wildlife Refuge by Eugene Kridler, Administrator, Hawaiian Islands National Wildlife Refuge (Paper presented at the second Hawaii Wildlife Symposium held in Hilo, Hawaii, 12 May 1971)

The Hawaiian Islands National Wildlife Refuge consists of a series of small islands, reefs, and atolls stretching in a chain over 800 miles long west of the main Hawaiian Islands. It was established by President Theodore Roosevelt by Executive Order 1019 dated February 3, 1909. Jurisdiction rests with the Bureau of Sport Fisheries and Wildlife, US Department of Interior. Refuge headquarters are located in Kailua, Oahu, Hawaii.

Although the land area is less than 2,000 acres, water areas within the established boundaries cover more than 200,000 acres. The islands vary in size, elevation and composition. Some are mere sand spits of a few acres. Other may be rocks of 160 acres in size and 900 feet high. All are the tops of giant underwater volcanic peaks. Atolls, some islands and the reefs are of coral formed on the tops of such peaks. A few islands are composed of basalt.

The only human habitation today is at the US Coast Guard LORAN Station on Tern Island at French Frigate Shoals. Nihoa and Necker contain primitive temples, house platforms and garden terraces estimated to be up to 700 years old and which bear mute testimony to their once being inhabited by Polynesians.

Access to the refuge is difficult because it is remote and off normal shipping lanes. Landing on the reefs and rocky shores frequently is very hazardous. Rare and endangered wildlife found nowhere else in the world also live there. These include the Nihoa finch or finchbill, the Nihoa Millerbird, Laysan finch or finchbill and the Laysan duck. Rare mammals include the Hawaiian Monk seal. About 95% of the world population of these mammals occur on the refuge.

At present Bureau scientists are conducting studies on all of these species, as well as on the green sea turtle. To date over 800 seals and 575 turtles have been tagged in efforts to determine movements and to obtain basic life history information. Studies of the green sea turtle indicate that French Frigate Shoals is the most important breeding area for this animal, not only in Hawaii but also in the nation since this species has been largely eliminated as a nesting entity in the Continental United States. A number of turtles tagged on the refuge have been recovered by fishermen in waters off the main Hawaiian Islands. Basic population data have been obtained for the bird species. Research is hampered by the inability at present to spend longer periods of time on the refuge or to visit it when desired because of transportation difficulties.

The refuge islands have some of the greatest nesting colonies of seabirds in the world. Species such as the Laysan albatross, black-footed albatross, sooty tern, gray-backed tern, wedge-tailed shearwater, bonin petrels and others nest in enormous numbers at various times of the year.

The leeward archipelago is considered to be the probable immigration route for many of the high island shallow water marine life forms. Some forms unusual now around the main islands are common here.

The entire area offers outstanding opportunities for research investigations, both marine and terrestrial. The refuge has additional status as a National Research Natural Area. Because of the fragile ecologies of the units, general public use is not permitted. Entry is by permit only and is being restricted to scientists on qualified research projects which have been approved in advance by the Bureau. Investigations to date have included those by the Pacific Project of the Smithsonian Institution, University of Hawaii, Bishop Museum, US Geological Survey and others on the ornithology, botany, history, archaeology, entomology, geology and marine biology of the various areas.

Since the refuge has qualities meeting the basic criteria outlined in the wilderness act, studies are underway to determine if it or parts of it should be

recommended for inclusion in the National Wilderness Reservation System. The principal objective of the refuge is to preserve its flora and fauna both terrestrial and marine in as natural a state as possible.

Included in these objectives are those to:

1. Preserve rare and endangered species.
2. Preserve seabird colonies.
3. Preserve marine biota.
4. Preserve selected areas in their natural state for reference observations and studies.
5. Preserve historic features.
6. Offer opportunities for qualified research studies or projects.

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ALOHA to new members:

Paul Breese, 1179 Punchbowl Street, Honolulu, Hawaii 96813
E.H. Campbell, IV, 138 Holy Cross, University of Portla nd, 5000 N. Willamette Blvd., Portland, Oregon 97203
Donn Carlsmith, P.O. Box 686, Hilo,Hawaii 96720
Laura C. Casey, P.O. Box 1243, Kamuela, Hawaii 96743
Mrs. Eleanor Gilje, 1494 Hythe St., St. Paul, Minnesota 55108
Mrs. Viola H. Mclaughlin, 1220-1403 Aala St., Honolulu, Hawaii 96817
John Richardson, 1223 W. Freeman St., Carbondale, Illinois 62901
Dr. William Wingfield, 1934 Alaeloa St., Honolulu, Hawaii 96821

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To the outgoing and incoming officers: MAHALO NUI LOA for offering your services.

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HAWAII'S BIRDS, a field guide, is available for $2.00. Send in your orders to: Book Order Committee, Hawaii Audubon Society, PO Box 5032, Honolulu, Hawaii 96814.

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JANUARY ACTIVITIES:

9 January - Field trip to study shore birds. Bring lunch, water, and if possible your car. Transportation cost ($1.00) to be paid to the drivers. Meet at the State Library on Punchbowl Street at 8:00 a.m. Leader: William P. Mull, telephone: 988-6798.

10 January - Board meeting at McCully-Moiliili Library, 6:45 p.m. Members welcome.

17 January - General meeting at the Waikiki Aquarium Auditorium at 7:30 p.m.
Speaker: Dr. Robert C. Eddinger, Ornithologist
Topic: Honeycreepers of Kauai

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DUES: Regular - $3.00 per annum
Regular out of State - $2.00 per annum
Junior (18 years and under) - $1.00 per annum
Organization - $2.00 per annum
Life - $50.00

DUES FOR 1972 ARE NOW PAYABLE