NOTES ON THE HAWAIIAN DUCK

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THE avifauna of the Hawaiian Archipelago contains three endemic members of the Anatidae. Of these, the Laysan Teal (*Anas platyrhynchos laysanensis*) and the Nene or Hawaiian Goose (*Branta sandwicensis*) are near extinction—only 30 teal existed in 1950 (Scott, 1951) and an estimated 33 wild and 24 captive Nene lived in 1952 (Smith, 1952); the Koloa or Hawaiian Duck (*Anas platyrhynchos wyvilliana*) is present in larger but still scarcely-safe numbers. Other species of waterfowl visit the Hawaiian Islands from North America but their sojourns are usually sporadic and brief. Although the Koloa occasionally joins flocks of migrant ducks during their island residence, it is not migratory.

Formerly, the Koloa occurred on all the major Hawaiian Islands and was common everywhere except on Lanai and Kahoolawe as reported by Perkins (1903), Munro (1944), and long-time residents interviewed during our game-bird survey (Schwartz and Schwartz, 1949). However, in recent years the population has been greatly reduced by draining of the principal breeding and feeding areas and by indiscriminate shooting. It is also likely that predation by mongooses, rats, feral cats, feral pigs, dogs, and humans, particularly on eggs and ducklings, has been instrumental in this decline.

The only numerical estimate of this bird's former abundance was given to us by Mr. Woodhouse of Kekaha Sugar Company. He reported about 400 ducks per square mile for the Mana Marsh area of Kauai prior to its drainage in 1923 and subsequent development into irrigated sugar-cane land. If this figure is reasonably correct, approximately 2,400 ducks may have resided in this tract of marsh which covered nearly six square miles and doubtless represented one of the best habitats of the Koloa. Our estimate was only five Koloa per square mile or a total of 30 for this same area in 1946–1947.

We found the Hawaiian Duck only on the islands of Kauai, Oahu, and Hawaii but it also is known to occur occasionally on Niihau (L. Robinson, in conversation; Fisher, 1951) and Molokai (J. D. Smith, letter). The possibility remains that the Koloa may still live on Maui where remnants of suitable habitat are found.

Almost all the present Koloa population inhabits Kauai where we estimated 500 birds remain. These figures are derived from our sample counts and information from resident hunters, plantation workers, and other observers. Probably more than half the ducks dwell on the major mountain streams from about 500 to 4,000 feet elevation where we found densities up to four birds per mile of stream. (The Koloa has been reported by Perkins (*op. cit.*) to

live as high as 8,000 feet above sea level; this must have been on Hawaii or Maui as only these two islands reach this height.) Some of its present mountain range receives as much or more than 200 inches of rain annually and at 4,000 feet the mean annual temperature is 60° F. During normal stage the mountain streams are seldom over 20 feet wide and consist of pools three

FIG. 1. Male Koloa or Hawaiian Duck. Kauai. March 23, 1947. This endemic member of Hawaii's avifauna has been practically extirpated from all islands except Kauai, its last stronghold. All photographs by C. W. Schwartz except Fig. 5.

to four feet deep alternating with small falls or shallow riffles studded with small cobblestones and boulders. Occasional patches of smartweed (*Polygonum* sp.) are found among the rocky beds, and grasses (particularly *Setaria* sp. and *Paspalum* sp.) grow among the rocks in the dry portion of the stream bed. The banks are generally heavily vegetated with native forest trees and shrubs and some ferns which trail in the water's edge. These brownish-colored streams are highly acid for the most part and possess very little aquatic vegetation or diversified animal life. Our superficial examination showed that the nymphal stages of damsel and dragon flies, snails (resembling *Melania mauiensis*), aquatic shrimp (*Gammarus* sp.), isopods, and a small leech were abundant. Earthworms were plentiful beneath the moss that covered the rocks above the waterline. This animal life together with the smartweed and grasses mentioned above probably furnishes food for the Koloa in these mountain

FIG. 2. Typical mountain habitat of the Koloa. Waialae Stream, Kauai. Elevation 3,600 feet. October 17, 1946.

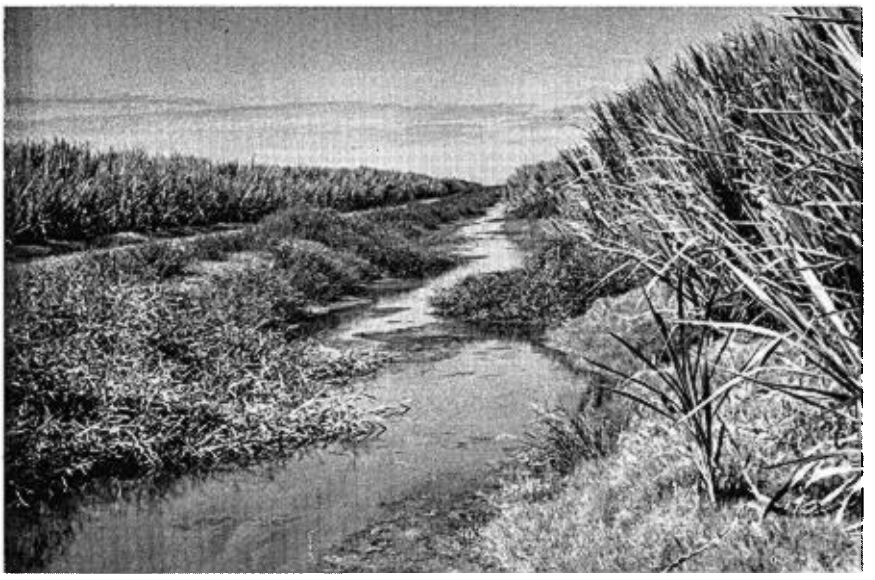

FIG. 3. Irrigation ditch in sugar-cane field of the type frequented by the Koloa. Elevation, sea level, on the island of Kauai. November 21, 1946.

FIG. 4. Forested habitat through which many of the mountain streams supporting Koloa flow. Watershed of Koaie Stream, Kauai. Elevation, 3,500 feet. October 3, 1946.

FIG. 5. Mokulua Islands. The Koloa still occasionally nests on these two islets which lie three-fourths of a mile offshore from Oahu. The ducks lead the newly-hatched young to the nearby Kawainui Swamp on Oahu. Photograph by J. D. Smith.

areas. The highly acid, vast Alakai Swamp or Bog which exists between 4,000 and 5,000 feet on Kauai is not reported to support Koloa nor is it said to have been an important habitat of this bird in the past.

The rest of the population on Kauai occurs very sparsely below 500 feet and is found in the reservoirs, major irrigation ditches, the very few remaining marshy areas, the coastal portions of some of the larger streams, and some flooded rice fields. Temperatures in this general zone of low elevation have an annual mean of approximately 70° F., but rainfall may vary from less than 20 to 100 inches annually.

Eight was the largest number of Hawaiian Ducks we saw on any reservoir and this was on the 400-acre Koloa Reservoir. Smaller reservoirs of about two to ten acres occasionally supported from two to three ducks each. These reservoirs generally have fluctuating water levels and are mostly devoid of aquatic vegetation. Although they support some fish (bass, *Micropterus salmoides*, and bluegill, *Lepomis macrochirus*) and other aquatic animal life, their value as habitat for the Koloa appears poor.

From one to two Koloa were observed per linear mile of some of the permanently-fed large irrigation ditches which flow through the sugar-cane fields or connect one field with another. These ditches, from two to four feet deep and approximately ten feet wide, have a certain amount of aquatic life, principally filamentous algae, snails, aquatic insects, and fish (Mexican swordtail, *Xiphophorus helleri*, guppy, *Lebistes reticulatus*, and mosquito fish, *Gambusia affinis*). Our knowledge of the food habits of the Koloa is too limited to evaluate this habitat in terms of food availability but from all indications there is ample food here provided it is not destroyed by poisoning operations. But since the plantations periodically poison the vegetation along these banks as a means of controlling weeds and insects, and also spray the water surfaces to kill aquatic plant growth which clogs the ditches, it is likely that some harm befalls the ducks through loss of nesting cover and poisoning of their food supply. The practice of burning sugar cane prior to its harvest doubtless destroys some nests and ducklings.

The few remaining marshy areas now supporting ducks on Kauai have limited stands of bulrush (*Scirpus validus*) bordering small shallow expanses of open water. The rapid rate of reclamation of these areas will soon eliminate the birds from this habitat.

The fact that Kauai now has a larger population of Koloa than the other islands can perhaps be explained by the following circumstances. The habitat conditions with respect to amount and quality have always been more favorable on Kauai than on the other islands, and the mongoose, whose predation has contributed to the destruction of native ground-nesting birds on other islands, does not occur on Kauai.

On the island of Oahu, the Koloa is occasionally observed in the Kawainui Swamp at Kailua, the Kaelepulu Pond and its drainage area near Lanikai, and on the twin Mokulua Islands offshore of Oahu near Lanikai. These locations are practically all at sea level. Our estimate placed the population at less than 30 birds on Oahu in 1946–1947. Subsequent to our observation, those made by Mr. J. Donald Smith, Territorial Game Conservationist (letter), indicate that the Koloa population on Oahu is still declining.

Only rarely is the Hawaiian Duck observed on some of the reservoirs on the island of Hawaii. Fisher (1951) reported that the Koloa was scarce on Niihau probably because of a decrease in suitable habitat.

The crops of two Hawaiian Ducks we obtained in the lowland sugar-cane habitat on Kauai contained the shells and soft parts of the snail *Melania mauiensis*, and seeds of the grasses *Paspalum Urvillei* and *Echinochloa crus-galli* var. *crus-pavonis*. Two Koloas collected on Hawaii by Henshaw (1902) had their stomachs crammed with two species of fresh and brackish-water snails, *Melania newcombii* and *Hydrobia porrectamigh*. Perkins (1903) reported Hawaiian Ducks to feed on ripe grains of rice, various kinds of molluscs frequenting fresh or brackish water, the larvae of dragon-flies, and other foods accessible to them. Munro (1944) stated that the Koloa fed on earthworms and foraged on grass.

We usually saw the ducks as singles or pairs and only rarely in groups of three or four. The largest number observed at any one time was eight on the Koloa Reservoir referred to above. Our observations and the reports of others indicate that no large flocks are formed at any time of the year now, although in the past post-breeding flocks occurred. Palmer (Rothschild, 1893–1900) observed large flocks on a lake on Niihau, on some occasions not less than 100, and Wilson and Evans (1890–1899) reported flocks in the marshes near Waimanelo, Oahu.

The scant information reported to us concerning the dates of nesting and young suggests that the Koloa breeds throughout the year in both mountain and lowland areas but probably most breeding takes place in the spring. This agrees with Perkins (*op. cit.*) who reported the Hawaiian Duck to be very irregular in its nesting time but with the majority of breeding taking place between March and June. Following breeding the adults molt and years ago it was the custom for the Hawaiians to make annual trips to the mountains where the flightless ducks were easily captured, killed, and salted for future use. According to Mr. Eric Knudsen, a long-time resident of Kauai, two favorite spots for collecting ducks were the Kokee and Waialae regions of Kauai. Forays did not occur frequently into the marshy areas presumably because of the difficulty of catching the birds there.

Nests reported to us have been located in sugar-cane fields, the dense grass border of irrigation ditches, and the grassy slopes of Mokulua Islands. They contain from two to 12 eggs but according to Munro (*op. cit.*) eight is the commonest number. Broods ranging from four to eight young have been observed.

It is of interest that the Koloa nests on the twin islands of Mokulua (whose combined area is about ten acres) and leads its young to Oahu over approximately three-fourths of a mile of open ocean (Munro, *op. cit.*; others, in conversation). These islands are uninhabited by humans.

Two wild specimens we obtained on Kauai (September 26, 1946, and October 10, 1946) were females. The duck secured in September had no bursa. Her ovary contained many yolky follicles, the largest of which was 9 mm. in diameter and her oviduct was enlarged sufficiently to have recently passed an egg. The female acquired in October possessed a bursa 22 mm. in length. Several large yolky follicles, up to 19 mm. in diameter, were present in the ovary and the oviduct was greatly enlarged. Since the presence of the bursa of Fabricius is generally accepted as an indication of an immature duck (Hochbaum, 1942), the breeding condition of this Hawaiian Duck which possessed a bursa is noteworthy.

The September and October females measured, respectively, as follows: total length, 467 mm., 435 mm.; culmen, 45, 45; extent of wing, 707, 750; closed wing, 234, 230; tail, 80, 80; longest toe, 51, 49.

Infestations of lice were light on both birds. Two species, *Trinoton querquedulae* (L.) and *Anaticola crassicorne* (Scop.), identified by Dr. E. W. Stafford of the U. S. Fish and Wildlife Service, were found on the September bird while only the former occurred on the October bird.

Because the Koloa is one of the world's rare birds, every effort should be made to maintain the race. Illegal shooting still constitutes a serious hazard to its survival and rigid protection is absolutely necessary. Some of the remaining marsh areas and possibly some reservoirs, particularly on Kauai, should be improved to provide better habitat. Because the Koloa lives and breeds under captive conditions (one we acquired had been in captivity five and one half years after its capture as a duckling), a supply of these birds could be maintained for strengthening populations in managed range and for stocking suitable but unoccupied areas.

Without doubt the drainage project in progress (1952) of the major marsh areas on windward Oahu will extirpate the duck from that island within the next few years. This will leave Kauai as the last major stronghold of the Koloa. The Board of Agriculture and Forestry of the Territory of Hawaii has incorporated the recommendations given above into its game management

program and is now improving the carrying capacity of water areas on Kauai and Maui and raising Hawaiian Ducks in captivity for release into these managed areas. A small flock of Koloa is also being raised at Kapiolani Park, Honolulu, and a pair of birds has been taken to the Severn Wildfowl Trust, England, for breeding purposes.

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