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BIOENERGETICS OF NIGHTLY WEIGHT LOSS IN A CAPTIVE RING DOVE

I. LEHR BRISBIN, JR.

A number of years ago, Taber (1928) proposed a method for estimating the daily food intake of wild birds by determining their nightly weight loss. Taber assumed that the bird's total weight loss over a 24 hour period was approximately twice the nightly weight loss and that, on the average, the bird would exactly replace this weight loss with an equal weight of food. However, when applied to captive birds whose daily food intake could be accurately determined, this method failed to give satisfactory results (Nice, 1929). This was probably because it is the daily energy budget rather than weight changes which must be balanced by a bird and there may be great differences between the caloric value of the biomass lost at night and that of the food eaten during the day.

Recently, a number of studies (Kontogianis, 1967; Helms *et al.*, 1967; Helms, 1968; Dolnik, 1968; Newton, 1968) have provided data which allow an approximation of the caloric value of the nightly loss of biomass in birds. This information, when combined with the weight loss data from a captive bird feeding on a diet of known caloric value, will then allow an analysis of the bioenergetic relationship between nightly weight loss and food intake. The purpose of this study was to conduct such an analysis on the Ring Dove (*Streptopelia risoria*) a species which has been the subject of a number of physiological and bioenergetic studies (Riddle, Christman and Benedict, 1930; Riddle, Smith and Benedict, 1933; Brisbin, 1969).

MATERIALS AND METHODS

It is unfortunate that circumstances prevented the use of more than one individual in this study. However, as Baldwin and Kendigh (1938) pointed out, differences between the average weights of different individual birds of differing ages and sexes are very little if any greater than differences between the weights of a single individual at different times. Thus, a large number of determinations made on this single individual should allow an approximation of the extent of day-to-day variation of nightly weight loss to be expected within a single individual as well as that to be expected be-

tween the average values for different individual birds. The bird used was an adult male Ring Dove which had been separated from its mate and held in isolation for four weeks before beginning the study. The bird was housed in a covered outdoor flight pen measuring approximately 100 square feet in floor area and 10 feet in height, located in Athens, Georgia. The bird was weighed twice daily on a triple beam balance to the nearest 0.1 g. Weighings were made within an hour of sunset and within an hour of sunrise. All data were collected between late May and mid July, when changes in day length were minimal and the intervals between morning and evening weighings were between 12 and 14 hours.

The food used throughout this study was Purina Pigeon Chow Checkers containing a minimum of crude protein (15.0 per cent), a minimum of crude fat (2.5 per cent), a maximum of crude fiber (6.0 per cent), an average moisture content of 10.8 per cent and supplemented with various amounts of required vitamins and minerals. This food was in the form of small pellets which were consumed intact by the bird. A caloric analysis of this food was conducted in connection with a previous study (Brisbin, 1969) and indicated an average caloric value of 3.92 ± 0.02 (SE) kcal/g fresh weight of food, as provided by the manufacturer. The bird was allowed free access to food between the morning and evening weighing, but food was removed at night to prevent the possibility of feeding before the next morning's weighing. For a total of eight non-consecutive days, no food was provided in order to evaluate weight loss during the day. These eight non-consecutive days of feed deprivation were scattered randomly throughout the study period and were separated from each other by at least two or more days of free-feeding to allow the bird fully to regain normal weight.

RESULTS

The nightly weight loss and daily food intake of the dove are presented in Table 1. There was no significant difference between the ratios of kcal food eaten/g weight loss during the previous night and kcal of food eaten/g weight loss during the following night ($t = 0.37$, $P > 0.50$). There was also no difference between the variances of these two ratios during the period of study ($F = 1.36$, $P > 0.10$). Thus, each gram of nightly weight loss corresponded to approximately 7.9 kcal of food intake during either the previous or following day. However, there was no significant correlation between daily food intake and weight loss during either the previous night ($r = 0.39$, $P > 0.05$) or the following night ($r = 0.16$, $P > 0.05$).

TABLE 1
NIGHTLY WEIGHT LOSS AND DAILY FOOD INTAKE
OF A FREE-FEEDING MALE RING DOVE

	Nightly Weight Loss (g)	Daily Food Intake (Kcal)	Kcal Food Eaten/g Weight Lost During Previous Night	Kcal Food Eaten/g Weight Lost During Following Night
Number of				
Determinations	26	19	19	17
Mean	7.6	59.0	7.5	8.4
Variance	2.2	199.1	3.6	4.9
Standard Error	0.3	3.2	0.4	0.5
Coefficient of				
Variation	19.5	23.9	25.4	26.3
Range	11.8-4.8	76.0-0.0	10.5-0.0	13.2-5.6

TABLE 2
WEIGHT CHANGES OF A STARVED MALE RING DOVE

	Nightly Weight Loss After First Day Without Food (g)	Weight Loss During First Day Without Food (g)
Number of		
Determinations	8	8
Mean	3.5	4.0
Variance	0.5	3.8
Standard Error	0.2	0.7
Coefficient of		
Variation	19.5	49.1
Range	4.4-2.3	7.2-1.0

The weight loss of the dove during the eight non-consecutive days of food deprivation is presented in Table 2. The nightly weight loss after one day of food deprivation was significantly smaller ($t = 6.83$, $P \leq 0.001$) and had a significantly smaller variance ($F = 4.40$, $P < 0.05$) than nightly weight loss following a day of free-feeding. There was no significant correlation between weight loss during a day of food deprivation and weight loss during either the previous night ($r = -0.015$, $P > 0.05$) or the following night ($r = 0.54$, $P > 0.05$).

DISCUSSION

The average nightly weight loss of the free-feeding dove represented 5.2% of its average morning weight. This figure is slightly less than that reported by Nice (1929) for captive Mourning Doves (*Zenaidura macroura marginella*) whose nightly weight losses ranged between 6.3 and 11.9% of their morning weights. It is also smaller than the average of

8.0% reported for wild Mourning Doves by Taber (1928). Nice (1938) reports diurnal changes in the body weights of small passerines which range from 4.6% in the Song Sparrow to 10.8% in the Junco. Nice (1938) concludes that, for birds weighing between 12 and 100 g, body size is not an important factor in determining the magnitude of nightly weight loss. The data from the Ring Dove indicate that this trend also holds for body weights ranging up to 150 g.

The nightly weight loss of the free-feeding Ring Dove may be considered to have two basic components: (1) non-urinary excrement voided from the digestive tract, and (2) body tissues converted into energy to support the basic body functions during the night, termed "basic exchange" (Blumenthal and Dolnik, 1962; Kontogianis, 1967). The basic exchange also includes respiratory losses of body water through the lungs and air sacs and losses of urinary wastes. Following a day of food deprivation, food should cease passing through the alimentary tract and any excrement voided would probably consist largely of urinary wastes (Stevenson, 1933). Thus, the nightly weight loss of the Ring Dove following a day of food deprivation should represent the basic exchange portion of the total nightly weight loss. Under these assumptions, the nightly basic exchange of the Ring Dove averaged 3.5 g/night, while excretion from the digestive tract averaged 7.6 - 3.5 = 4.1 g/night. The dove's average daily food intake of 59.0 kcal/day does not appear to be significantly different from those reported for other non-breeding Ring Doves in a previous study (Brisbin, 1969).

Riddle *et al.* (1930) report the basic metabolic rate of non-breeding Ring Doves to average 4.5 kcal/150 g body weight /4 hours. Assuming this basal metabolic rate for the bird used in this study, whose body weight remained close to 150 g, the 3.5 g of nightly basic exchange would have to provide $4.5 \times 3 = 13.5$ kcal of energy for the bird to survive 12 hours of nighttime inactivity. This means that each g of basic exchange represents a contribution of $13.5/3.5 = 3.9$ kcal to the bird's energy budget. This value is within the range of values found by Dolnik (1968) for the caloric value of nightly weight loss of Chaffinches (2.91-4.86 kcal/g). Iampietro *et al.* (1961) found the weight losses of men subjected to periods of both partial and complete starvation to be composed of 39% protein, 10-11% water and 49-51% fat, with caloric values ranging from 3.91 to 4.06 kcal/g. The close agreement of these caloric values with that calculated for the nightly basic exchange of the Ring Dove in this study suggests the basic nature of the bioenergetic processes associated with weight loss during fasting in homotherms and it is likely that the composition of the basic exchange of the Ring Dove is closely approximated by the weight-loss composition reported by Iampietro *et al.* (1961).

Helms *et al.* (1967), Helms (1968) and Newton (1968) have found that diurnal weight changes in small passerines seem to involve proportionately greater changes in the fat component than in the lean dry or water components. Helms (1968) thus found the caloric value of nightly weight loss in small passerines to average 9.02 kcal/g, if variations in gut contents, non-fat tissue and water components were excluded from the calculations. The inclusion of these components would probably lower this estimate considerably — possibly to the level of 3-4 kcal/g found in this study. Dolnik (1968) also found body fat, along with ambient temperature and respiratory quotient, to be an important factor in determining the caloric value of nightly weight loss in Chaffinches. The caloric value of the basic exchange of the Ring Dove is higher than corresponding caloric values for homogenized whole adult non-breeding Ring Doves which averaged 2.26 kcal/g (Brisbin, 1969). This again suggests a greater proportion of fat in the nightly basic exchange than in the live bird, considered as a whole. Some of the physiological mechanisms associated with diurnal weight changes are discussed in detail by Fisher and Bartlett (1957).

The characteristics of the regulation of food intake and its influence on body weight are discussed by Mayer (1967), who describes three types of such regulation: (1) *biometric regulation* which sets broad general limits for energy exchange and is a property of the structure of the animal itself; (2) *short-term regulation* which adjusts energy intake to output on a day-to-day basis, within the limits set by the biometric regulation and (3) *long-term regulation* which regulates reserves, closely related to body weight, through a series of successive recombinations, thereby correcting for errors in the short-term regulatory mechanisms. These inherent errors in the short-term regulatory mechanisms probably explain the lack of any significant correlations between nightly weight loss and daily caloric intake of the Ring Dove. The biometric margin of variation for these parameters is probably much larger than indicated in Tables 1 and 2, since all data presented there were collected under quite uniform environmental conditions. To estimate properly the biometric margin of variation for this individual, similar data must be obtained for a broader regime of varying environmental conditions such as temperature, photoperiod, etc. If such data could be accompanied by accurate evaluations of recombinatory changes in various body component reserves, the long-term correlations of these parameters should be significantly improved.

Dolnik (1968) found that the caloric value of the mean weight loss in Chaffinches trapped from a wild population was similar to the daily caloric value of weight changes in one bird during the same season. Thus, the data obtained from the single dove used in this study may serve as useful estimates of the mean values of similar parameters in other doves. Because of

the characteristics of the regulatory mechanisms described above, however, all of the calculations based on data obtained in this study have used average figures derived over the entire period of study. The absence of any significant correlations between nightly weight loss and caloric intake suggests the dangers of using any of these parameters in a predictive fashion, with shorter time periods.

ACKNOWLEDGEMENTS

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SUMMARY

Nightly weight loss and daily caloric intake were determined for a single male Ring Dove feeding on a diet of known caloric density for a period of 20 days. Nightly weight loss averaged 5.2% of the morning weight, and caloric intake averaged 59.0 kcal/day.

The nightly weight loss may be considered to have two basic components: (1) non-urinary excrement voided from the digestive tract and (2) water losses and body tissues converted into energy to support the basic body functions during the night, termed the "basic exchange". Eight determinations of nightly weight loss following one day of food deprivation averaged 3.5 g and may be considered to represent the basic exchange for the dove.

Calculations made using published values for the basal metabolic rate of the Ring Dove indicated that the caloric density of the dove's basic exchange averaged 3.9 kcal/g, which was nearly identical to that for the weight loss of men subjected to periods of both partial and complete starvation.

On a day-to-day basis, there was no significant correlation between daily caloric intake and weight loss during either the previous or following night. There was also no significant correlation between weight loss during a day of food deprivation and weight loss during either the previous or following night. Apparently, nightly weight loss in this species under captive conditions has little value as a predictor of caloric intake or other bioenergetic parameters on a short-term basis, although on a longer-term basis, more valid estimates may be obtainable.

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GENERAL NOTES

A PROTHONOTARY WARBLER NEST IN "SPANISH MOSS"—A Prothonotary Warbler (*Protonotaria citrea*) nest was located in a large bunch of Spanish or Florida moss (*Tillandsia usneoides*) hanging in a cypress tree within a heron rookery near Abbeville, but in Dodge County, Georgia, on June 15, 1968.

My attention was drawn to the clump of moss in the cypress tree by the fact that what appeared to be a male warbler of this species landed on it, sang a few notes, and then disappeared into it. Closer examination disclosed four eggs in the nest cavity that had been hollowed out in the moss and which was connected with the small opening on the north side by a "tunnel" of the same material.

Bent (1953) says that this species is one of the two American warblers that habitually build their nests in usually well concealed cavities. He cites many instances of this warblers' nesting in bird boxes, cans, glass jars, and cardboard boxes, but notes no nests contained in live vegetation.

The present nest was five feet above the water in a mass of moss hanging in the crotch of the cypress tree and did not contain additional nesting material. Two active Cattle Egret (*Bubulcus ibis*) nests, one being two feet above it and one four feet above it, and both having two nestlings each, were also in the same cypress tree.

Walkinshaw (1941) says: "The Prothonotary Warbler is a very strongly territorial species." He lists three small passerine birds as having been driven away from warbler nest sites.

Meyer and Nevius (1943) say that: "combat with other species found within the territories of these birds was observed." They list seven species of birds that Prothonotary Warblers drove away from their nest sites.

We again visited the rookery on July 4, 1968, at which time Squadron Leader Philip G. Murton, RAF, banded the two large warbler nestlings remaining in the moss.

In the rookery pond were many rotten stumps and cypress knees, the usual preferred nest sites of this species in this area.

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Milton Hopkins, Jr., RFD 5, Box 113, Fitzgerald, Georgia.

A POSSIBLE RANGE EXTENSION OF THE PHOEBE IN GEORGIA—Burleigh (1958. *Georgia Birds*, U. of Oklahoma Press, Norman, Oklahoma) states that the Eastern Phoebe (*Sayornis phoebe*) in Georgia "occurs casually in summer as far south as Atlanta and Athens" and also that "there is some evidence that it is gradually extending its breeding range southward into the lower Piedmont, and in time it may reach the fall line."

On June 22, 1968, Wilson Baker, Philip G. Murton, and I were going to a heron rookery located about four miles SSE of Towns, Wheeler County, Georgia, when near the junction of Gum Swamp Creek and Alligator Creek Baker called my attention to the call of a Phoebe. The bird called twice as we drove by the location, but I attached no significance to it, for it is not unusual here to hear the Mockingbird mimic the Phoebe. However, in retrospect, I realized that when the mocker mimics the Phoebe the call is usually preceded or followed by other notes or songs.

Murton and I were back in the area on July 5, 1968, and did not see or hear a Phoebe. We returned again on July 20, 1968, and I searched an area where a wooden bridge crossed Alligator Creek and also where the Phoebe was first heard in June. About one-fourth of a mile north of this area a Phoebe was sighted and observed for some time as it jerked its tail while perched on a fence wire and then flew to a tall pine sapling nearby. The bird did not call at this time. No evidence of nesting was found at the bridge area and I failed to search an old barn nearby, but the fact that the bird was in the general area for over a month in mid-summer certainly points to the likelihood of its breeding there. Milton Hopkins, Jr., RFD 5, Box 113, Fitzgerald, Georgia.

ABANDONMENT OF YOUNG BY THE PURPLE MARTIN—Many species of birds continue to feed and care for their young even though they may fall from their nests or leave their nests before they are fully fledged and free flying.

The Purple Martin (*Progne subis*), however, is not among these. I have maintained martin boxes and gourds for over ten years and during this period I have seen at least two or three young martins fall from

their nesting sites each year. Even though the young birds may be able to fly short distances they are invariably abandoned and are not fed by the parent birds. On several occasions these young birds have been placed on perches within a few feet of the high boxes, but still the parent birds did not feed them.

The young birds are not completely ignored by the parents for on 23 May 1969 I watched as over 35 adult martins swooped low over a fallen nestling as it flew short distances over the ground. They excitedly chirped and hovered over the nestling, but no attempts were made to feed it and it was found dead the following day.

The young of martins usually do not leave their nesting sites until they are adept at free flying. The abandonment may have something to do with the "fear of the ground" by adult martins. Rarely is one seen alighting on the ground except during nest building by this species. At this time both sexes quite often fly to the ground and gather grass stems. Arthur Cleveland Bent (*Life Histories of North American Flycatchers, Larks, Swallows, and Their Allies*, U. S. National Museum Bulletin 179, Government Printing Office, Washington, D. C.) mentions this abandonment of young, but the fact does not seem to be generally known. Milton Hopkins, Jr., Rt. 5, Fitzgerald, Georgia.

WILSON'S WARBLER IN FORSYTH COUNTY, GA.—On Sunday, May 11, 1969, I came upon a Wilson's Warbler (*Wilsonia pusilla*) at Lake Lanier in Forsyth County, Ga., and kept it under observation for well over 30 minutes at approximately 20 feet. The Pocket Checklist of Georgia Birds (Denton, J. F., and M. N. Hopkins, Jr. 1969. Published by the Georgia Ornithological Society) states that this bird is a rather scarce spring and fall transient above the fall line in Georgia. Sybil C. Aberly, 2420 Peachtree Road, NW, Atlanta, Ga. 30305.

EARLY ATLANTA RECORD FOR PROTHONOTARY WARBLER—On April 6, 1969, Bob Manns and I saw a Prothonotary Warbler (*Protonotaria citrea*) while birding in the Conservation Garden on Lullwater Road in Atlanta. The bird, a male, seemed undisturbed by our presence and we were able to observe it from practically all angles for about 15 minutes as it continued to feed from ground level to about 25 feet overhead. Burleigh (1958, *Georgia Birds*, U. of Okla. Press, Norman) states that this species has been noted in Atlanta between April 14 (1921) and October 8 (1939). April 14 is still shown as the early record in the Occurrence Extremes of Birds of the Atlanta, Georgia, Region compiled by Griffin and Parks and last published in 1955. C. M. Einhorn, 1340 Holly Lane, N.E., Atlanta, Ga. 30329.

AN UNUSUAL BIRDING DAY IN THE ATLANTA AREA—On Sunday morning, April 13, 1969, Marjorie Stuart phoned me to advise that she had just returned from the old Honor Farm area south of Atlanta where she had seen some Upland Plovers (*Bartramia longicauda*) which had been sighted by John O'Connell the day before. My wife and I invited Bob Manns to accompany us in an attempt to find the plovers. We were successful and a short time later we saw an Osprey (*Pandion haliaetus*). In the afternoon, Peg and I decided to do a little more birding so we drove to Stone Mountain where we saw two Herring Gulls (*Larus argentatus*) flying over the lake. Before returning home, we went to nearby Lake Lucerne, formerly Possum Lake, where we found a Double-crested Cormorant (*Phalacrocorax auritus*). According to the Occurrence Extremes of the Birds of the Atlanta, Georgia, Region compiled by Griffin and Parks, the above mentioned plovers and cormorant are rare transients for this area and the gulls and osprey are listed as uncommon transients. C. M. Einhorn, 1340 Holly Lane, N.E., Atlanta, Georgia 30329.

NEWS AND COMMENTS

A NOVICE AT A GOS MEETING*

CHARLOTTE H. SHARPE

I had never noticed birds until 12 years ago when I was a student at Florida State University. At that time I took a canoe trip down the Suwannee River. Of the 20 students along, there was one who was a bird watcher. I determined upon spying this birder that I would avoid her. But before the cruise ended, I was begging for a peep through her binoculars and studying her bird field guide by campfire at the end of the day.

Since then I have often watched birds, but had never been to a meeting or done any organized birding. My attendance at the joint meeting of the Georgia Ornithological Society and the Carolina Bird Club in Augusta on April 24-26 was enlightening. It was an exciting experience and I am looking forward to more bird watching than ever. I saw 23 birds that I had never seen before, which gives you an idea of what a novice I am at this business, or hobby, or whatever you choose to call it. Perhaps it is a disease.

I was amused on reaching the Down Towner Motor Inn to see a huge sign reading: WELCOME ORNITHOLOGISTS GYNECOLOGISTS LIONS. I thought: these are unusual Lions!

The first thing that impressed me about the meeting was the personalities who gathered there from Georgia, South Carolina, and North Carolina. Nobody seemed to be in a hurry. Everyone appeared to be calm and easy going. No one cared about rushing any place. Schedules were met, but apparently with great ease. The second thing was the friendliness of the bird watchers. They shared their equipment and their knowledge without pushing either on you. The third thing was the versatility of the group. They came from many vocations and their interest did not pinpoint just birds, but their environment, all of nature and wildlife. There were zoologists, botanists, and microbiologists in the group. There were preachers, teachers, lawyers, doctors, business men, nurses, recreation directors, housewives, and children present.

A special attraction for the group was Dick Park's exhibit of bird paintings and etchings. I liked the Barn Owl, the doves, the Evening

*Ed. Note: The usual policy of *The Oriole* is to publish only material of a scientific nature. An exception has been made for this article which shows so clearly some of the pleasures that a non-scientific person may derive from participating in the activities of the Georgia Ornithological Society, membership in which is open to all interested persons.

Grosbeaks, and the Bobwhites the best. But I would love owning any one of them.

A new movie, "So Little Time", was shown on Friday night. It was excellent, and I have never seen a movie on conservation presented in such a fascinating way. It sold you on conservation without your realizing what was happening. A song, "So Little Time", was composed especially for this production. The music was played on a guitar, and the melody furnished background for several scenes. Roger Tory Peterson played the role of teacher to a handsome young chap who was eager to learn more about wildlife. The scenes of water birds were superb. This movie should be shown in every public school in the country.

Dr. Leslie Davenport, Department of Biology, Armstrong State College, gave an interesting talk on "Making a Breeding Bird Census". He was followed by Dr. J. Fred Denton of the Medical College of Georgia, who gave a field-trip brief.

On Saturday morning the crowd divided and went on eight separate field trips. I went to the Municipal Airport and the New Savannah Lock and Dam with Louis Schweizer and Ellen Merry leading. As we meandered we saw Horned Larks, an Upland Plover, a Meadowlark, a Grasshopper Sparrow, an Indigo Bunting, an Evening Grosbeak, some Crows, Cardinals, a Chat, a Prothonotary Warbler, and a Parula Warbler. We heard more birds, but were unable to see them, because the river was swollen and much of the wooded area usually hiked was flooded.

On Saturday night there was a sumptuous banquet. Each table had a tree adorned with birds. There were spring flowers beneath the trees. Mr. Donald W. Pfitzer, Conservation Education Coordinator for the Fish and Wildlife Service, showed some excellent slides as he lectured on birds and wildlife in different refuges throughout the country. He began his speech by reproaching the Augusta Bird Club for allowing so many "birdies" and "eagles" to be shot in their beautiful city, home of the Masters Golf Tournament.

Sunday morning found the bird watchers rising at six to greet the birds in the field. I carried some cheap binoculars that were really not worth lifting. I think they came in a popcorn box. We all carried field guides and area check-lists in our pockets. A few carried cameras.

On this field trip Tom Rial led us past Beach Island, S. C., to a point called Silver Bluff on the Savannah River. We stopped many times before we reached the river to observe birds and hear their songs along the way. While standing on a wooden bridge we noticed a pair of Parula Warblers and a Prothonotary Warbler. The female Prothonotary was

making a nest over the water, hitching it between two blackberry bushes. This stream was very clear with a sandy bottom. We saw a school of bass and watched them dart away when a beaver hit the water just beyond them. Marie Mellinger pointed out a tree nearby which beaver had chewed.

Between the bridge and the river we heard a Bachman's Sparrow, which Ann Hamilton recognized. At the river we saw two Ruby-throated Hummingbirds and a Cattle Egret. The water was 12 feet above its standard depth and hundreds of cattle had sought high ground to keep from being drowned. They were stranded and bellowing for food as boatmen approached them in small boats loaded with hay.

An Indian village had been located at Silver Bluff before the Revolutionary War. Hernando DeSoto and his men crossed the river at this point. William Bartram crossed here while traveling through Georgia and the Carolinas. One of the birders found an old piece of broken Indian pottery and another found a part of a stem to an Indian pipe.

While we were listening to a kingfisher and a warbler, we heard a rooster crow. One of the gentlemen remarked that he heard an Indian Jungle Fowl. He said that chickens originated in the jungles of India. Our Rhode Island Reds are the most like the original fowl. A noteworthy bit of information, I would say. Georgia's broiler industry owes much to India.

I missed the count-down in order to fish in Clark Hill Dam Lake, so I don't know how many birds were seen. But I can tell you that I saw six Mallards on a pond near Clark Hill. There were four drakes and two hens.

I arrived home with all kinds of literature, among which are articles entitled: "A Recipe for Bird Cake", "Plans for Bluebird Houses", "Georgia's Hawks and Owls—A Valuable Natural Resource", "Invite Birds to Your Home", a March copy of *Audubon Magazine*, and the Carolina Bird Club's magazine, *The Chat*. All of this I have devoured, plus an historical summary about Bartram's travels called "Wrightsborough's Famous Visitor".

Now I must mail my dues to the GOS. I joined the CBC while I was in Augusta. It was their patch with the Chat that charmed me. Why don't we commission Dick Parks to design a patch for the GOS? 117 Telephone Street, Sylvania, Ga.

RECENT LITERATURE

EXTINCT AND VANISHING BIRDS OF THE WORLD, second revised edition, by James C. Greenway, Jr. Reprinted by Dover Publications, Inc., 180 Varick Street, New York, N. Y.; 1967, 438 pp., 48 p. bibliography, appendix, index; paperback, \$3.50.

This book is a comprehensive account by species of the birds known to be extinct and of those which are in danger of extinction. There is also an extensive discussion of the geography of extinction in various regions of the world. An effort is made to consider all possible causes of extinction, both in general for geographic areas and in particular for the various species. A useful feature is an introductory summary which lists on a few pages all of the species and subspecies known to be extinct or endangered.

In preparing this work the author, who is a member of the staff of the American Museum of Natural History, has searched for all available records of early travelers and naturalists as well as biologists to obtain the most accurate and extensive information available on the life history of each species, including such things as migratory habits, preferred habitats, descriptions of adult and young birds, reproductive habits, diets, and the dates and places of last sightings. The bibliography is vast and has been brought up to date through 1966.

The book is interestingly written and contains a large amount of valuable information about the general biology of birds as well as the biology of extinction. L.B.D., Jr.

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