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ISLAND OF HAWAII LAND BIRD DISTRIBUTION AND ABUNDANCE

By Charles van Riper, III

Kohala Mountains

The eastern part of the Kohala Mountains is virtually a "bird desert." The only passerines found here in any numbers are the White-eye (Zosterops j. japonica) and the Red-billed Leiothrix (Leiothrix lutea). There are moderate numbers of 'Elepaio (Chasiempis sandwichensis); a few 'Anakihi (Loxops virens) and 'Apapane (Himatione sanguinea) may be found scattered throughout the region, usually concentrated in the larger tree clumps. A pair of Koloa (Anas wyvilliana) can often be found feeding in the upper reaches of the Hamakua irrigation ditch.

The lush western end of the Kohala rain forest is a marked contrast to the stark eastern side. Here trees are much larger and native birds are found in greater numbers, although never equal in density to the other major forest regions of the island. The most obvious bird to the observer is the 'Elepaio. It occupies the lower story of the forest and can often be seen chasing insects among the fronds of the tree fern (Cibotium glaucum).

Of the drepanids, the 'Apapane is by far the most abundant. The 'Apapane population follows the bloom to the different areas of the forest. In places where they might have been abundant one week, they are totally absent the following. The 'I'iwi (Vestiaria coccinea) also moves around following the bloom of the 'ohi'a (Metrosideros collina var. polymorpha).

The 'Anakihi occupies the middle strata of the Kohala forest, being found in lesser numbers than the 'Apapane. The 'Anakihi moves little and can be found in the same area throughout the entire year.

I have observed few endangered species of birds in the Kohala area. On 29 June 1971 I did observe a male 'Akiapola'au (Hemignathus wilsoni) on the edge of the forest. He was feeding in 'ohi'a trees, fluttering in front of and poking repeatedly into the flowers. A number of birds in this area look and act very much like Creepers (Loxops maculata). I have observed groups of three to five along the far reaches of the Kehena ditch trail. The 'Io (Buteo solitarius) and Pueo (Asio flammeus) are infrequent visitors to this forest.

Eastern Slope of Mauna Kea

This pristine native 'ohi'a forest, stretching from Laupahoehoe to Puu Oo, is one of the most productive areas in Hawaii for numbers of birds. The forest is extensive and in most cases unspoiled by human activity. It is truely a shame that the State is allowing the rape of this area by Blair Ltd. The granting of permission to cut a second 500 acre tract of Koa is surely the "beginning of the end" for this beautiful virgin forest.

The banana poka (Passiflora mollissima) is well established in this area and has become an important food source for many of the birds. In the regions where this plant is abundant, the 'I'iwi far outnumbers any other species of bird. On one spring trip to Nauhi, 27 June 1971, I observed the 'I'iwi in all stages of plumage development, flitting about in the tree tops in such great numbers that it was hard to distinguish the presence of any other species of bird.

The 'Io is often found in this locality, usually on the upper edges of the forest. On 2 August 1971 I found an active nest 21 feet high in the fork of a large 'ohi'a. The nest, near the Keanakolu forestry cabin, contained one young which was just about ready to fledge. Below the nest was a number of partially eaten mature banana poka fruits and a number of berries.

The 'Apapane is very abundant in this area, as is the 'Amakihi and 'Elepaio. The 'Oma'o (Phaeornis obscura) is also a common resident of this area. I am sure that this forest, when more thoroughly studied, will turn up a number of the rarer Hawaiian birds.

Eastern Slope of Mauna Loa

The kipuka from the saddle road to the volcano area have a diverse avifauna. The 'Apapane, 'Amakihi, 'I'iwi, 'Oma'o, Creeper, and 'Akepa (Loxops coccinea) are all found here. One of the most productive areas in this region is the Kilauea Forest Reserve. Here 'Apapane are by far the most abundant bird; 'I'iwi, 'Elepaio, and 'Oma'o are all found in sizeable numbers. There is a marked reduction in the number of 'Amakihi.

The Kilauea Forest is most likely the best place on the island today to see 'Akepa. On 30 December 1972 I observed 13 individuals in this region. The male birds were in all stages of coloration ranging from mottled brown to bright orange. One immature, apparently a female, was patchy grey and yellow. On 2 January 1973 I searched this same area for an entire day and observed only one bright yellow female.

The 'Ohi'a-koa forest of Kilauea provides good habitat for the rare and endangered 'Akiapola'au. The birds prefer the dead branches of the koa, but I have observed them feeding just as freely on naio (Myoporum sandwicense) and, on one occasion, probing into a kolea (Myrsine lessertiana). On 18 January 1973, while with James Jacobi, Paul Banko, and Terry Palmer, I had the good fortune of finding an active 'Akiapola'au nest; this was the first nest ever reported for this species. The structure was situated in the lateral fork of an 'ohi'a more than 40 feet above the ground. When I first saw the nest the female was sitting inside and appeared to be shaping the exterior of the rim. The nest appeared to be in the final stages of construction as the outside was complete; it resembled an 'Amakihi nest as it had very small twigs and mosses interwoven into the base. Unfortunately, the nest was never finished.

Higher on the slopes of Mauna Loa, Nene (Branta sandvicensis) are frequently found. The only other birds I have ever observed at this elevation (8,000 to 10,000 feet) are the 'Oma'o and 'Amakihi. Some of the 'Amakihi I have observed at the tree line area are very darkly colored. On 22 June 1971, on the southwestern slope of Mauna Loa, I observed from 10 to 14 of these dark colored individuals feeding on 'ohi'a blossoms. In this region the 'Apapane utilize lava tubes as nesting sites.

Saddle Area between Mauna Loa and Hualalai

Due to extensive forest destruction by cattle, goats, sheep, and man, the northwestern slope of Mauna Loa offers little suitable habitat for birds. The mamane (Sophora chrysophylla) forest is almost entirely gone and the birds are now restricted to the forests of the rough 'a'a flows. In the Puu Lehua area one can still find occasional 'Amakihi, 'Apapane, 'I'iwi, and 'Elepaio, but their numbers have been greatly reduced. The Papaloa area has a greater concentration of endemic birds. Introduced passerines in the form of White-eye, Leiothrix, Linnet (Carpodacus mexicanus frontalis), and Cardinal (Richmondena cardinalis) are very abundant in this region.

At lower elevations (2,000 to 3,000 feet) beautiful mature 'ohi'a forests are extant; 'ie'ie (Freycinetia arborea) can be found climbing any number of trees. For some unexplained reason this belt of forest has very few birds in it; one would be hard pressed to find even introduced species. The only "native" that has been able to hold its own here is the Moa or Jungle Fowl (Gallus gallus). A small population still remains in the wild state foraging on the floor of the forest.

Hualalai

The diverse habitats of Hualalai offer shelter to many species of Hawaii's birds. The dry summit area is the home of the Nene. I have observed more Nene across the summit region of Hualalai than any other area on the island. The birds are a breeding composite of the color-banded pen-reared birds from Pohakuloa and those from Puu Waawaa Ranch. Very few other birds are found here as the landscape is barren and little cover is available for them.

Hualalai is the home of the rare Hawaiian Crow (Corvus tropicus). The southwestern slope of the mountain is the usual haunt of this bird. I have observed a few birds above Puu Waawaa, and they often times get as low as the ranch house when the fog is in. When the plums are ripe in this area, the crows feed on them almost exclusively.

The 'Io at one time was common from sea level to the top of Hualalai. Today it is found mainly in the higher forested regions down to the Kona coast road. I know of at least two active nests on the northern slope of Hualalai; both nests have been in use for at least the last three years.

On the lower slopes near Puu Waawaa, the 'Amakihi is abundant. They like the mamane forest and are commonly found along with the 'Elepaio. The 'Apapane come down to this elevation for the 'ohi'a bloom, but are more frequently encountered at the higher elevations (4,000+ feet) along with the 'I'iwi.

I have observed 'Akepa on this mountain from as low as 5,500 feet to as high as 7,000 feet elevation. They seem to prefer the 'ohi'a belt that runs horizontally around the dormant volcano. I have observed the 'Akiapola'au only once on this mountain. On 11 August 1971, as I was descending the western side, I observed a male feeding in 'ohi'a trees. He remained in the immediate area for over seven minutes, going from tree to tree. The area was 1.5 miles southeast of the Moanuia radio relay station at an elevation of 5,500 feet.

There are many species of introduced finches in this area. The Linnet, Ricebird (Lonchura punctulata), and Saffron Finch (Sicalis flaveola) have all established breeding populations on the mountain. Both the American Cardinal and Red-crested Cardinal (Paroaria cucullata) are found here with the former in much more abundant numbers. Numerous releases of exotic passerines and game birds have been made on the Puu Waawaa Ranch, and as a result, one is liable to encounter many types of birds. The Cordon bleu (Uraeginthus bengalus) is one that has established a fairly large population in this area.

Western Slope of Mauna Kea

The most abundant bird of the dry mamane-naio forest on Mauna Kea is the 'Amakihi. This species far outnumbers any other bird here. The other common native bird in this region is the 'Elepaio. Localized population of Palila (Psittirostra bailleui) and 'Akiapola'au can be found if one takes the time and effort. Other endemic birds can sometimes be seen in this region. In over four years of work in this area I have seen only one 'Akepa, two 'I'iwi and no more than 15 'Apapane. A lot of these birds are immature individuals and appear to be merely passing through the area.

There is a large number of introduced birds that have adapted to the cold dry climate of Mauna Kea. The Chinese Thrush (Garrulax canorus) and Skylark (Alauda arvensis arvensis) can be found in the forest throughout the year. The White-eye and Ricebird are found here during their nesting season, but apparently return to lower elevations in the nonbreeding season. The Linnet and Leiothrix may exhibit such seasonal movements. Many species of game birds have been released in this area by the State Division of Fish and Game.

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WHITE-EYE VOCAL MIMICRY

By Sandra J. Guest

Vocal mimicry, in which the call notes or song of other species are imitated, is well known for many birds (Van Tyne and Berger, 1971, Fundamentals of Ornithology). In 1932, Chisholm (Ibis 1932: 605-624) reported that the Gray-breasted White-eye (Zosterops lateralis) of Australia is a capable mimic. He stated "the song...nearly always includes borrowed notes," and further speculated that the "imitative ability is possessed by all Australian species of Zosterops, and possibly by many in other countries as well." I know of no report discussing the mimicking ability of the Japanese White-eye (Zosterops japonica japonica)in Hawaii.

On April 28, 1973 on the University of Hawaii campus, I heard a White-eye singing a rambling song, similiar to their whisper song, but much louder. The song was different enough to catch my attention. Singing from a branch about 10 ft. above my head, the bird shifted from a rambling warble to the territorial song of the American Cardinal (Richmondena cardinalis), which it sang several times in its entirety. The

White-eye then flew to a nearby banyan tree and disappeared in the foliage. It is of interest that in the immediate area two American Cardinals had been singing almost constantly for at least a month prior to my observation. From March 18 to April 28, 1973, I was in the area on 21 different days, and heard the Cardinals singing 19 of those days.

The function of vocal mimicry is not well understood, and how common it is in the White-eye in Hawaii is not known. However, this species is capable of mimicking other birds. Had I not been watching the White-eye, I would surely have mistaken it for a Cardinal.

Editor's Note: MAHALO for the excellent field note! Any comments? Please share your experiences with other members by writing to Kojima, 725-A 8th Ave, Honolulu, Hi 96816.

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BIRDS, PARASITES, AND DISEASE

By F. J. Radovsky, Bishop Museum

(Excerpts from a lecture at Hawaii Audubon Society General Meeting, 21 May 1973)

...Consider a mite that has progressed so far in its parasitism that its immature stage lives in the subcutaneous tissues of pigeons and other birds and often gets into the blood stream; it has no mouthparts but feeds by uptake of nutrients through its cuticle, increasing greatly in size; when fully developed its legs are tiny and relatively useless--how it exits from the bird is not fully understood; in the nest of the bird, it sheds its skin to produce a non-feeding adult that mates and produces a new set of immatures of the same nymphal stage, and these penetrate a host anew. The free-living mites related to this parasite lay eggs and have 5 active feeding stages including the adults, all with well-developed mouthparts. The parasite, relying on the rich food supply of the host, has been able to dispense with all but 2 stages, and only one of these feeds. What a wealth of conjecture, observation, and experimentation can be devoted to understanding the adaptations of this one parasite alone.

Again, many birds have parasitic flies, blood sucking and often wingless, that run with great speed through the feathers. These flies are flattened and have a very un-fly-like form, with peculiar comb-like structures on parts of the head and body that aid in progress through the feathers and defense against preening of the bird. ...These flies too have shortened their life-cycle to take advantage of the rich and constantly available food supply in the blood of the host bird. A single larva develops at a time <u>inside</u> the uterus of the female fly, feeding on a milk-like secretion; when fully developed, the larva is deposited in the nest, pupates, and gives rise to another adult. ...Free-living flies generally have an external egg stage, a larva that goes through as many as 5 stages as it grows and molts, a pupa and the adult. By nourishing the larva internally, through its feeding period, the female protects it from all the slings and arrows that it would be exposed to in a free-living environment; thus the parasite can afford a low reproductive potential, because of the excellent chance that each young conceived will reach maturity.

Not all parasites have gone in this direction of a simplified life cycle; some have taken an opposite turn. Many of the internal worm parasites of birds have very complex cycles. Let us examine the cycle of a typical fluke living in the intestine of a shore bird, say a gull. Flukes are parasitic flatworms which as adults have one or two suckers with which they cling to an internal surface of a host. ...The gull fluke lays great numbers of eggs which are carried out with the faeces of the host. If dropped in water, an active swimming larval stage hatches from the egg; it finds an aquatic snail of the right kind, if fortunate, and penetrates into its internal organs where it transforms into a sac-like form quite different in appearance. This new larval type asexually reproduces numbers of a still different sort of larva which also reproduces asexually (sometimes through repeated generations). This last form eventually reproduces numbers of another form that <u>finally</u> is ready to burrow out of the snail. The larva that leaves the snail swims actively until it finds a proper kind of fish; using secretions that dissolve the host tissues, it penetrates just beneath the scales of the host and transforms into a resting type of larva. If the immature flukes on a fish are again fortunate, a gull will come along and eat the fish. The gastric juices of the gull will free the parasites and activate them to go through a final transforma-

tion into young adults. These attach to the intestinal wall and mature until they are able to produce eggs.

...Many eggs are produced by the fluke throughout its life in the gull's intestine. The number of potential progeny from a single fluke is made astronomical by the repeated immature stages that reproduce asexually. ...The adult fluke has both male and female organs and can fertilize itself. Therefore, only one progeny of a fluke needs to mature in order to maintain a stable population.

This is a peculiar waste of potential, considering all the eggs that are shed into unsuitable habitats, all the larvae that fail to find a first or second host, all the infected fish that are not eaten by appropriate bird hosts. Yet there is an elegance in the adaptation of the parasite to its several hosts and the general environment. Like all organisms, the fluke is nicely adapted to the conditions under which it evolved. Since they all require snails as one of their hosts, flukes of this type may first have evolved in association with snails. Adoption of other hosts may have permitted a more advantageous source of nourishment for the adults. The necessity of passing from one host to another through a hostile environment required a high reproductive potential. At the same time, the use of a number of hosts in each of which it can survive for extended periods gave it a form of security: If one host in the chain migrates or otherwise fluctuates seasonally, or should it be depleted in any way, the parasite has a reservoir to tide it over in the other hosts.

It seems incongruous that birds, typically with a neat, clean and bright look superficially, should be burdened with so great a variety of parasites. If a wild bird were to suddenly disappear and only its parasites remain, fixed in space, often there would be a fairly complete silhouette of the bird remaining. Certainly, a composite of all the parts of birds susceptible to parasitism would be a model of the complete bird. And this is with reference to metazoan animal parasites only, excluding the microbial forms. One naturalist has stated "They are not only birds but aviating zoological gardens."

Among the external parasites, there are the house flies mentioned earlier, the lice (and often one bird will have several kinds of feather lice on different parts of the body; a South American tinamou may be infested by 21 different spp. (!)), feather mites (again with several kinds on one bird), quill mites, skin mites, and mites that burrow into the beak or feet. Temporary visitors from nest or field include blood-sucking maggots, fleas, bird bugs, kissing bugs, more mites, ticks, mosquitoes and a variety of other biting flies. Internally there are flukes--these alone occur at places throughout the alimentary tract (esophagus, crop, gizzard, intestine), in the reproductive system, the blood vessels, the lungs, and so on; there are also tapeworms, roundworms, and spiny-headed worms, mites in the respiratory system from nares to air sacs. At the microbial level, there is a great range of Protozoa that infect the blood stream as well as intestine and other organs; there are bacteria, fungi, and viruses. It would be tedious to continue or to attempt a more detailed survey here. ...

Birds are not really extraordinary in their variety of parasites. Similar lists could be drawn for various groups of mammals, such as rodents or bats, for fish, etc. Invertebrates also have parasites. And there is hyperparasitism or parasites of parasites. You may recall the hyperbolic rhyme "Every flea has fleas to bite them and so on, ad infinitum."

There is a total spectrum in the degree of harm and annoyance that a parasite causes its host. The predator must kill its prey, but the well-adapted parasite lives on interest and leaves the capital alone. When applied to bird parasites, not killing the goose that laid the golden egg seems an especially appropriate phrase. It is also to the parasite's advantage to be sneaky about dipping into the interest; obviously the less annoying the external parasite may be, the less likely it is to be destroyed by preening or other behaviorial responses of the host. Humans today take great precautions to avoid parasitism, but a number of us are infected with tiny mites living in the hair follicles of the face. These mites are harmless in most cases and we are unaware of their presence. So it appears that parasites evolve from the malignant to the benign. When a parasite is particularly harmful to its host, it is considered axiomatic that the co-evolution of the parasite with that host has been brief. This is a generalization

with exceptions, but it appears to be correct in the great majority of cases.

One good example is of particular concern to us in Hawaii. Many of you are familiar with the work of Richard Warner (1968, CONDOR, 70:101-120) on the effects of mosquito-transmitted pathogens on endemic Hawaiian birds. The results are indicative of a greater susceptibility to bird pox virus and a much great susceptibility to avian malaria in drepanidids and an endemic sea bird (Dark-rumped Petrel) than is generally true of birds from continental areas. We know that mosquitoes have been in these islands for only 150 years, and mosquitoes are necessary for the natural transmission of these pathogens. The conclusion is well-supported that lack of prior exposure to the malaria parasite or to the virus resulted in lack of adaptation by the native birds to resist these parasites and their damaging effects. The relative importance of the mosquito-borne pathogens in causing extinction, reduction, and range-limitation of native birds is a separate question, and one that requires further study.

In a family of mites that includes many species parasitizing nasal passages of birds of most genera and throughout the world, there is one species that has become a lung parasite. That this is a recent event in evolutionary terms is supported by evidence of relationship, morphology, and host range of the mite. Unlike the nasal mites which generally seem to do little damage, the lung mite may severely injure or even kill its hosts, including canaries.

This brings up another point that must be considered relative to the severity of a parasite's effects on the host. The canary is a cage bird as well as occurring in the wild. It appears that the stress on caged birds may induce severe effects by parasites that are well-tolerated in nature. A classic example is psittacosis. Wild parrots are regularly infected without clinical manifestation. Cage these parrots and they often sicken and die of the disease.

There are situations in nature, apparently of long-standing, where bird parasites do regularly cause severe injury to their hosts. One example is that of the blood-sucking nest maggots. These are larvae of flies that belong to the blowfly family. ... The larvae attack nestlings and frequently kill them by feeding on their blood. In parts of North America, it has been estimated that over 50% of the nestlings of some passerines are destroyed by the maggots. ...The fly larvae are somewhat similar to predators in relation to the host or prey. There may be little advantage to their moderating their effect on the nestlings. If they take blood to any considerable degree, the nestling is less likely to survive, and it is also necessary for the parasites to take full advantage of the periods when the birds are nesting. ...

Parasitism is one form of close relationship between different species of animals. There are others and we should consider these even to understand parasitism itself. The terminology is of some interest per se. Symbiosis simply means living together, and in the broad sense in which I use it, it includes parasitism (along side its food), commensalism (same table), and mutualism. These are separated on the basis of harm or benefit to the host.

The parasite is the partner in such a close relationship that injures the host.

A commensal derives benefit from the host but neither injures it nor helps it. Some feather lice and mites feeding only on skin scales and parts of feathers may fall in this category. A classic example is the remora accompanying sharks and other large fish.

In mutualism, both partners benefit. For example, there are certain predatory mites living in the feathers of birds that feed exclusively on the mites and lice that are parasitic on the bird. The classic example of mutualism is the lichen, in which an alga and a fungus live in intimate association; some would restrict the term mutualism to this type of obligatory association.

None of these definitions is satisfactory because of the complete intergrading spectrum of interactions between organisms. ...Also, one organism may take on different attributes at different times. Some of our intestinal bacteria (and undoubtedly some in birds as well) may be parasitic, commensalistic, or mutualistic according to circumstances.

Birds themselves are adapted for symbioses of various kinds, some of them particularly fascinating. Members of several families, including the icterid Cowbird in

North America, have evolved brood-parasitism in which eggs are laid in the nests of other birds. The European Cuckoo has perhaps carried this habit to the most fabulous extreme and is certainly the best studied. The complex of adaptations include mimicry of various host bird eggs, sometimes cooperation of the male in distracting the host parents from the nest, destruction of eggs replaced, forcible ejection of eggs into small-apertured nests, and so on.

Commensalism in birds is nicely exemplified by the Buff-bodied Heron or Cattle Egret now here in Hawaii. Here where the cattle lack ticks or similar large parasites, the egret feeds relative to cattle only by taking advantage of the insects stirred up from the grass by movements of the cattle. This can be readily observed in pastures near the road on the windward side of Oahu. Also apparently commensal is the habit of a number of tropical birds of building nests near or even in the nests of stinging wasps or ants. Why the insects tolerate the birds is not known, and perhaps there is some unknown benefit to the insects.

Mutualism is exemplified in a number of bird relationships. One of these also involves deparasitization and is called "anting." Many birds will stand on a nest or trail of ants, with wings outspread, allowing the ants to climb into the feathers and feed on the ectoparasites. Presumably if it stayed too long the bird itself would be eaten, but the bird apparently is able to shake off or preen any ants that do not leave voluntarily. The relation between the African Honeyguide (Indicator indicator) and the honey badger or ratel is obviously beneficial to both. The bird leads the mammal to bee hives, the ratel breaks open the hive and feeds on honey and grubs; the bird feeds on the grubs and perhaps honey as well.

There is a book that describes such relationships of birds and the subject of parasitism of birds in general that I can unreservedly recommend to you. It is probably the only book on parasitology that has gotten excellent popular press reviews as enjoyable reading. It is FLEAS, FLUKES, AND CUCKOOS by Miriam Rothschild and Theresa Clay, published in England. The hardcover 3rd edition is published by New Naturalist Library (1957); a paperback is published by Arrow Books, Ltd. (1961).

One feature attributable to parasites in greater or lesser degree is that they have evolved in close association with another organism, the host. Particularly for permanent parasites, we can then consider the environment of the parasite as the host itself. Since a particular host animal is much easier to characterize than all of the potential influences of a multiorganismic free-living environment, parasites offer special advantages for evolutionary study.

For example, it has been demonstrated that certain lice of mammals are restricted to particular types of rodents by the shape of the louse claws. The claws are adapted to grasp hairs of a certain size, and these lice can infect certain hosts with hairs of this size but not related hosts with thicker or thinner hairs. Such restriction of lice may apply even as to areas of a single host, as illustrated by the pubic louse of man; this parasite will occur on hairs up to and including the eyebrows but can not exist on the scalp hair because it is too fine for the claws to grasp.

The subject of host specificity is both complex and important. Clearly some parasites have adapted toward increased specificity, which allows them to become most closely adapted to a particular host; this increased specificity is generally accepted as an indication of long coevolution of parasite and host group. However, some parasites apparently must retain a broad range of hosts in order to survive. For example the same species of gull fluke described earlier not only can live in a variety of birds but also exists in such mammals as seals.

One of the more fascinating aspects of specificity and coevolution of host and parasite is that it provides clues to the evolution of each group. ...Bird lice are particularly good examples of host specificity and coevolution. So much so, that a specialist on the group may tell a collector providing a louse supposedly from a passerine that he must have had raptor in the same collecting bag.

One example of the information that can be gained concerns the African Ostrich and the South American Rhea. Because of long fossil histories on their respective continents and some basic morphological differences, ornithologists have considered these birds to be convergent remnants of unrelated evolutionary lines. However, consider their parasites.

Ostrich and Rhea share 2 closely related spp. of a louse genus not found on any other birds; 2 identical species of feather mites, found on no other birds; the same species of tapeworm, found on no other birds; 2 species of roundworms in the same genus, and 2 species of roundworms belonging to related genera. Such evidence does not prove that the birds are related, but it is strongly indicative of common evolutionary origin and is most difficult to explain in any other way.

Another example based on feather lice concerns the flamingoes. Modern classifications are divided in placing the flamingoes with the storks and herons in Ciconiiformes or with the ducks and relatives in the Anseriformes, but usually the former classification has been followed. Flamingoes share 3 genera of lice with the Anseriformes, while ciconiiform lice are totally unrelated to these. On the basis of parasite distribution the anseriform relationship for flamingoes appears to carry the most weight.

Evidence from their parasites may prove useful in interpreting the origins of native Hawaiian forest birds, including the Drepanididae. Few studies have been made on their parasites, but 5 species of apparently endemic feather lice were described from 'Amakihi, 'Apapane, and 'I'iwi at the beginning of this century. All of these species of lice are classified in widespread and complex genera. It will require analysis by an expert student of bird lice to discover what information on host evolution may be found in these relationships.

Many of the microbial pathogens causing disease in birds are transmitted by other parasites, usually ectoparasites. Malaria and birdpox and mosquitoes were already mentioned. Other viruses are transmitted by mosquitoes, other biting flies, and ticks. Other blood protozoa are transmitted by louse flies and black flies. Rickettsial parasites are transmitted by ticks.

Some of these pathogens or disease agents are restricted to birds while others are able to infect other hosts, in some cases humans. Rocky Mountain spotted fever, affecting man in North America, is caused by a rickettsia and transmitted by ticks. Rabbits and ground squirrels are subject to the disease, and the ticks can also pass the pathogen from generation to generation through their eggs. However, birds are hosts of the immature stages of some of the ticks and can also be infected with the rickettsia. Presumably birds could play a significant role in spreading and maintaining the disease, especially through their migrations; but much more research is needed before the role of birds is really understood. Again, the various encephalitis infections in North America and elsewhere transmitted by mosquitoes usually have wild birds as hosts of the virus. In these cases, it is clear that birds are an important factor in maintaining the disease agents in nature.

There are few parasites of birds that are likely to directly affect humans in Hawaii. Three species of blood sucking mites found here and in many other regions of the world are nest-dwelling parasites. Where nests of Mynahs or House Sparrows or pigeons are built under eves or elsewhere on or in houses, mites may migrate from the nest and attempt to feed on humans, causing a pricking sensation and sometimes dermatitis. The obvious and simple solution is to remove the nest and, at the same time, spray the surrounding area with a low toxicity insecticide containing pyrethrins.

Psittacosis is caused by a bacterium of very small size and unusual characteristics. Ornithosis is caused by different strains of the same pathogen; it is simply a different name for the disease in, or derived from, birds other than parrots. One common host is the pigeon. The disease is highly contagious and serious in humans. I don't know that it has been investigated in Hawaii but it appears probable to me that pigeons here are infected as elsewhere. When I participated in studies on the ornithosis group in California, there were no laboratory infections among those of us handling the pathogens. However, there were several cases of ornithosis in others in the same institute. The affected people were all at one end of the building; pigeons roosted there and cracks near the ceiling allowed infectious pigeon droppings to sift into the offices. Some of the pigeons were caught and were indeed infected with the ornithosis agent. What is interesting is that identification of the infection and its probable source was due to the unusual circumstance that the source was in one of the few major laboratories conducting studies on the disease. This suggests that infection of humans by pigeon contact is not rare in urban areas but is often not diagnosed. ...

READERS NOTES

HONOLULU STAR-BULLETIN, 24 May 1973, page B-4: Secret Base Lets Turtle Out of Bag by Helen Altonn

...George H. Balazs, marine biologist at the University of Hawaii's Institute of Marine Biology said he found evidence of "a fairly large number of animals" at Canton and concluded: "The size of the total nesting population in the Phoenix Islands could well constitute the largest found in any Central or South Pacific island group due to exploitation of the resource in the inhabited locations."

...He said it appears that seasonal nesting occurs, probably during October and November. "But it takes place all year around on a low key level."

...Balazs cited two possible reasons for the previous absence of information on the turtles: "The place is extremely remote and it's not suitable for habitation by man." ...

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Field Trip, Manoa Cliffs Trail, 11 March 1973 by William Mingfield

Because of the heavy rains, the March field trip was shortened and very few birds were observed. Those seen were shama thrush, mejiro, American cardinal, and doves. An interesting native insect was found, Dictyophora delfax. As this bizarre creature is noted to have part of its intestine looping up into its long tubular nose, it has affectionately been nicknamed "guthead" by Bill Mull.

By J.K. Yoshida

Though the Manoa Cliffs trail is adjacent to Honolulu and to the dense bedroom district of Makiki, it is relatively rich in native flora. Aside from the plant and bird hunting, those on the field trip sampled a sweet, though halfripe, 'ie'ie fruit.

The following were native trees noted in the short region of the trail which we covered: 'ie'ie (Freycinetia arborea) in fruit, hapu'u (Cibotium splendens), uluhe (Gleichenia linearis), naupaka kuahiwi (Scaevola gaudichaudiana), 'ohi'a lehua (Metrosideros collina), koa (Acacia koa) in blossom, 'akoko (Euphorbia multiformis), 'ahakea (Bobea elatior), pilo (Coprosma longifolia), a lobeliad (Cyanea angustifolia), Hibiscus arnottianus at the end of its flowering period, kopiko (Straussia 'Psychotria' sp.), kalia (Elaeocarpus sp.).

The following exotic plants were seen in noticeable numbers: fiddlewood (Sitheroxylon sp.), guava--common (Psidium guajava)and strawberry (Psidium cattleianum), lantana (Lantana camara), pamakani (Eupatorium riparium), rose apple (Eugenia jambos).

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Excerpts: Minutes of Hawaii Audubon Society general meeting, 19 March 1973

...Dr. William Mingfield gave an account of the Manoa Cliffs field trip of the previous Sunday. A small group also went to Walker Bay to see the stilt and coot. ...

William Mull commented on the recent observation of feral goat damage on Mauna Kea, asking Mr. Wayne Gagne to brief the Society on the issue. Mr. Gagne reported a trip that he made down Puhakaloa Gulch, from 7000 feet. He reported that the goats hang out in much more precipitous terrain than the sheep. The tree line has declined some thousand feet and the native vegetation consists only of mamane, some naio, and some Dubautia. Mr. Gagne also mentioned an expedition to the Kohala Mountains along the Kehena Ditch Trail. He was accompanied by John Kjargaard and Jim Jacobi. He remarked on the sad condition of the vegetation because of the pig diggings. All natives seemed to be epiphytic to be able to grow in the area at all. They saw and heard 'Apapane, White-eyes, 'Elepaio, 'Amakihi, 'I'iwi, Leiothrix, and Koloa.

Mr. Mull refferred to John Porter's pamphlet, HAWAIIAN NAMES FOR VASCULAR PLANTS as a handy guide in the field.

Miss Julia Yoshida, Chairman of the Environmental Education Program, discussed a plan for a computer program to compile data on the global environment, which has been imitiated, but its funding will be narrowed somewhat in June. One of the fundamental and primary goals of the Society is to educate the public.

It was announced that in October of this year, Steve Montgomery, Wayne Gagne, and William Mull will be giving a one hour presentation on environmental education to the Hawaii Council of Teachers of English.

Current issues were also discussed. Bill and Mae Mull gave testimony on Kanaha Pond Sewage Treatment Plant on Maui on Feb. 23, 1973. On March 12, the first hearing in

Kahalui was conducted by the Dept. of Land and Natural Resources.

Act 139, Hawaii's first Natural Area, Ahihi Bay at Cape Kinau, was supported in testimony by Mr. Mull for the Society.

The Reef Runway issue was mentioned, in that Judge King's clarification has still not been announced, and it is already two months late. The Hawaii Audubon Society solicited the National Audubon Society to join in the appeals suit. ...

William Mull reported that Mae Mull was testifying at two hearings--on the fate of Salt Lake, and on a bill recommending ridding Mauna Kea of its sheep population. She also testified earlier in the day on the Green Sea Turtle bill and on aspects of the Reef Runway issue. This involved encouraging Hawaiian and Aloha Airlines to stop taking the entire runway on landing and taking off.

The results of the Animal Species Advisory Commission were to the effect that the Pitman-Robertson Funds were being used to conduct research on more opportunities for game bird hunting in Hawaii, and there was some mention of an open hunting season on Golden Plovers.

Senate Bill 1048...provides for the elimination of the Animal Species Advisory Commission. It was submitted by a Hawaii legislator, at the request of a Big Island hunter.

...Mr. John Porter gave a very interesting slide show and commentary on the Hawaiian birds in relation to flowering plants. He mentioned the more known species such as 'Ohi'a, Koa, Manane, as well as natives eating...Lobeliad family, Chierodendron, 'Ie'ie, Pritchardia, Astelia, Manono, Pittosporum and others. He also gave an extensive review of the work that has been completed by various other scientists.

Mr. Mull relayed the information that Mr. Jacobi saw a pair of 'Akepa and some 'Akiapola'au in a Kipuka along the Saddle Road between 5 and 6 thousand feet.

Mr. Mull also commented on a recent trip made to Lanai with Steve Montgomery and Dr. Gressitt and finding the predacious Lepidoptera. ...

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CAMP DENALI WILDERNESS RETREAT

An educational and wilderness workshop experience is available for Audubon members at Camp Denali. For information write to Box D, College, Alaska 99701.

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ALOHA to new members:

Peter J. Connally, PO Box 585, Hailu, Maui 96708
Mrs. Virginia L. DeCastro, 1224 Manu Aloha St, Kailua, Oahu 96734
Mrs. Marjorie Rosenberg, 239 Kuuhale St, Kailua, Oahu 96734
Cindy Winegar, 430 Kaiolu St, #209, Honolulu, Hawaii 96815

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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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JULY ACTIVITIES:

9 July - Board meeting at McCully-Moiliili Library, 6:45 p.m. Members welcome.
Since subject to change, please call Bill Mull 988-6798 for confirmation.
PLEASE NOTE: Vacation time! No field trip nor general meeting for July.

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