

The Question of Avian Introductions in Hawaii

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A UNIQUE FACT about the avifauna of the Hawaiian Islands is that seldom is a native bird seen in the urban areas. However, birds of a few species are abundant in the same areas; these birds are exotics introduced for various "good" reasons. The importation of birds has not been limited to forms that would be restricted to the habitat provided by the lower coastal areas which, with few exceptions, are also the urban sections. Hawaiian mountains and forests have many established foreign birds, and native birds in most regions are relatively rare.

In perhaps no other similarly circumscribed area in the world have as many exotic species been introduced successfully. Bryan (1944: 84) records 232 species for Hawaii; of these, 94 are exotics of which 53 are probably established and the remainder of unknown status. He notes that so little field work has been done that it is impossible to know the fate of many of the exotics. In addition, it is worthy of mention that in many instances no one even knew at the time what was being liberated here; the records of the territorial agency concerned often simply state "500 small birds," or list little-used colloquial names, or those used by dealers in birds. Furthermore, the home locale of the bird is not generally recorded; the port of embarkation for Hawaii is the only information we have that sheds light on the native region of the species, and such information is of little use. In those instances in which closely related species, and subspecies of one species, have been imported (as in doves), and where interbreeding may have occurred, we probably never will be able

to unravel the situation enough to determine the breeding stock first liberated. Had all pertinent information been recorded, the ornithologist now and in the future might have been able to note the adaptive changes in the structure, food habits, and behavior of the birds occasioned by the environmental conditions in Hawaii. This knowledge would in turn aid us in evaluating past and possible future importations, and it would have been of interest and value to ornithologists all over the world.

Importations in the past have been for the most part a result of the activities of a few organizations and several individuals. At least one group in Hawaii was organized primarily for the purpose of introducing and establishing songbirds in these islands. There is no question that these groups and individuals believed they were "improving" the natural attractiveness of the islands. One may question, however, the benefits derived from these activities. In addition to the species purposely liberated, several kinds of birds have first come in as cage birds and later escaped. Among these are the Chinese Thrush (*Trochaloxypterus canorum*), which escaped in Honolulu during a large fire in 1900, the Strawberry Finch (*Amandava amandava*), and the House Finch, or Linnet (*Carpodacus mexicanus*). These are, of course, inadvertent liberations, but the effects are often the same as in purposeful liberations. Care must be exercised in permitting the entry of cage birds.

Much of the fervor for exotic birds is based upon the assumption that Hawaii is an "avian desert." In part this is true today if one considers only the native species and the lower, urbanized parts of the islands. It is not and never has been true of the higher, forested areas where some of the native Hawaiian species still

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exist in considerable numbers. Furthermore, it is probable that the importation of foreign species has contributed not a little to this apparent paucity of the avifauna by driving the native species farther into the mountains and perhaps by aiding materially in the extinction of some species.

This desire to have birds in the Hawaiian Islands has gone beyond the concept of filling a vacancy in the lowlands and has proceeded to extremes as shown by the following statements of a former official of the Territorial Board of Agriculture and Forestry in the *Paradise of the Pacific* (49 (1): 28, 30, 1937): "We want to fill the Islands with birds of all desirable species that will survive here" and, "Hawaii can be transformed into a universal aviary, a bird haven where every known species of birds, not injurious to Hawaii, will propagate and thrive under the conditions of their natural habitats." It is true that these statements are qualified by the terms "desirable" and "not injurious," but there is no positive way to predict the "injurious" phases of an exotic bird's behavior in its new home. Yet, this same official indicates quite correctly (*op. cit.*, p. 6) that what is desirable at one time may not be desirable at a later date by saying in regard to species wanted that "... things are different in the 1930's than in the 1850's." He might also have said that birds desirable to one economic group are not so to another, and that birds esthetically desirable may not be so desirable economically, and vice versa. No mention was made of the desire on the part of some to try to preserve and increase the populations of native birds, many of which are peculiar to these islands and, if lost here, would be extinct.

The movement for more and more birds has also been supported by unfounded generalized statements (*Aviculture*, 3:333-334, 1931; and 4:70-71, 1932) that exotic birds are *not* detrimental to the native species in Hawaii. To my knowledge no comprehensive study has ever been made of the interaction of an exotic and a native bird in Hawaii!

Whether the past introductions of birds were beneficial or detrimental is beside the point; we must now accept the successful exotics as a part of the avifauna; but at the same time extreme care should be exercised in the importation of additional species. It is not enough that a bird is desired by a group or an individual, and that it appears innocuous in its native ecological niche. No one can foretell definitely and accurately the overall activities of a species transplanted to a new region, nor can anyone foresee all the multitudinous implications of such transplanting. However, as McAtee (1925: 160) states "... when we consider animals and plants not strictly domesticated, successful introductions have almost invariably had regrettable consequences."

Birds that are omnivorous in their original home need special investigation before being transplanted. Such birds are often opportunists, as regards food, and thus feed on the most abundant and easily obtained food item. This item may be beneficial insects, a particular farm crop, or some other article more "valuable" than the bird itself, even to those who had clamored for its importation. A species predominantly insectivorous in its native region may for various reasons change its food habits so that its major item of food in its new home is grain, or perhaps fruit. Or, if it fed almost exclusively on a single insect or group of insects in its native home, it may find that this insect or group is not as easily obtained as some other insect; it may then feed on the most abundant food supply. Consequently, such a bird, when imported for insect control, particularly of a specific insect, may be a failure. Yet, it may become firmly rooted here. Perhaps the search starts again, and another species is tried, and another, with varying results, until we have a polyglot fauna such as is found in Hawaii at the present time.

The breeding potential, or the ability of a bird to reproduce successfully, is another important consideration when a bird is moved into a new region. We need not concern ourselves with those which cannot breed successfully. A

species transported to a more equable climate may show an increased length of breeding season; it may nest several times in a year and may be more successful in raising its young. The Kentucky Cardinal (*Richmondia cardinalis*) is a good example; in the Territory of Hawaii this bird breeds throughout the year, and a single pair has been known to rear three broods in a year, compared to one or sometimes two broods in continental United States. Its numbers are increasing remarkably. Other species show similar trends. Not only is the longer season important in raising the breeding potential. In their native countries most of the species are partly limited by the amount of food available and by the number of species using them as prey. With an abundant food supply for many different species, as in Hawaii, and the possibility of birds adapting their food habits to the more easily obtained foods, there is a distinct probability of enormous increases in the populations of certain species. This may not be desirable.

In the islands there is no avian predator to help control the populations; the only hawk (*Buteo solitarius*), which does not feed on birds except occasionally, is limited to the island of Hawaii, and is present in such small numbers that it is ecologically unimportant. The Short-eared Owl (*Asio flammeus sandwichensis*) is a possible predator. It is thought to feed primarily on mice, but its food habits are largely unknown. The only other vertebrate animal species available to prey on young or adult birds or their eggs are: feral cats, dogs and hogs, the native rat (*Rattus hawaiiensis*), which is not numerous, several exotic species of the family of Old World mice and rats which are cosmopolitan, and the many mongooses (*Herpestes*) which have to a great extent failed to accomplish the purpose for which they were imported, that is, to keep the rat populations at a minimal level. There are those who maintain the mongoose is the major factor keeping the rats under control, but field observations indicate that large numbers of rats and of mongooses are present

in the same areas. The tendency of rats to spend more time in trees may have been occasioned by the activities of the mongoose. Because of this tendency to live in trees, the rats are now more of a menace to the tree-nesting birds; formerly their predatory activities were more or less restricted to ground-nesting birds. Aside from this, the mongoose is probably the most important control on ground-nesting birds in Hawaii. This theory is attacked by those who have examined stomachs of the animal on the grounds that they do not usually find feathers or remains of eggs in the stomachs. A study of the feeding habits of the mongoose has shown the inadequacy of such an argument because the mongoose never eats the shell of an egg, and in eating birds it makes only one or two small openings in the carcass, works through these, and leaves the outside of the bird ruffled but practically intact. Considering this method of feeding, one could not expect to encounter numerous feathers in the stomach of the mongoose. The workers who studied the stomach contents do not mention in their unpublished studies the fate of the ground-nesting birds of Jamaica when the mongoose was introduced, but they do cite the success of the mongooses in helping to control the rats there.

Whether or not the mongoose fulfilled the promises of its importers, we now have rats and mongooses in abundance on the main islands, except on Kauai, Niihau, and Lanai, where the mongoose was never liberated. Both animals exert a depressing effect on the population of birds.

Avian diseases also aid in controlling numbers of birds, but we know practically nothing of these in Hawaii. Avian malaria has been found in the exotic Red-billed Leiothrix (*Leiothrix lutea lutea*) in Hawaii (Fisher and Baldwin, 1947: 51). We cannot say definitely that this disease was first introduced with imported birds, but the evidence seems to point that way; nor can we say definitely that the native birds have been adversely affected by malaria. For most animals imported into the Territory a

period of quarantine is imposed to give some modicum of insurance against the introduction of diseases communicable to animals and man. No such provisions are present for avian importations as evidenced by the recent arrival (March, 1947) and almost immediate release of a number of Mexican Buntings. Holding wild birds in custody might result in the loss of some individuals, but it would be preferable to subjecting native birds and already established exotic birds to the danger of unknown diseases. At the very least, representative fecal and blood smears should be made, and a few birds of each shipment should be sacrificed for autopsy and pathological study. It seems insufficient to allow the entry of birds on the basis of a clean bill of health as testified by the importer or by a veterinarian in the country of export.

Except in one or two areas in these islands, the weather is never a major factor in decreasing already established populations. In other parts of the world, inclement winter weather conditions may act as a severe check, especially on small birds, by increasing greatly the mortality rates.

The interaction of the exotics and the native flora and fauna is a matter of concern and is unpredictable. Not only this interaction but also that between the various exotic species established here should be investigated. One example may emphasize the significance of the interlocking activities of exotics in Hawaii. *Lantana Camara* was brought in as an ornamental plant. Mynahs (*Acridotheres tristis*) were imported especially to aid in controlling the army worm (*Laphygma exempta*). Various species of doves were established for sundry reasons. *Lantana* in its native Mexico is not a pest and mynahs and doves are not undesirable in their original homes. The individual importations of these three organisms seemed harmless. Each importation was made for specific reasons, and each might not have been so detrimental had not the others also occurred. This is what happened in Hawaii. The mynah fed on army worms as was expected, but it also began to feed on

lantana berries, so much so that correlative fluctuations in the abundance of berries and mynahs were observed. The army worm is now seemingly a secondary food item, subject to selection on the basis of relative abundance. Although doves may feed on lantana berries to only a limited extent, it is enough to have been a factor in spreading the seeds. The seeds pass through the digestive tract of birds and are viable. Experimentation with various other seeds has shown that viability is often actually increased by the passage of a seed through a bird. This might be true with lantana. It is known that other factors were of importance in spreading lantana, but in this review we are interested in birds primarily, and they did have a part in the dissemination of the seeds. As a result of all factors lantana spread widely and became one of the most noxious of plants in the Territory. To curb the spread of lantana certain insects were brought in. They were successful in part, but it is reported that in areas where the lantana was eradicated or greatly reduced another undesirable exotic plant took over.

The result of establishing the mynah in Hawaii is similar to that obtained in Fiji, as reported by Stoner (1923: 328-330). In Fiji the mynah was also imported to control injurious insects, but, as in Hawaii, it soon began eating more easily obtained foods, and, in addition, was harmful to the native birds. Therefore, by 1923, the mynah was considered a pest and was no longer protected. One important aspect of Stoner's observation was that the mynah in the Fijian area was heavily parasitized. It is also replete with parasites in Hawaii. Thus, there is the possibility that species already present in a region may be infected when the mynah is transplanted there, subject, of course, to the degree of host specificity of the parasites. Moreover, on the offshore bird islands of Oahu the author and his students have found the mynah pecking open the eggs of Sooty and Noddy Terns.

The person responsible for introduction of the mynah is also credited with the importation of the Rice-bird (*Munia punctulata*), which is now numerous on all the islands. It became a pest in the rice fields, but this is a minor discredit now because of the decline of rice as an important crop in the islands and not because of any foresight at the time it was introduced.

The Kentucky Cardinal, imported because of its brilliant color and song, is now considered detrimental by some fruit growers. This situation, in contrast to the usual situation in continental United States, is probably brought about by the relatively large populations of cardinals, discussed previously, and the relatively small acreages devoted to fruits in the Territory. It simply means that in Hawaii more birds are present per unit of fruit grown. Consequently, the percentage of damaged fruit is greater. One cannot, however, condemn the bird entirely on this evidence, for it may aid in controlling certain insects.

The European Skylark (*Alauda arvensis*) was considered by many to be a pest when it became established in New Zealand. Although this bird is present in the Hawaiian Islands, it seems unlikely that it will become a major nuisance as long as it continues to frequent open grassland; on most of the islands the area of suitable habitat is relatively small and is not in juxtaposition to truck farms. However, on the island of Kauai this species is regarded as a scourge to newly planted lettuce in the truck farming country. If the skylark should become more and more reliant on seeds of cultivated plants, or if the truck farms should expand to include part of the range of the skylark, or even extend to the edge of the range, it seems likely that the species will be on the pest list.

The Red-billed Leiothrix was established for its pleasing song. As mentioned previously, it has been found to be a carrier of avian malaria. It is now considered undesirable by various fruit and vegetable farmers.

The Linnet (*Carpodacus mexicanus*) has al-

ready acquired the Hawaiian name of "Ainikana" (papaya eater) because of its proclivity to eat papaya, a staple fruit of the islands. At present, however, the papayas damaged are usually those considered overripe for human consumption.

The ecological balance of the various organisms in an area, which is established by natural processes over long periods of time, has been so altered in Hawaii that years will be necessary for any sort of equilibrium to be reached, and it will never be attained if indiscriminate introductions do not cease. Most of the importations have been of this category. Little care or thought has been given to the complexities of an organism's behavior, other than that it is esthetically pleasing, or that it might destroy a certain plant or animal as part of its activity.

We in Hawaii must change our concepts regarding importations. We must not accept birds on the simple basis that someone wants them and that no objection has been raised. We should express our concern about continued, unstudied introductions, especially in view of past experiences here and elsewhere. The responsibility for proving the "need" for a certain species should lie with the importer, and he should bear the burden of a complete investigation by competent authorities over a period of time. This would prevent many introductions and would of course make all importations difficult. I feel that our general attitude should be that we want no more exotics.

However, if importations for transplanting and for cage purposes are to continue, a definite program of control should be set up. Such a program might include the following points:

1. The first step toward importation should be a study of the various aspects of the species in its native habitat. If the species has been established in other areas foreign to it, the effects of introduction there should be noted. In many instances much information could be gained simply by a survey of the literature on the species involved.

2. As soon as a shipment arrives, representative specimens of both sexes should be prepared as study skins for use in positive identification and for future reference.
3. For all birds imported, there should be recorded: (a) The native home of the birds. This should be specific, listing country, province or district, and nearest town, and the date on which the birds were first removed from this area. If, as is true quite frequently with cage birds, the birds have been raised in a country other than their native home, this fact should be recorded. (b) The number of males and females should be noted, if it is possible to sex the birds on the basis of external characters.
4. Immediately after arrival in the Territory, all birds in any one shipment should be placed in quarantine, as are other animals, for a certain period of time, to provide some protection against introducing parasites and disease.
5. At the end of the period of quarantine a general pathological examination should be performed on a sample of the importation, and fecal and blood smears made.
6. At the time of release to the importer for liberation, the exact locality at which the birds are to be freed should be put on permanent record. The date of liberation, the valley, ridge or town, and the island of release should be noted.
7. In some cases it might be best at first to limit the liberation of a species to one island in the archipelago. The effects of the species on the plants and animals of that island and its own success in surviving and reproducing

could be studied for a few years. Later, if desired, it could be moved to other islands. This procedure might save some of the islands from the effects of a new pest species.

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