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## THE GREENHOUSE EFFECT AND AVIAN DISTRIBUTION: WHAT MIGHT HAPPEN IN GEORGIA?

Mark W. Oberle

Changes in climate have affected bird distribution gradually over the millennia, but recent alterations of Earth's atmosphere by human activities may have rapid, profound consequences for climate and for bird distribution. Carbon dioxide in the Earth's atmosphere has increased by about 23% in the last two centuries, chiefly as a result of fossil fuel combustion and deforestation (Postel 1986). Carbon dioxide absorbs infrared light and thus reduces the radiation of heat into space. Consequently, increased atmospheric carbon dioxide may produce a rise in global temperatures - the greenhouse effect. Over the next few decades, this greenhouse effect could cause rising sea levels, changes in precipitation, longer growing seasons, and alterations of storm patterns (Seidel and Keyes 1983).

Major climatic changes may have a destabilizing impact on modern ecosystems (Peters and Darling 1985). Because bird distribution reflects alterations in ecosystems, this paper examines possible alterations in the distribution and abundance of Georgia's avifauna as a consequence of the greenhouse effect. This predictive exercise suggests that greenhouse warming will probably have a major impact on Georgia's avifauna, despite the fact that current climate models predict relatively small climate alterations in southeastern North America, compared to anticipated changes in northern latitudes.

## BACKGROUND

Over the last 130 years, average global temperatures have increased, with the most rapid warming in the last decade (Jones *et al.* 1986; Damen and Kunen 1976). The four warmest years of this period have been in the 1980's. Some climate modelers have suggested that greenhouse warming may have accounted for 0.4° C. of the observed temperature rise (Hansen *et al.* 1981). However, the recent warming trend may be the consequence of poorly understood natural cycles in weather patterns (Kerr 1983).

Although few climatologists doubt that a greenhouse effect will occur, the precise timing and extent of greenhouse warming is difficult to predict. Human demand for fossil fuel is uncertain, and the rate at which oceans can absorb



and transport excess heat and carbon dioxide is not well understood (Hansen *et al.* 1985). In addition to carbon dioxide, the concentrations of several other radiatively active gases have increased during the last century, chiefly as a result of human activity (Abelson 1986). These gases include methane from rice fields, swamps, termite colonies, and cattle; nitrous oxide from fertilizer, sewage, and deforestation; and chlorofluorocarbons from refrigerants and aerosol sprays (Bowden and Bormann 1986; Stauffer *et al.* 1985; Rasmussen and Khalil 1986; Levine *et al.* 1985). Water vapor also can enhance the greenhouse effect (Seidel and Keyes 1983). As global temperatures rise, increased evapotranspiration may raise atmospheric water vapor concentrations and augment the greenhouse effect.

Most climate models assume that a greenhouse warming of 1.3-3.9°C may occur over the next three to five decades, with the greatest alterations in temperatures occurring in northern latitudes (Kerr 1986). This warming would produce a rise of at least 0.5 m in mean sea level, as a consequence of thermal expansion of seawater and glacial melting. Additional warming of 2-5°C by the end of the 21st century is possible, with consequent increases in sea level. In addition, global warming could alter the oceans' vertical circulation and currents, and disrupt pelagic communities (Frye 1983; Venrick *et al.* 1987). Growing seasons would be prolonged, and vegetation zones may shift northward (Peters and Darling 1985; Woodwell 1986). Precipitation patterns would change, but the precise nature of changes in regional weather patterns is one of the most difficult consequences of greenhouse warming to predict (Manabe and Wetherald 1986; Kerr 1987). One widely-cited climate model suggests that southeastern North America would be drier than it is currently (Kerr 1986).

Predicting the ecological impact of greenhouse warming is complicated further by the likelihood that global warming and the resulting climatic instability would be extremely abrupt in evolutionary terms. Although one plant community might disappear from a region in a matter of a few decades, it may take centuries for better-adapted organisms to disperse naturally into the region to replace it (Peters and Darling 1985; Woodwell 1986). Human activities would facilitate some plant and animal species' dispersal. On the other hand, urbanization, agricultural development and commercial forestry practices would pose formidable barriers to the dispersal of other species. Nevertheless, biologists must begin to investigate and model the ecological impact of the greenhouse effect in order to assist society in adapting to these changes. Alterations in the distribution and abundance of one region's avifauna will illustrate the wide-ranging impact of the impending climate change.

#### METHODS

Because of the uncertainties described above, biologists can estimate the impact of the greenhouse effect on only a few species and families, and cannot predict the precise timing of these changes. Based on median projections used by the U.S. Environmental Protection Agency (Seidel and Keyes 1983), this analysis assumes that increasing carbon dioxide concentrations would produce a rise of 2°C in global mean temperature, a rise of 0.5 m in mean sea level, and a decrease of 20% in summer soil wetness in Georgia. These assumptions

may well prove conservative if the additional effects of other greenhouse gases were considered. No major changes in human land use patterns were assumed. I then examined the impact that these changes would have on the known habitat of the 410 avian species documented to have occurred in the state (Burleigh 1958; Haney *et al.* 1986). The following examples illustrate the potential impact of the greenhouse effect on Georgia's avifauna.

#### THE CASE OF GEORGIA

**Breeding species** - The greenhouse effect would tend to shift ecosystem boundaries northward and toward higher altitudes (Peters and Darling 1985). Thus species that reach the southern limit of their breeding range in the mountains of northern Georgia may decline, and those from the coastal plain might extend their breeding range northward and toward higher elevations inland. High altitude (>1000 m) nesting species such as Veery (*Catharus fuscescens*) and Canada Warbler (*Wilsonia canadensis*) may decrease in abundance. Other species such as Winter Wren (*Troglodytes troglodytes*) and Common Raven (*Corvus corax*) may already have disappeared as high-altitude nesters in Georgia.

The Gray Kingbird (*Tyrannus dominicensis*) may become more common in appropriate coastal habitat, and the Burrowing Owl (*Athene cunicularia*), which is expanding its nesting range northward in Florida, might become a regular breeding species in south Georgia (Courser 1979). Extreme greenhouse conditions could eventually alter the coastal plain habitat sufficiently to be suitable for Scrub Jay (*Aphelocoma coerulescens*) or Crested Caracara (*Polyborus plancus*). But the extension of these species into Georgia is unlikely because of the barrier of extensive human development in northern Florida. If Red Mangroves (*Rhizophora mangle*) or similar species disperse from northern Florida or are introduced into coastal Georgia, the Black-whiskered Vireo (*Vireo altiloquus*) could also extend its breeding range northward.

If precipitation declines in Georgia, freshwater nesting species such as Wood Duck (*Aix sponsa*), King Rail (*Rallus elegans*), and Wood Stork (*Mycteria americana*) would decline. Nesting warblers that prefer riparian or moist woodland habitat, such as Hooded Warbler (*Wilsonia citrina*) and Prothonotary Warbler (*Protonotaria citrea*) would also decline. Interestingly, some of the upland warbler species may not decline with small precipitation decreases, because increased carbon dioxide concentrations may enhance the growth of certain plant species (Cooper 1986). Thus the effect of higher carbon dioxide levels on individual plant species and their corresponding arthropod communities might determine whether specific upland insectivores benefit or suffer from altered climate.

Rising sea level would inundate much of today's salt marsh habitat but ultimately convert some lowlands into new salt marsh areas. However, near coastal urban areas and commercial facilities, humans will attempt to retard the salt marsh advance. The net result would be some decline in salt marsh and estuarine habitat, and a corresponding decline in associated breeding birds such as Clapper Rail (*Rallus longirostris*).



Based on ecological changes such as those cited above, 40 of Georgia's avian species will probably decline in abundance during the breeding season, 6 will probably increase, (see Table 1) and 1-2 new breeding species may colonize parts of Georgia. For the remaining breeding species, the impact of the greenhouse effect is too complex to predict at present.

Wintering species - Some northern species that regularly winter in Georgia may remain farther north if mild winters predominate in northern latitudes. In addition, if nesting ranges shift northward with vegetation zones, some populations would have farther to travel to reach their former winter ground in Georgia, and thus might winter farther north. Winter waterfowl numbers are typically low in Georgia during years with minimal lake ice farther north, and such winters may become more common if the greenhouse effect materializes. Other wintering species such as Eastern Bluebird (*Sialia sialis*) and Field Sparrow (*Spizella pusilla*) which frequently reach their maximal winter abundance in the Georgia Piedmont (Sykes 1986), may winter in more northerly areas if elevated temperatures, decreased snow cover, and longer growing seasons enhance winter food availability farther north. Irruptive winter species such as Evening Grosbeak (*Coccothraustes vespertinus*) may follow a similar pattern, although irruptive behavior may be less dependent on simple temperature and snow cover relationships.

Current winter residents of the coastal plain such as Palm Warbler (*Dendroica palmarum*) and Yellow-throated Warbler (*Dendroica dominica*) may become more numerous. Some western and northern migrants that winter in southern Florida, such as Scissor-tailed Flycatcher (*Tyrannus forficatus*), and Northern Parula (*Parula americana*), may occur more regularly in Georgia's coastal plain if the greenhouse effect produces mild winters.

Thus for wintering waterfowl and sparrows, the extent of greenhouse warming in traditional northern wintering grounds may determine the abundance of these species in Georgia. On the other hand, for warbler and flycatcher species that winter farther south, mild winters in Georgia itself may be the important determinant of winter occurrence. For these insectivorous species, the frequency of severe cold fronts may be as crucial as average winter temperatures in determining how far north they can survive in winter.

In addition to permanent resident species included as nesters above, 36 of Georgia's wintering bird species will probably decrease in abundance or spend less of each winter in Georgia as a consequence of the greenhouse effect, and 13 species will probably occur more frequently (Table 2).

Accidental species - The driving forces behind accidental occurrences of birds are not well understood, but strong frontal storms and hurricanes are often associated with accidental records (DeSante and Ainley 1980). Georgia has a relative paucity of Old World and Caribbean accidental records, in part because of the distance from these potential source regions and the relatively few strong storms originating in these regions that reach Georgia. Storm paths and intensity will probably change due to greenhouse warming (Emmanuel 1987).

Severe winter weather in northern states and provinces may also contribute to accidental occurrences in Georgia. These occurrences may decrease if winter temperatures moderate farther north. In addition, if the normal breeding and

Table 1. Georgia nesting species most likely to be impacted by projected greenhouse effect.

Decreasing Species	Scientific Name
Pied-billed Grebe	<i>Podilymbus podiceps</i>
Anhinga	<i>Anhinga anhinga</i>
Least Bittern	<i>Ixobrychus exilis</i>
Great Blue Heron	<i>Ardea herodias</i>
Great Egret	<i>Casmerodius albus</i>
Snowy Egret	<i>Egretta thula</i>
Little Blue Heron	<i>Egretta caerulea</i>
Tricolored Heron	<i>Egretta tricolor</i>
Green-backed Heron	<i>Butorides striatus</i>
White Ibis	<i>Eudocimus albus</i>
Glossy Ibis	<i>Plegadis falcinellus</i>
Wood Stork	<i>Mycteria americana</i>
Wood Duck	<i>Aix sponsa</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>
Clapper Rail	<i>Rallus longirostris</i>
King Rail	<i>Rallus elegans</i>
Purple Gallinule	<i>Porphyryla martinica</i>
Common Moorhen	<i>Gallinula chloropus</i>
Limpkin	<i>Aramus guarana</i>
Wilson's Plover	<i>Charadrius wilsonia</i>
Semipalmated Plover	<i>Charadrius semipalmatus</i>
Willet	<i>Catoptrophorus semipalmatus</i>
Gull-billed Tern	<i>Sterna nilotica</i>
Forster's Tern	<i>Sterna forsteri</i>
Least Tern	<i>Sterna antillarum</i>
Willow Flycatcher	<i>Empidonax traillii</i>
Least Flycatcher	<i>Empidonax minimus</i>
Eastern Phoebe	<i>Sayornis phoebe</i>
Veery	<i>Catharus fuscescens</i>
Northern Parula	<i>Parula americana</i>
Yellow Warbler	<i>Dendroica petechia</i>
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>
Prothonotary Warbler	<i>Protonotaria citrea</i>
Swainson's Warbler	<i>Limothlypis swainsonii</i>
Louisiana Waterthrush	<i>Seiurus motacilla</i>
Kentucky Warbler	<i>Oporornis formosus</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Hooded Warbler	<i>Wilsonia citrina</i>
Canada Warbler	<i>Wilsonia canadensis</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Increasing Species	Scientific Name
Cattle Egret	<i>Bubulcus ibis</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>
Gray Kingbird	<i>Tyrannus dominicensis</i>
Pine Warbler	<i>Dendroica pinus</i>
Prairie Warbler	<i>Dendroica discolor</i>
Dickcissel	<i>Spiza americana</i>



Table 2. Georgia wintering species most likely impacted by projected greenhouse effect. Many of the permanent resident species cited in Table 1 would most likely decline in winter abundance also.

Decreasing Species	Scientific Name
Tundra Swan	<i>Cygnus columbianus</i>
Greater White-fronted Goose	<i>Anser albifrons</i>
Snow Goose	<i>Chen caerulescens</i>
Green-winged Teal	<i>Anas crecca</i>
American Black Duck	<i>Anas rubripes</i>
Mallard	<i>Anas platyrhynchos</i>
Northern Pintail	<i>Anas acuta</i>
Blue-winged Teal	<i>Anas discors</i>
Northern Shoveler	<i>Anas clypeata</i>
Gadwall	<i>Anas strepera</i>
American Wigeon	<i>Anas americana</i>
Canvasback	<i>Aythya valisineria</i>
Redhead	<i>Aythya americana</i>
Ring-necked Duck	<i>Aythya collaris</i>
Common Goldeneye	<i>Bucephala clangula</i>
Bufflehead	<i>Bucephala albeola</i>
Red-breasted Merganser	<i>Mergus serrator</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>
Golden Eagle	<i>Aquila chrysaetos</i>
Black Rail	<i>Laterallus jamaicensis</i>
Virginia Rail	<i>Rallus limicola</i>
Sora	<i>Porzana carolina</i>
Long-eared Owl	<i>Asio otus</i>
Short-eared Owl	<i>Asio flammeus</i>
Northern Saw-whet Owl	<i>Aegolius acadicus</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
Winter Wren	<i>Troglodytes troglodytes</i>
Eastern Bluebird	<i>Sialia sialis</i>
Water Pipit	<i>Anthus spinoletta</i>
Field Sparrow	<i>Spizella pusilla</i>
Vesper Sparrow	<i>Poocetes gramineus</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Fox Sparrow	<i>Passerella iliaca</i>
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
Lapland Longspur	<i>Calcarius lapponicus</i>
Snow Bunting	<i>Plectrophenax nivalis</i>
Increasing Species	Scientific Name
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>
Western Kingbird	<i>Tyrannus verticalis</i>
Scissor-tailed Flycatcher	<i>Tyrannus forficatus</i>
Orange-crowned Warbler	<i>Vermivora celata</i>
Northern Parula	<i>Parula americana</i>
Yellow-throated Warbler	<i>Dendroica dominica</i>
Pine Warbler	<i>Dendroica pinus</i>
Prairie Warbler	<i>Dendroica discolor</i>
Palm Warbler	<i>Dendroica palmarum</i>
Black-and-white Warbler	<i>Mniotilta varia</i>
American Redstart	<i>Setophaga ruticilla</i>
Ovenbird	<i>Seiurus aurocapillus</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>

wintering ranges of such recent accidentals as White-winged Crossbill (*Loxia leucoptera*) and Northern Goshawk (*Accipiter gentilis*) shift northward, these species might be less likely to recur in Georgia (Oberle 1986, Cohrs 1984). The lack of any invasion year for Dovekie (*Alle alle*) since 1950 (Haney *et al.* 1986) may be related to general climatic warming.

Overall, the occurrence of accidental species in Georgia is so little understood that the number of accidental species that would increase or decrease as a consequence of the greenhouse effect is virtually impossible to predict.

## DISCUSSION

Several uncertainties currently surround the ecological impact of the greenhouse theory. First, there are the intrinsic uncertainties of climate models themselves (Tribbia and Anthes 1987). The extent of temperature change, the rate of change, the effect of atmospheric particulates and sulfates, and the extent of human efforts to ameliorate global warming are all uncertain (Speth 1986; Seidel and Keyes 1983). The kinetics of the oceans' absorption of CO<sub>2</sub> and the possible increase in cloud cover resulting from climatic warming are additional uncertainties (Charlson *et al.* 1987). Greenhouse gases other than carbon dioxide could exacerbate greenhouse warming, but their role is only now being quantified. Fluctuations in solar irradiance could exacerbate or ameliorate the greenhouse effect (Willson *et al.* 1986).

The impact of greenhouse warming on precipitation and evapotranspiration may not be well-defined for decades, but these factors are probably more important than temperature trends for many species. Changes in storm paths and frontal movements would also be more important for some species than changes in average temperature. Finally, the changes in temperature or precipitation resulting from the greenhouse effect may be more pronounced in some seasons than in others, and thus could impact breeding or wintering birds differentially.

Second, in addition to the uncertainties of climatology, are the uncertainties about the ecological response to the greenhouse effect. Several factors complicate predictions of population changes among birds and other indicator species near the top of food chains. Habitat modification by humans will alter ecosystems' gene pools and pose barriers to the dispersal of some species. For example, urban growth in Georgia will probably continue in response to the Sunbelt migration (Bur. of Economic Analysis 1985). The developing worldwide shortage of timber may encourage plantations of pine and other pulp species throughout southeastern North America (Smith 1981). Humans will accidentally or intentionally introduce better-adapted plant and animal species that will replace indigenous species that fail to adapt to altered conditions of temperature, carbon dioxide, moisture, or inter-specific competition. In addition, increased carbon dioxide levels will differentially enhance the growth of certain plant species. These factors will alter the species mix of ecosystems in ways that are currently unpredictable.



Finally, climatic change from greenhouse gases will not occur in isolation. Acid rain and other forms of pollution will influence the response of current ecosystems to the greenhouse effect.

Although the greenhouse effect is still an unproven climatological theory, a number of recent trends suggest that the greenhouse effect may already be upon us. Earth's atmosphere has been warmer in recent decades, and sea level is rising (Jones *et al.* 1986; Postel 1986). Significant increases in mid-latitude precipitation and concurrent decreases in low-latitude precipitation have occurred worldwide over the last 30 to 40 years (Bradley *et al.* 1987). These recent patterns are consistent with the greenhouse model.

Despite the relatively small predicted increase in Georgia's mean temperature, a climatic warming trend resulting from the greenhouse effect would have a major impact on many of Georgia's avian species. The recent warming trend, whether caused by the greenhouse effect or some poorly-understood natural climatic cycle, may already have contributed to changes in bird distribution. The decline of some high altitude nesting species in north Georgia, and the expansion of "southern" species into New England and southern Canada (Robbins *et al.* 1986; Laughlin and Kibbe 1985) may be a consequence of a variety of environmental changes, including the long-term warming trend.

Based on conservative predictions of the greenhouse effect, the changes in temperature, precipitation and sea level that may occur by the early 21st Century could lead to declines of 76 bird species and increases of 19 species in their Georgia summer or winter populations. However, virtually all species would be affected by climate change and the ratio of species favorably affected to those adversely affected may be quite different from that suggested by the tables. The impact of the greenhouse effect is currently impossible to predict for most species, especially for pelagic birds, upland nesting species and accidentals.

Resource managers will need to adjust management plans for nature reserves to anticipate climate change. Some ecological situations will be especially vulnerable to climate change, such as peripheral or isolated populations, poor dispersers, specialized species, coastal ecosystems, and high-altitude communities (Peters and Darling 1985). As climatologists improve our understanding of the greenhouse effect, biologists should continue to define its likely consequences on individual species and on ecosystems.

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## LARVAL DERMESTID INFESTATION OF NESTLING WOOD STORKS

### (*MYCTERIA AMERICANA*) IN GEORGIA

Susan D. Jewell

Snyder *et al.* (1984) discovered *Dermestes nidum* Arrow in the nests of Wood Storks (*Mycteria americana*) and Snail Kites (*Rostrhamus sociabilis*) in Florida and Great Blue Herons (*Ardea herodias*) in Ohio. They reported open lesions on live nestlings and determined that the dermestids were responsible for the wounds. I report here a similar occurrence in Wood Stork nests in east-central Georgia.

During observations of nesting Wood Storks from a blind in the Birdsville colony near Millen, Jenkins County, Georgia, in 1984 and 1985, I noted evidence of ectoparasitic infestations of many nestlings. The nestlings exhibited open wounds on the ventral surface of the neck and abdomen. I climbed to three nests in 1985 from which I collected larval skin beetles from the inner linings of the nests. The larvae were subsequently identified as *Dermestes nidum* Arrow by R.S. Beal of Northern Arizona University. Three are preserved in the U.S. National Entomological Collection (Dept. of Agriculture, Beltsville, MD) and 16 by the author. This is apparently the first record of this species in Georgia. Observations from a blind with a spotting scope and handling of chicks indicated that the dermestid infestation was more widespread in 1985 than in 1984. Those two seasons were drastically different in breeding success and weather. In 1984, a year of excessive rainfall, fledging success rate was 2.04 chicks per nest at 50 days of age (Coulter 1986a). In 1985, a year of severe drought, only 0.33 chicks per breeding pair fledged (16% of the previous year) (Coulter 1986b).

Another difference between the two nesting seasons was the colony's location. In 1985, the storks nested a little over a kilometer from their previous colony location. The habitat was virtually identical, with the only difference being the depth of the water below the nest trees. The 1985 drought caused the water under the original nest trees to completely dry out, while the new location remained inundated with water. Ostensibly, the latter was sought as a predator deterrence and no connection can be made with ectoparasitic escape.

In 1984, 5 of approximately 263 chicks (approximately 110 nests) in the colony were observed with dermestid-caused lesions. Of those 5, 3 were known to have recovered, and the fate of the other 2 is unknown. Observations of 9 nests (17 chicks) from one tree in 1985 revealed that 7 nests contained 9 chicks with similar wounds. Two chicks were found dead in separate nests 5 and 7 days respectively after dermal wounds were noted on their pectoral areas. The carcasses were not collected. Some nestlings recovered from their wounds and others disappeared. At least 2 nests from other trees contained chicks with dermestid lesions (discovered by handling of chicks and spotting scope observations) from a total of approximately 108 nests in 1985. The author witnessed the disappearance of one chick from an infested nest when a neighboring adult stork pushed it from the nest and it fell to the water. It was not determined whether the victim was the known infested chick. It was the only example of such behavior witnessed either year at this colony.



The drought apparently caused severe stress on the Wood Storks during the 1985 breeding season (Coulter 1986b), since many of their foraging ponds dried up. Stress from starvation may explain the higher mortality of infested chicks and perhaps even a greater incidence of infestation. After stork nestlings reach 3 or 4 weeks of age, they are normally able to stand for long periods (Kahl 1962). If starvation had weakened the nestlings to the point that they were lying down more often than usual, the ventral body surfaces would be in contact with the nest for longer periods of time, and the chance of picking up dermestid larvae, particularly in the pectoral region, might be increased.

Snyder *et al.* (1984) considered the possibility that larvae in the nest that normally feed on food scraps falling to the nest floor may switch to feeding on nestlings at times. They rejected this idea because they believed the amount of scraps in the nest had not changed over the years, and should not cause fluctuations in attacks. However, the dermestids may have been accustomed to feeding on food scraps left in the nest by amply-fed birds. If starvation conditions caused the nestlings and adults to meticulously clean up every scrap of food, and defecation was also reduced, the larvae may have attacked the nestlings for lack of their accustomed food.

The spread of *D. nidum* from one area to another obviously occurs by the winged adults. Another possible intra-colony vehicle of dispersion of eggs and larvae is by nest-material theft by adult storks. The nests were constructed of twigs from local baldcypress (*Taxodium distichum*). I observed adult storks stealing twigs from neighbors' nests, both infested and uninfested, to add to their own nests.

*D. nidum* has been found in Black-crowned Night-Heron (*Nycticorax nycticorax*) nests (Barber 1914) and was suspected of causing lesions in Snowy Egrets (*Egretta thula*), Tricolored Herons (*Egretta tricolor*), and Cattle Egrets (*Bulbulcus ibis*) in Florida (Black *et al.* 1984). This author found a dead Little Blue Heron (*Egretta caerulea*) chick with abdominal lesions and 4 *D. nidum* larvae in its nest in the Lane River colony of Everglades National Park in 1986. A common breeding place for the dermestids seems to be the nests of wading birds. More work needs to be done to determine the importance of these dermestids as a potential stressor of wading birds such as Wood Storks. The potential for synergisms between dermestid larvae and other stressors such as drought and/or food shortage also needs to be considered.

#### ACKNOWLEDGMENTS

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## GENERAL NOTES

**BIRDS KILLED BY HAILSTORM IN SOUTH GEORGIA AND NORTH FLORIDA** - During the early night of 25 March 1982, severe hailstorms struck from the northwest through Thomas and Brooks counties in Georgia and adjacent Jefferson, Madison, and Hamilton counties in Florida. There was extensive crop damage reported subsequently, and a local television news program showed film of 21 dead birds (identifiable on the screen as Yellow-rumped Warblers (*Dendroica coronata*) under an oak, killed by the hail. A few days after the storm, a Thomas County plantation manager reported to Neel that he had found five Northern Bobwhites (*Colinus virginianus*) dead, obviously killed by the hail; three were together. Neel and his wife, Julie, found two dead Yellow-rumped Warblers in their Thomas County yard after the storm, and for several days thereafter they noticed birds at their feeding station that appeared to have been injured by hail. One Northern Cardinal (*Cardinalis cardinalis*), for example, had an obvious lesion on its head and one eye was closed. On 1 April 1982, Crawford visited Linton Lake in southern Thomas County, where some large wading birds were reported killed by the storm. The birds were evidently caught on roost in the evening as the storm passed, for all the dead birds were floating among and around a small cluster of cypress trees. Crawford counted about 140 White Ibis (*Eudocimus albus*), 40 Little Blue Herons (*Egretta caerulea*), 5-10 Cattle Egrets (*Bubulcus ibis*), and one Great Blue Heron (*Ardea herodias*). Two ibis with broken wings were still alive in the trees. The count is a minimum as there was evidence of scavenging among the dead birds by predators. The cypress trees were noticeably scarred on the sides facing the direction from which the storm came.

Possibly other birds were affected by the storm but no others came to our attention. We made no systematic attempt to search for dead birds, although the potential for significant avian mortality became clear when Neel was able to assess the storm's impact on the local environment during salvaging efforts by his consulting forestry practice.

There was extensive defoliation, and subsequent mortality of trees in areas where the heaviest hail occurred, and, in places, it covered a path 2-3 miles wide from northwest to southeast. There, the herbaceous ground cover characteristic of the region's annually-burned pine forests was flattened to the ground. Cover usually about two feet high looked like bare ground covered with leaves and other small debris. There was an overall gray-green cast to the ground for hundreds of acres, where the beaten pine needles and hardwood leaves covered the flattened ground cover. Pine trees were virtually stripped of needles, and the bark had a reddish appearance where the hail had beaten off the bark plates; exposed cambium surfaces were frequent. Neel's field notes record "the eeriness of the landscape; the stark, flattened, silent, lifeless appearance with a gray-green patina that added a strange beauty to this scene". Long-term observations revealed that mortality was caused by defoliation and possibly other physical damage to the trees, rather than Bark Beetle (*Ips* sp.) infestation, which one would normally expect with weakened trees. The direct, catastrophic

destruction of the habitats in the path of the storm suggests that we only observed a miniscule portion of mortality inflicted on avian and other animal species.

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**POSSIBLE WINTERING OF KING RAILS IN UPPER COASTAL PLAIN** - On 19 January 1987, William Brown, Blake Brown and I observed a King Rail (*Rallus elegans*) in a run off swamp near the C.A. Newcomer Waste Water Treatment Facility just southwest of Fitzgerald, GA. The bird was identified on the basis of its large size, rusty coloration and lack of the gray cheeks of the Virginia Rail (*Rallus limicola*). After about 10 minutes the bird disappeared and was not seen again. However, approximately 30 minutes later, another bird of the same species was seen in a different part of the same swamp. There is a distinct possibility that these two sightings were of separate individuals.

Although the King Rail is listed as uncommon in the Coastal Plain in winter (*Annotated checklist of Georgia birds*, GOS Occ. Publ. No. 10, 1986), this is the first winter record for Ben Hill county and is an indication that the species possibly spends the entire winter in the region during some years.

W. Brian Brown, P. O. Box 661, Young Harris, Georgia 30582.



## FROM THE FIELD

August - November 1986

Along with a number of early and late dates for fall migrants, there were enough rare sightings to make this fall rather interesting. Among these sightings were reports of Eared Grebes, Black Rails, Long-billed Curlews, Lesser Black-backed Gulls, a Rufous Hummingbird, Western Kingbirds, Henslow's Sparrow, Harris' Sparrow and Lapland Longspur.

Abbreviations include CCWTP - Clayton County Water Treatment Plant about 20 miles south of Atlanta, MIA - Macon Industrial Area, MBBT - Merry Brothers Brick and Tile Company in Augusta, SCSP - Sweetwater Creek State Park about 20 miles west of Atlanta and PCL - Peachtree City Lake about 20 miles southwest of Atlanta.

**EARED GREBE** - Very unusual were the three reports received this fall. The first one was found by Terry Moore at CCWTP on 2 Sept. and noted by other observers through 4 Sept. The next bird was sighted on 28 Sept. from Jekyll Island by Robert Manns, Paul Raney and Nell Kirkland. The last one was found by John Paget on 11 Oct. in Forsyth County. All birds were in immature or winter type plumage and represent the 7th through the 9th Georgia records. The 28 Sept. record was also the first one for the Georgia coast.

**HORNED GREBE** - Where have all the Horned Grebes gone? A single bird at the MIA on 8 Nov. and 4 more individuals at the Plant Scherer Power Plant Pond the next day were noted during the GOS meeting in Macon. In Augusta, where the species is rare, Anne and Vernon Waters sighted 2 on 27 Nov. In Atlanta, Patrick Brisse saw 3 birds on 29 Nov. and Paul Raney saw 6 on 30 Nov. The latter number could even be the highest count ever for the Atlanta area.

**DOUBLE-CRESTED CORMORANT** - The species was reported as usual in small numbers from the Macon, Augusta, and Eufaula NWR areas. More unusual were the 5 records from the Atlanta area between 29 Sept. and 29 Nov. according to Terry Moore. Just a few years back the species was classified as accidental in that area.

**ANHINGA** - A few were mentioned around the Fall Line. Ty Ivey saw 2 females at the MIA on 10 Aug. Dwight Harley saw another bird in Wilkinson County on 30 Oct. and Anne and Vernon Waters saw the last one at MBBT on 27 Nov. Although rare around the Fall Line, the species has been regular in the Augusta area in the last few years.

**AMERICAN BITTERN** - Probably present in small numbers during migration and winter, the species was reported only 4 times. Harriett DiGioia saw the first one in Murray County in 17 Sept., Jeff Dixon saw the second near Carter's Lake on 10 Nov., Tom Patterson sighted the third one in NE Laurens County on 15 Nov. and Anne and Vernon Waters had the fourth one at MBBT from 16 to 30 Nov.

**GREAT WHITE HERON** - This form of the Great Blue Heron was reported from Jekyll Island on 28 Sept. by Paul Raney, Nell Kirkland and Robert Manns. Paul saw probably the same bird again on 20 Oct.

**GREAT EGRET** - A late migrant was still in Harris County on 17 Nov. according to Parker Swift, *vide* Sam Pate.

**LITTLE BLUE HERON** - John Paget noted a late bird for the Piedmont area in Forsyth County on 12 Oct.

**BLACK-CROWNED NIGHT-HERON** - Of note was a juvenile in NE Laurens County on 15 Nov. according to Tom Patterson. Three adults and 2 immatures at MBBT on 22 and 27 Nov. are more expected as a few birds do winter in the Augusta area regularly (Anne and Vernon Waters).

**GLOSSY IBIS** - The species was still at the Altamaha WMA near Darien on 16 Oct. (Don and Joyce Duncan). Although not a late date, it would be interesting to learn more of the status of the bird during the fall migration period.

**WOOD STORK** - Noteworthy were the 110 storks along with some egrets found by Sam and Nan Pate in an almost dry farm pond north of Bluffton in Clay County on 9 Aug. Not far from there, seven birds were noted near Sylvester in Worth County on 29 Sept. by Larry and Lynn Thomas.

**SNOW GOOSE** - More birds than usual were reported this year. Four individuals were at the Oconee WMA in late Oct. according to Dwight Harley, one was seen at the ash pond of Plant Scherer on 8 Nov. by many GOS members, two blue morphs in NE Laurens County from 15 to 30 Nov. *vide* Tom Patterson, and 2 more blue phase birds were at Lake Lanier from 29 Oct. to 30 Nov. as noted by John Paget.

**GREEN-WINGED TEAL** - One of the highest counts for the Atlanta area was the 40+ noted by Patrick Brisse at PCL on 27 Nov.

**AMERICAN BLACK DUCK** - Nineteen birds were at Shamrock Lake on 29 Nov. according to Patrick Brisse for the highest count of the species in the Atlanta area in recent years.

**NORTHERN PINTAIL** - Parker Swift mentioned the species from Harris County in mid-Oct. and Patrick Brisse sighted 2-3 individuals at PCL starting on 22 Nov. This species is one of the rarest puddle ducks inland.

**BLUE-WINGED TEAL** - Ty Ivey found the species as early as 10 Aug. at the MIA. In the Piedmont area, late birds were noted by Joe Greenberg on 2 Nov. at PCL and by John Paget on 18 Nov. in Forsyth County.

**AMERICAN WIGEON** - Over forty individuals at PCL on 22 Nov. by Patrick Brisse represent a good inland count for the Atlanta area.

**REDHEAD** - About 50 birds were at PCL on 29 Nov. (Patrick Brisse).

**RING-NECKED DUCK** - Terry Johnson mentioned 3 individuals summering in Monroe County and the species was notable in its absence from PCL during the summer. Elsewhere a male was quite early at MBBT on 11 Oct. according to Anne Waters. A very conservative count of 1100+ birds was reported from PCL on 27 Nov. by Patrick Brisse, probably the highest count for the Atlanta area.

**LESSER SCAUP** - A female seen off the Augusta levee on 16 and 27 Sept. and 11 Oct. was quite early (Anne and Vernon Waters).

**BLACK SCOTER** - For the second consecutive year, the species was reported as early as 24 Oct. from St. Simons Island by Terry and Peggy Moore.

**SURF SCOTER** - Ken and Arlene Clark mentioned a female at Lake Tobesofkee near Macon on 14 Oct. More unusual for an inland location were the eight birds, immatures or females, seen by Paul Raney and Nell Kirkland at SCSP on 26 Oct. which represents the third Atlanta record.

**WHITE-WINGED SCOTER** - Patrick Brisse and Hugh Garrett sighted a White-winged Scoter near Griffin on 29 Nov. A second bird could only be identified as a scoter sp.

**HOODED Merganser** - A lone bird at CCWTP on 4 Oct. was quite early for the Atlanta area (Patrick Brisse).

**AMERICAN SWALLOW-TAILED KITE** - Always noteworthy inland, one was seen by Eddie and Nina Arnold in south Macon on 21 Sept. This record should be written up for *The Oriole* as only 4 previous records exist for the interior of the state away from the coastal areas.

**BALD EAGLE** - As usual a few birds were noted during the period. Near Macon an adult was sighted by a ranger (*vide* Terry Johnson) on 8 Aug. at the Rum Creek WMA; at the MIA on 11 Oct. Ty Ivey and others sighted one adult and an immature; and the last one was near Lake Juliette on 12 Nov. by Terry Johnson. Near Callaway an adult was observed over the main lake on 1 Sept. by Dorothy and Bob Potts and another bird was reported to Sam Pate by several observers near Columbus on 14 Nov. Along the coast the only report received was of an adult and an immature near Darien on 22 Oct. by Patrick and Donna Brisse.



**BLACK RAIL** - Two and possibly three birds were flushed during a field mowing near Lake Juliette in Sept. (*vide* Terry Johnson). Details of the observation should be submitted to *The Oriole* as the species is rarely located in Georgia.

**VIRGINIA RAIL** - Always a rare find in Atlanta, one was spotted during the 21 Sept. Atlanta Audubon Society migration walk (*vide* Terry Moore).

**SANDHILL CRANE** - This was one of the better migrations over Atlanta according to Terry Moore who received or heard of at least two dozen reports. The species was noted as early as 2 Nov. through 20 Nov. with the major flights on 2-4 and 18-20 Nov. The total number was at least 1000 individuals. Rather unusual for the Augusta area was an early bird seen by Fielding Dillard on 31 Oct. The bird was later relocated on 22 Nov. during an Augusta Audubon Society field trip.

**LESSER GOLDEN-PLOVER** - Hugh Garrett mentioned 13 birds near Duluth on 1 Sept. during a rainy day.

**PIPING PLOVER** - Since the species seems to be in trouble more data would be appreciated. Don and Joyce Duncan noted 6 birds on the South Beach of Jekyll Island on 17 Oct. and only 3 were seen there on 20-24 Oct. by Patrick Brisse, Peggy and Terry Moore.

**GREATER YELLOWLEGS** - John Paget reported a late bird near Lake Lanier on 15-20 Nov.

**LESSER YELLOWLEGS** - Over 100 birds seen at CCWTP on 1 Sept. by Patrick Brisse was probably the highest count for the area.

**WHIMBREL** - Eleven were noted on the Jekyll Island Causeway on 17 Aug. by Patrick Brisse and Terry Miller.

**LONG-BILLED CURLEW** - As the species has been reappearing in the last few years a question arises. Do we have more birders along the coast in the fall or is the species coming back to Georgia? Don and Joyce Duncan saw the first one on Little St. Simons Island on 19 Oct. and Peggy and Terry Moore and Patrick Brisse saw another or the same one on 24 Oct. at St. Simon's Island East Beach.

**MARbled GODWIT** - Of note were the 40+ seen on Little St. Simon's Island on 18 Oct. by Don and Joyce Duncan. More unusual was a bird seen by Ty Ivey on 10 Aug. at the MIA for the third inland state record (should be written up for *The Oriole*).

**RUDDY TURNSTONE** - A few inland birds were mentioned. At the MIA one was studied by Jerry and Marie Amerson on 3 Aug. and 3 more were observed there on 30 Aug. by Ty Ivey and others. Seven individuals were at the Plant Bowen Ash Pond near Cartersville on 1 Sept. according to Dan and Kathy Jacobson.

**SANDERLING** - John Paget sighted the first inland bird near Lake Lanier on 13 Aug. and Ty Ivey reported singles from the MIA on 30 Aug. and 6 Sept. Only 2 previous records exist from the Macon area.

**PECTORAL SANDPIPER** - Rather late single migrants were observed by John Paget in Forsyth County on 23 Nov. and around Lake Lanier on 24-30 Nov.

**PURPLE SANDPIPER** - Don and Joyce Duncan mentioned 3 birds from the Jekyll Island South Beach on 17 Oct. Since all reported sightings for the species for the past 10 years or so have been from the Tybee Island area, this deserves documentation in *The Oriole*.

**DUNLIN** - A few birds were noted inland again this fall: the species was sighted at the Rum Creek WMA on 13 Sept. during an Ocmulgee Audubon Society field trip. Patrick Brisse noted 3 at CCWTP on 26 Nov. and 2 more were found at the MIA on 8 Nov. by many observers during the GOS fall meeting.

**STILT SANDPIPER** - Better coverage of inland shorebird locations is now producing sightings every fall. Between the Atlanta and Macon areas the species was observed from 2 Aug. through 13 Sept. with an outstanding high count of 46 at the MIA on 3 Aug. (Ty Ivey and others) and 7 at CCWTP on 1 Sept. (Patrick Brisse and Terry Miller).

**BUFF-BREASTED SANDPIPER** - A lone bird in NE Laurens County on 28 Sept. by Tom Patterson was the only report of the season.

**LAUGHING GULL** - A single bird at SCSP on 14 Oct. according to Paul Raney was a rare sighting for the Atlanta area.

**LESSER BLACK-BACKED GULL** - Up to 2 birds were on Jekyll Island's South Beach during 20-24 Oct. (Peggy and Terry Moore, Patrick Brisse) and an additional individual was at the St. Simon's Island East Beach on 23 Oct. (Patrick Brisse). Over a dozen records now exist for the state, most of them in the fall along the coast.

**CASPIAN TERN** - Always worth mentioning inland were single birds seen by Ty Ivey at the MIA on 23 and 30 Aug.

**FORSTER'S TERN** - Ty Ivey reported 3 at the MIA on 30 Aug. and Dan Jacobson mentioned 6 from the Plant Bowen Ash Pond on 1 Sept.

**BLACK TERN** - About 10 sightings were received from the Piedmont area, a little better than in previous years. The high count was 9 birds at the CCWTP on 9 Aug. (Patrick Brisse and Paul Raney).

**COMMON GROUND-DOVE** - One found by Anne and Vernon Waters on 29 Nov. at the Augusta levee is an uncommon occurrence for the area.

**BLACK-BILLED CUCKOO** - One was banded at Jekyll Island on 6 Oct. (*vide* Terry Moore).

**COMMON BARN-OWL** - Tom Patterson reported birds seen and heard in north Laurens County throughout the period. Only one previous record had been recorded for the county.

**SHORT-EARED OWL** - An early bird was a rare sight at the Gainesville Airport on 15 Nov. according to John Paget.

**COMMON NIGHTHAWK** - Thousands were moving over Atlanta on 5 Sept. for one of the best migrations in recent years (*vide* Terry Moore).

**WHIP-POOR-WILL** - How late does the bird stay in north Georgia? Terry Moore heard 2 birds near Roswell on 25 Sept. and one was still calling on 1 Oct. He also flushed a bird in downtown Atlanta on 7 Oct. and heard the latest one along the coast at Jekyll Island on 22 Oct.

**RUBY-THROATED HUMMINGBIRD** - Tom Patterson reported a late individual on 18 Nov. from Laurens County.

**RUFous HUMMINGBIRD** - An immature male showed up at Frank Parrish's feeder in Fitzgerald on 18-19 Sept. If accepted by the Checklist Committee this will represent the third state record.

**OLIVE-SIDED FLYCATCHER** - Harriett DiGioia saw the first one in Murray County on 28 Aug. Patrick Brisse and Hugh Garrett mentioned one at Shakerag near Duluth on 6 Sept., a rare but regular species in the fall in the Atlanta area. More unusual was one spotted along the coast by Don and Joyce Duncan on 17 and 19 Oct. from Little St. Simon's Island.

**EASTERN WOOD-PEWEE** - A bird near Stone Mountain on 26 Oct. was rather late for the Atlanta area (Joel Hitt).

**YELLOW-BELLIED FLYCATCHER** - A bird was reported without details by Jerry and Marie Amerson on 6 Oct. from the Ocmulgee National Monument in Macon.

**WESTERN KINGBIRD** - Two reports received were a little more than usual. One was near Lake Tobesofkee near Macon on 17 Oct. (Ken and Arlene Clark) and the other was on Jekyll Island on 20 Oct. (Terry Moore *et al.*).

**TREE SWALLOW** - A good Atlanta count was 60+ at SCSP on 11 Oct. according to Paul Raney.

**BANK SWALLOW** - Many observers saw the species in good numbers this fall. Ty Ivey mentioned 200-300 at MIA on 30 Aug., Paul Raney had 200+ along the Chattahoochee River in Atlanta on 31 Aug., Patrick Brisse and Hugh Garrett had 50 for a week at CCWTP starting 30 Aug. In Augusta large numbers bypassed the area, but one bird off the levee on 25 Oct. could be the latest record for the state according to Anne Waters.

**CLIFF SWALLOW** - A few were noted in Atlanta and Macon along with the Bank Swallows mentioned above. Elsewhere singles were noted on 1 Sept. at Callaway Gardens (Bob and Dorothy Potts) and along the Augusta levee (Anne Waters) on 16 Sept.

**BARN SWALLOW** - Paul Raney noted 3 late birds at Lake Seminole in southwest Georgia on 2 Nov.



FISH CROW - A few birds remained through the period at Morgan Falls landfill in north Atlanta according to Paul Raney. This is surprising for a species that has just recently been accepted on the Atlanta list. Now some individuals spend most of the year in that area.

RED-BREASTED NUTHATCH - This winter will probably not be an invasion year as only 1 sighting was received for this fall. Two birds were seen near Commerce on 16 Nov. (Patrick Brisse, Hugh Garrett and Terry Moore).

BLUE-GRAY GNATCATCHER - Inland the species is occasional in late fall and winter but a group of 5 on 27 Nov. by Anne Waters at MBBT seemed unusual. A late bird was also near Griffin on 29 Nov. (Patrick Brisse and Hugh Garrett).

VEERY - Ken and Arlene Clark noted an early bird near Lake Tobesofkee near Macon on 31 Aug.

GRAY-CHEEKED THRUSH - A bird was seen near Macon on 6 Oct. (Jerry and Marie Amerson), another was in Dalton on 16 Oct. (Ken and Arlene Clark) and four individuals were seen in Atlanta from 15 Sept. through 7 Oct. (*vide* Terry Moore).

SOLITARY VIREO - Early birds were sighted by Paul Raney on 20 and 31 Aug. along the Chattahoochee River in north Atlanta. Although the species nests regularly just north of Atlanta, these are early dates for the area.

PHILADELPHIA VIREO - Only 4 records were received, all from the Atlanta area from 14 Sept. through 5 Oct. (*vide* Terry Moore).

BREWSTER'S WARBLER - Patrick Brisse reported this hybrid near CCWTP on 30 Aug. on 3 Aug. according to Terry Moore.

CHESTNUT-SIDED WARBLER - An early bird was already back in north Fulton County on 3 Aug. according to Terry Moore.

PALM WARBLER - Over 1000 were banded on Jekyll Island during Oct. (*vide* Terry Moore).

BAY-BREASTED WARBLER - Terry Moore noted the absence of this generally most common late migrant during the migration walks in Atlanta.

CERULEAN WARBLER - The species is still following the Atlanta path as Terry Moore received 12 reports from 3 Aug. through 6 Sept. (many observers).

WILSON'S WARBLER - Terry Moore received 5 reports in the Atlanta area from 31 Aug. through 21 Sept. Does anyone else find the species around Georgia anymore?

SCARLET TANAGER - A bird sighted by Terry and Peggy Moore on 2 Nov. in north Fulton County provided the state with probably its first Nov. record.

PAINTED BUNTING - Anne Waters reported a late bird from the Augusta area on 27 Sept. and 15 Oct.

DICKCISSEL - A bird was banded on Jekyll Island on 16 Oct. (*vide* Terry Moore).

HENSLOW'S SPARROW - Worth mentioning was a bird banded on Jekyll Island on 16 Oct. (*vide* Terry Moore). This was the first one ever banded by the banding station in its 10 years of operation.

HARRIS' SPARROW - Joe Greenberg found one near Rome on 21 Nov. for one of the few records for the state in the last 10 years.

LAPLAND LONGSPUR - John Paget saw a bird on some flats around Lake Lanier on 19-20 Nov. This species is definitely not that easy to locate in the state.

Patrick Brisse, 4960 Gatehouse Way, Stone Mountain, Georgia 30088.

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