Extinction, Extirpation, and Range Reduction of Breeding Birds in North Carolina: What Can be Learned?

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Despite current conservation concerns for our native avifauna, relatively few species that are known to have nested in North Carolina within the historic period have become extinct, extirpated, or reduced in overall distribution. Considering the extensive logging that occurred in all parts of the state prior to this century, and subsequent changes in land use, it is surprising that more of our breeding fauna was not lost. Actually, the state's breeding fauna has increased in diversity, and many species have expanded their distribution considerably in the last century. Based on a current breeding fauna of approximately 200 species, we have had a 45% increase in avifaunal diversity and less than a 6% reduction in breeding species or their distributions during the past 100 years (North Carolina State Museum [NCSM] files, this study). Of the twelve species discussed here, the majority exhibit distributional changes that have been as much a result of the dramatic nature of the birds themselves in response to changing conditions as it has to negative effects of human alteration of landscapes. This is not to say that current major conservation issues are unimportant or that the increased faunal assemblage is adequate repayment for species lost. Nonetheless, what is interesting is that our original indigenous avifauna has remained relatively intact despite what we have done to the natural landscape. Not only has the original fauna itself remained mostly unchanged, but few species (<6% of the cumulative total) even show a decline in overall breeding distribution within the state.

This paper reviews faunal losses and range reductions of breeding birds on both specific and subspecific levels and briefly discusses the causes for those declines. The species addressed are a combination of extinctions, widespread range reductions, and regional range contractions. Interpretation of events is complicated by corresponding prior breeding range expansion in some of these same species. Rarity *per se* is not discussed. The focus is only on negative distributional changes for avian species within the historic period in North Carolina. For discussions of rare and endangered species in the state see Lee and Parnell (1990). Maps denote historic and current ranges. Cut-off dates for

current *vs.* historic vary (1970 to 1985) to allow some latitude in illustrating distribution changes.

Common Merganser (*Mergus merganser*)

The Common Merganser breeds throughout the forested boreal Holarctic. In eastern North America it presently nests only sporadically south of New England. Brimley (1941) reported the species as nesting in Chowan County, N.C., in 1938. Kiff (1989) reviewed historical information, obtained unpublished museum egg data, and concluded that the species historically nested throughout much of the southeastern United States. He mentioned records from western Pennsylvania, West Virginia, Virginia, and Tennessee, and he cited a report from Audubon of nesting in Kentucky. Thus, it appears that nesting in the South was formerly widespread and that the local decline of these birds corresponds with the time beavers (*Castor canadensis*) disappeared from the region. Common Mergansers also experienced a breeding range contraction in Europe in this same general time period.

Black Rail (*Laterallus jamaicensis jamaicensis*)

As a breeding species, these small rails now appear to be confined to salt marshes in the state's coastal counties. In the late 1800s and early part of this century they were reported from a number of inland freshwater marshes and meadows (Fig 1). Pearson *et al.* (1942), in addition to the coastal sites, reported them from Wake County (Walnut Creek; eggs and chicks, 1890 to 1902), Guilford County (near Jamestown; eggs, 1893), and Iredell County (Statesville; pre-1897). Smithwick (1897) reported eggs taken at Statesville and Asheville. The latter is certainly the same as the 1887 Weaverville egg record of Carins. Oberholser (1905) noted breeding Black Rails as rare in middle and western sections of North Carolina and was unaware that the species nested in coastal areas. (Many of Smithwick's [1897] and Oberholser's [1905] statements are based on the works of John Carins. I have simply chosen to cite the more recent and thereby presumably more complete records.) The wet meadows where these rails occurred in Wake County, and probably those elsewhere, were cut annually for hay. Thus, at inland sites the rails probably were not nesting in natural plant communities, although it is possible that prior to the late 1800s abandoned beaver ponds provided suitable inland habitat. With the change from horse-powered equipment to tractors, most wetlands being used for agricultural purposes were drained because tractors did not work well in wet soils. Today there is no way to determine whether the open wet grassy areas that existed in the state under natural regimes formerly supported Black Rails. In 1959 and 1961 there were a few reports of breeding, or suggested breeding, in the northwest part of the state (Chat 23:87, 25:45). No subsequent reports have

been published. There is also a report from Polk County in 1990 (Chat 54:44), but the April date suggests the bird was a migrant. It appears that currently these rails do not use wetlands of the Piedmont and Blue Ridge province. A lot of effort has gone into the search for Bog Turtles (*Clemmys muhlenbergii*) in North Carolina and elsewhere in the Southeast (Tryon and Herman 1990). Although the small, isolated wetlands in the Piedmont and mountains used by these turtles seem superficially acceptable to Black Rails, none have been detected. It appears that Black Rails expanded their breeding distribution into inland sites as a result of post-Civil War agricultural practices and disappeared from those sites when agricultural practices changed.

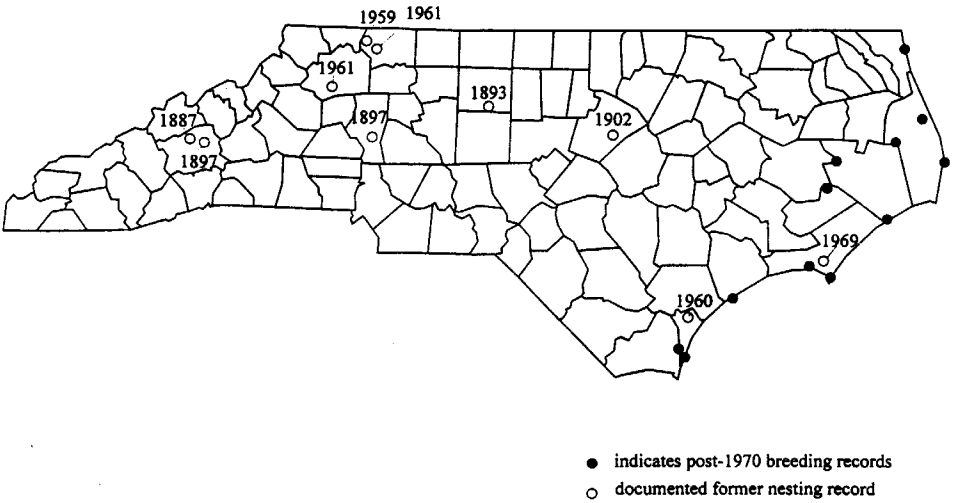

Fig 1: Historic and current breeding distribution of the Black Rail in North Carolina

Peregrine Falcon (*Falco peregrinus anatum*)

Breeding populations of Peregrine Falcons are believed to have been extirpated from the eastern United States by 1964. Most authorities state that they were never a common breeder in the southeastern states, yet Brewster (1886) reported that "Nearly every suitable cliff on the higher mountains (western North Carolina) was occupied by a pair of these noisy Falcons." Berger *et al.* (1969) drove more than 13,000 miles in 1964 checking 133 known nesting sites in the eastern United States and failed to locate a single active nest. In North Carolina four of the eight known nest sites were inactive by 1940, and the last active nest in the state was reported in 1957 (Hickey 1969). Records compiled by the N.C. Wildlife Resources Commission indicated a total of ten

active eyries in the state between 1887 and 1957 (Chris McGraft pers. com.). The species was reported to breed at Devil's Courthouse (*ca.* 1957) and Looking Glass Rock (1954), Transylvania County; Grandfather Mountain (1930), Avery/Caldwell/Watauga counties; Linville Gorge (1951), Burke County; Whiteside Mountain (1934), Jackson County; Brinegar's Cabin (1953-54), Wilkes County; Mount Mitchell (1894), Yancey County; Roan Mountain (1934), Mitchell County; Jump Off (1932), Swain County; and Pilot Mountain (1892), Surry County. Four additional breeding-season records exist for the state. Pearson *et al.* (1942, *in* 1958 edition) reported breeding season birds at Blowing Rock, Watauga County; Craggy Pinnacle, Burke County; Ronda, Wilkes County; and Highlands, Macon County. The Highlands report was verified through another source by Ganier (1934). The species continued to be reported during the breeding season in western North Carolina through the mid-1970s, but no nests was ever located. Historic eyries and sites of breeding season occurrence are shown in Fig. 2.

Releases of captive-bred young Peregrine Falcons into the Southeast were started in the 1980s. The first birds were released in North Carolina in 1984, and hacking of captive-bred Peregrine chicks continued though the late 1990s. Successful breeding pairs have become established at several of sites in the Blue Ridge Province. Unfortunately, the indigenous subspecies was not initially used for the release, and the founding stock comprised intergrades of various races. The program has been successful, and the species was proposed for removal from the federal endangered species list in 1998. The native race, however, has been regionally extirpated from the wild.

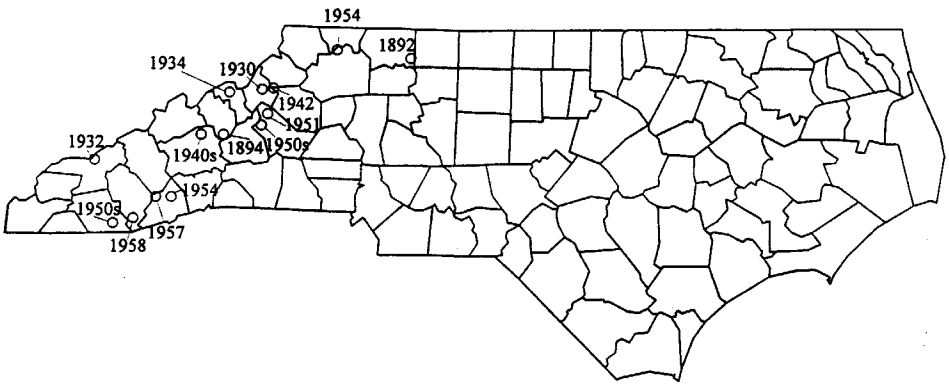

Fig 2: Historic breeding sites for the Peregrine Falcon in North Carolina. Dates are the last recorded occurrence of indigenous populations.

Carolina Parakeet (*Conuropsis carolinensis corolinensis*)

There are few published records of this species in North Carolina to document the distribution and breeding status prior to the bird's extinction. McKinley (1979) compiled the historic literature pertaining to the Carolina Parakeet in North Carolina. There are no reports from outside the Coastal Plain, and the last mention of the species in the state was in 1782 (Fig. 3). However, the Carolina Parakeet still occurred elsewhere in the region in the mid 1800s (*i.e.*, Maryland on the Potomac River in 1866 and South Carolina, perhaps through the 1930s; Lee 1984 and discussion in McKinley 1979). North Carolina reports include Roanoke Island, Dare County, 1588 (Hariot 1588), the lower Cape Fear River (below Fayetteville, probably Bladen County area), 1664, Capt. William Hilton (Salley 1911); 1709, no specific locality (Lawson [1709] 1967): Brunswick/New Hanover County, 1730, Hugh Meredith (1922); Edenton, Chowan County, plate in a 1737 edition of John Brickell's *The Natural History of North Carolina* [1737] (1911); and Council, Bladen County, 1761-1765 and 1770-1772 (implied, Bartram 1791). William Bartram's journal refers to North Carolina, "where they are very numerous." Catesby reports Carolina Parakeets from 1731 in North Carolina, with no specific locality (*in* Smithwick 1879). Colonel William Byrd (1929) mentioned that "paraqueets" frequently raided fruit trees in the fall in North Carolina, but he did not provide any specific localities. Accounts of Meredith and others refer to occurrence in the summer and fall, suggesting the species may have been partly migratory in the northern portion of its range. The species is reported as lost as a result of excessive hunting, but deforestation must have also been a factor.

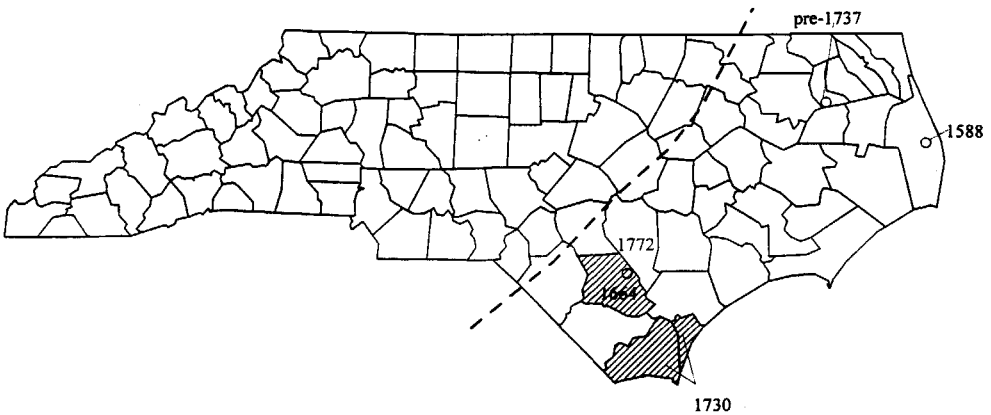

Fig 3: Historical distribution of the Carolina Parakeet in North Carolina

— — - Dashed line indicates assumed limits of distribution

Ivory-billed Woodpecker (*Campephilus principalis principalis*)

This large woodpecker is believed to be extinct on the North American continent. The last reliable reports are from central Florida in the late 1960s (Agey and Heinzman 1971). Another race endemic to Cuba is still extant but highly endangered. Tanner (1942) reviewed the biology and distribution of these woodpeckers and, in the absence of specimens, recognized only a single record for North Carolina. It is of three specimens collected by Wilson near Wilmington in 1809 (Wilson 1811). The specimens are no longer extant. Coues and Yarrow (1871 *in* Smithwick 1897) refer to reports from near Fort Macon, North Carolina. These reports are not based on specimens, and no specific information was provided. Based on the distribution of local plant communities on the outer coastal plain of the state, it seems highly probable that the species was not limited to just the Wilmington area in former times. Hasbrouck (1891) considered the Fort Macon report to be the northernmost site of occurrence (Fig. 4), whereas, Audubon (1838-1843) stated that the species ranged as far north as southern Maryland (never confirmed). The Ivory-billed Woodpecker is one of the few historically occurring bird species that probably was in decline in the pre-Columbian period. Native Americans prized the bills, which were used for trade. Contrary to most recent accounts, this bird was historically a resident of open mature pine forest in the Southeast (Allen and Kellogg 1937),

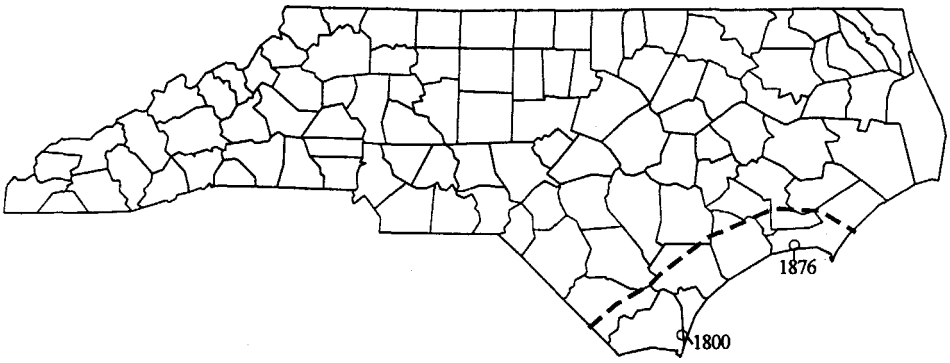

Fig 4: Historic distribution of the Ivory-billed Woodpecker

- - - Dashed line indicates suggested limits of breeding range

and swamp forests (see Tanner 1942) were probably only peripheral habitats. Reliance on mature trees and a need for large tracts of forests resulted in disappearance of the species. From the 1940s through the 1970s there were occasional reports of sightings of this species in eastern North Carolina (NCSM records). There is no way to evaluate the reliability of those reports, and at this point no purpose is served in trying to validate or refute them.

Red-cockaded Woodpecker (*Picoides borealis borealis*)

There has been a general reduction of Red-cockaded Woodpecker colonies throughout the range of this endangered species (Federal Register 16047, 13 Oct. 1970). The same is true in North Carolina along the western and northern limits of the bird's distribution in the state. The recent loss of colonies is pronounced to the extent that, based on the distribution mapped by Walters and Carter *in* Lee and Parnell (1990), the overall historic geographic range has declined by as much as perhaps 25%. To what degree this loss represents recently colonized areas is unclear. Lumbering and loss of cotton crops to boll weevils resulted in pines reclaiming land that in pre-colonial times was hardwoods. As those pine woods matured, they were colonized by Red-cockaded Woodpeckers, resulting in some degree of local range expansion. By the 1970s many of these same areas were reverting back to hardwoods. This scenario is certainly typical for the central and northern Piedmont, but how this relates to the northern Coastal Plain is unclear. Historic accounts provide no information to define the earliest limits of the geographic distribution of the Red-cockaded Woodpecker in the state.

Common Ground-Dove (*Columbina passerina passerina*)

In the early 1900s breeding ground-doves were unknown from North Carolina. In the 1930s two pairs were found in New Hanover County, but nesting was not confirmed (Carolina Beach 1930; Fort Fisher [Burleigh 1937]). Thus it seems likely that this dove had only recently expanded its breeding range into North Carolina in the 1930s. By the mid-1970s the species nested along the coast at least as far north as Topsail Island. It was known to breed in Brunswick, New Hanover, and Pender counties of N.C. and was reported as a summer resident as far north as Carteret County (NCSM records, Potter *et al.* 1980; Fig. 5). In the early 1980s the species underwent a sharp local decline. During the museum's Breeding Bird Atlas program (1988 -1992), no breeding records were obtained in the state. While individuals still wander northward during the post-breeding season, there no longer appears to be any indication of nesting in the state. Extensive commercial and residential development of barrier islands along the southeastern coast of North Carolina seems unlikely to be the primary cause of decline. Common Ground-Doves regularly nest in

yards and feed on lawns. Furthermore, stretches of undeveloped barrier islands continue to provide suitable habitat. Feral and outdoor house cats are believed to be a major problem for this species in developed coastal areas.

The expansion of the Common Ground-Dove into North Carolina in the 1930s appears to be its second documented invasion of the state. The species was apparently absent throughout much of the 1800s. Coues (1871) did not record it from Fort Macon, and Atkinson (1887) did not include it in his catalogue of the birds of North Carolina. Smithwick (1897) reported a late 1800s nesting record from Davidson County. The record, which was supported with eggs, was not referred to by subsequent authors. Those eggs, combined with records from this same period from the mountains (*i.e.*, Cairns, 29 May 1881, and another shot some years previously; *in* Oberholser 1905), suggest the species was for a time a widespread, but uncommon, breeding bird in North Carolina.

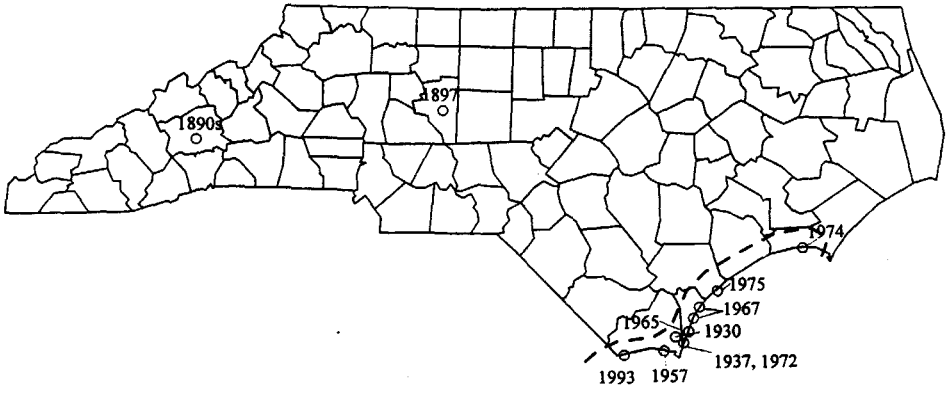

Fig 5: Former breeding distribution of the Ground Dove in North Carolina

— — — Dashed line indicates limits of breeding range in this century

Olive-sided Flycatcher (*Contopus borealis*)

This boreal flycatcher is an uncommon migrant in North Carolina. It nests in the mountains primarily above 3,500 feet (Fig. 6). In the Great Smoky Mountains National Park, it is still found sparingly as a breeding bird. There are nesting reports from as recently as 1998 from the park (T. Simons pers. comm.). Prior to the 1930s it was more common and widespread in the Southern Appalachians, and even as recently as the 1960s Stupka (1963) considered it "by no means a rare breeder." Its late northern migration (19 April

to 7 June) and early fall migration (as early as 11 August) present difficulties in identifying nesting areas with certainty. Olive-sided Flycatchers are present on territory from at least 13 May to 30 June, and three young begging food were seen at North Wilkesboro as late as 12 September (Chat 33:28). The species was formerly reported breeding at Black Mountain, Highlands, Great Craggy Mountain, Roan Mountain, North Wilkesboro, and in the southeastern corner of Macon County. It has been found in the breeding season in Joyce Kilmer Memorial Forest and on Grandfather Mountain (Lee 1997, Lee 1985) and Linville Gorge (LeGrand *in* Lee and Parnell 1990), but nesting was not established. Thus, this species has disappeared from most of the southern portion of its range, and the few nesting pairs remaining in the Great Smoky Mountains National Park are now disjunct by several hundred miles from extant populations to the north.

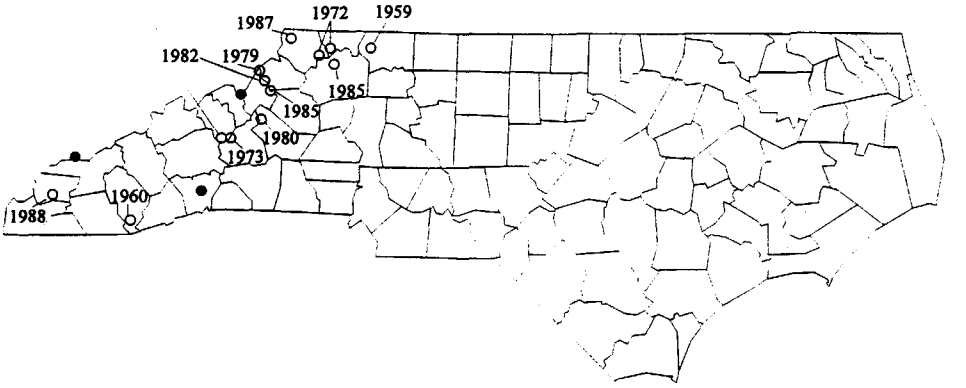

Fig 6: Former and current breeding season reports of the Olive-sided Flycatcher in North Carolina

Black-capped Chickadee (*Poecile atricapillus practicus*)

This race is an Appalachian endemic. Populations in the Southern Appalachians are small, isolated relicts restricted to high-elevation "islands" mostly above 4,500 feet (Fig 7). The species was extirpated from the Black Mountains by the 1930s as a result of extensive logging (Tanner 1952; specimen NCSM 3294). Despite the regrowth of the forest and proximal extant populations, this mountain range has not been recolonized. Jefferies and Jefferies (1889) collected a specimen in second-growth oaks and scattered pines "a little below Sylva" (below ca. 2,000 feet) on 15 May 1888, indicating the

species was not always restricted to high elevations. South of central Virginia and West Virginia the species is now restricted to high-elevation areas on Mt. Rogers in Virginia, the Plott Balsams, and the Great Smoky Mountains National Park. Black-capped Chickadees possibly occur on Grandfather Mountain (Lee *et. al.* 1985) and Beech Gap (Haywood County; NCSM specimens), but genetic identity of individuals at those sites needs to be established (see discussion in Lee and Browning *ms*). It has been reported by Johnston (1971) to hybridize with Carolina Chickadees (*P. carolinensis*) in Virginia. There are management problems facing the extant populations (Lee and Browning in *ms*).

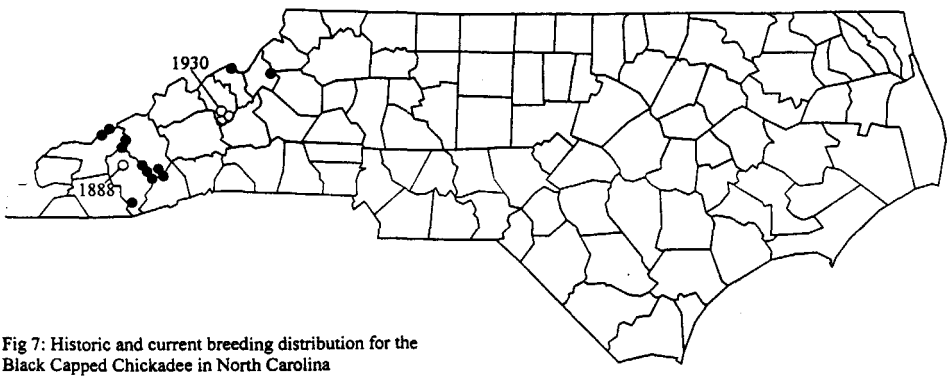

Fig 7: Historic and current breeding distribution for the Black Capped Chickadee in North Carolina

● = Current

○ = Historic

Bewick's Wren (*Thryomanes bewickii altus*)

The endemic Appalachian race of the Bewick's Wren is believed to be extinct. The last documented reports of breeding are from western Maryland (Robbins and Boon 1984) and West Virginia (Hall 1983), where it was last detected in the early 1980s. At one time Bewick's Wrens were very common in western North Carolina, nesting to the tops of the highest peaks (Oberholster 1905). Brewster (1886) considered it to be one of the most abundant birds in western North Carolina, nesting in nearly every out-building in Asheville. Ganier (1933) described it as very common in Tennessee. The species apparently expanded its range within the historical period and also occurred at scattered locations in the Piedmont of Virginia, North Carolina (Fig 8), South Carolina, and Georgia (Lee and Browning in *ms*). In the 1930s the range began

to contract, and the last documentation of birds on breeding territory in the Southeast was in 1971 on the Blue Ridge Parkway near Mt. Pisgah, N.C. (Chat 35:115, 47:110). Several subsequent reports were less well documented (*i.e.*, Chat 45:106). Simpson (1978) reviewed the history of this wren in North Carolina and discussed ecological factors possibly contributing to its decline.

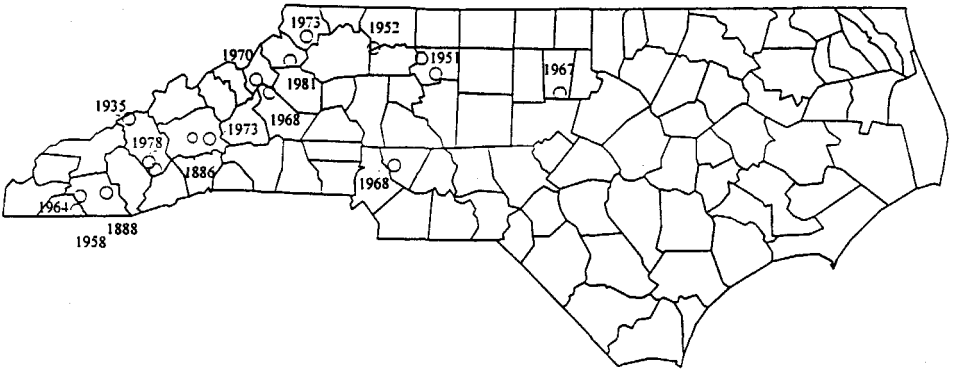

Fig 8: Historical breeding distribution and breeding season reports of the Bewick's Wren in North Carolina

Bachman's Sparrow (*Aimophila aestivalis bachmani*)

As a result of lumbering during the late 1800s and early 1900s, Bachman's Sparrows made a rapid northward range expansion into Kentucky, Tennessee, southern Ohio, and southwestern Pennsylvania (Weston 1968). Habitats occupied included shrub thickets and old fields, and once at an elevation of 3,000 feet in the spruce/fir zone of West Virginia (Weston 1968). The species was absent from these areas for most of the 1800s. For example, even by the late 1800s Atkinson (1887) considered this species to be only a rare summer visitor to North Carolina, but he was probably unaware of southeastern Coastal Plain populations, which were almost certainly present in this period. In the 1890s this sparrow was reported as a breeding species in Buncombe, Guilford, Orange, and Wake counties (Smithwick 1897). Carter and Walters (*in* Lee and Parnell 1990) mapped the known breeding localities for this species in North Carolina. Today the range has contracted to that of former times. Bachman's Sparrows are mostly confined to fire-maintained wiregrass (*Aristida stricta*) savannas in longleaf pine (*Pinus palustra*) forests in the southeastern and south

central portions of North Carolina. The sparrow is now rare or absent from the northern Coastal Plain, and it is rare and declining in the Piedmont.

Vesper Sparrow (*Pooecetes gramineus*)

Vesper Sparrows are currently rare breeding residents at scattered sites in the Blue Ridge Province of North Carolina. Their local ancestral distribution was relict and peripheral and probably restricted to grassy balds and other natural successional openings in high- and mid-elevation areas of the mountains. In the 1970s it bred southward at least to Buncombe and Haywood counties (Potter *et al.* 1980) and southern Jackson County (Chat 39:98). Smithwick (1897) reported breeding birds as far east as Greensboro (1 June 1893). There are former breeding records from near Asheville, Blowing Rock, Transylvania County (Oberholser 1905), Rocky Mount (Pearson *et al.* 1942) and Wilmington (Potter *et al.* 1980). See Fig. 9. This species nests in pastures and in cultivated and abandoned fields. It apparently expanded its distribution eastward into the Piedmont and Coastal Plain as a result of agricultural practices around 1900. Its distribution within the state appears to have reverted to its ancestral one.

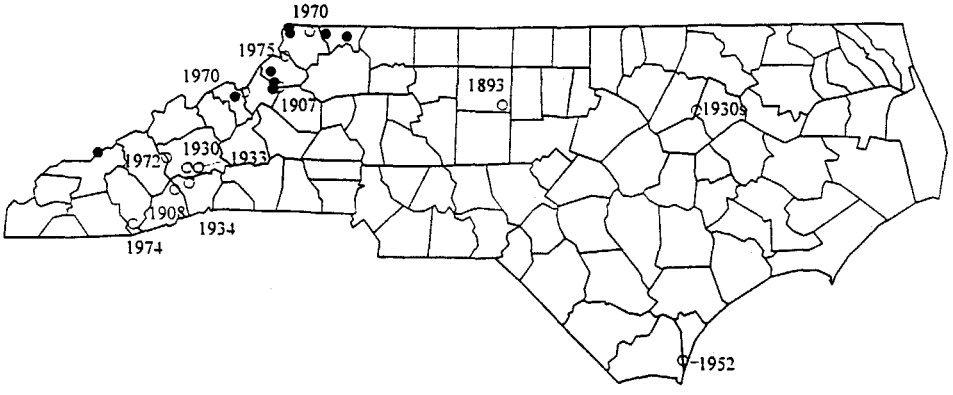

Fig 9: Historic and current breeding distribution of the Vesper Sparrow in North Carolina

● indicates a breeding record post-1980

○ documented former nesting record

Other Species

Other species could be included in this list, but their total geographic area of decline was small, or their period of expanded occupancy was brief. They typically represented peripheral distributions within the state: *i.e.*, inland

heronries and several inland site-specific reports of breeding rails. The Roseate Tern (*Sterna dougallii*) has been reported as nesting twice in North Carolina (Soots and Parnell 1974 and Lee and Parnell 1990), but nesting colonies were never established.

Chuck-will's-widows (*Caprimulgus carolinensis*) are being replaced by Whip-poor-wills (*C. vociferus*) in some Coastal Plain areas, and Painted Buntings (*Passerina ciris*) have had a minor decline in distribution from their previously northern-most breeding sites.

The Loggerhead Shrike (*Lanius ludovicianus*), which was not discussed in this study, has also undergone a modification of its range. In the late 1800s it was considered to be only a rare winter visitor (Atkinson 1887). As a breeding species it invaded the state around 1900, remaining uncommon and restricted in overall distribution in North Carolina in the early part of the century. As its overall geographic breeding distribution gradually increased, its center of distribution within the state shifted to the south and west. Its current distribution and abundance is largely a result of land use, and, excluding the Sandhills region, is not an artifact of natural community structure.

Bachman's Warblers (*Vermivora bachmani*) were known from the state during what should have been their breeding season (Brimley 1891), but there is no evidence they ever nested here. The loss of migrant species and winter residents, while not a topic of this study, is even more limited than the loss of the breeding fauna.

Discussion

Populations and species distributions are constantly shifting as birds respond to natural and man-made environmental change. The question is whether these changes are occurring at alarming rates that will become irreversible. This question applies equally to both range contractions and expansions, though most concerns have been of the former. The present paper treats only losses. However, in many cases the range expansions are affecting original indigenous breeding populations. Ultimately, the two issues must be addressed simultaneously.

Despite growing conservation concerns for our indigenous avifauna, very few birds have disappeared as breeding species from the state (<3 %), and for ones still occurring in the state, few have exhibited significant reductions in their overall area of geographic occurrence (<2.5 %). Several are high-profile species (Ivory-billed Woodpecker, Carolina Parakeet, and Peregrine Falcon), and some of the others have become high-profile birds because of their rarity, recent decline, or endangered status.

It is difficult to characterize these birds as a group. Seven to eight of the twelve species discussed have or had populations that are peripheral to their

current centers of distribution. Breeding Common Mergansers, Olive-sided Flycatchers, Black-capped Chickadee and Vesper Sparrows are peripheral, but their occurrence in North Carolina represents relicts of Pleistocene events. For only three of the species discussed (Carolina Parakeet, Red-cockaded Woodpecker and the Appalachian race of the Bewick's Wren) has North Carolina historically been an important component of the bird's total natural range.

Distributional changes did not occur just within the political boundaries of North Carolina. Most of the extant species discussed here have shown similar reductions in range in other mid-Atlantic and southeastern states. In many cases the range reductions in other states in the region were more extreme than those shown in North Carolina (*i.e.*, Vesper Sparrow in Maryland; Robbins and Blom 1996).

One bird species and two subspecies discussed here are extinct or considered to be extinct. The extinct species is the Carolina Parakeet. The two extinct subspecies discussed here are the North American race of the Ivory-billed Woodpecker (*Campephilus principalis principalis*) and the Appalachian race of the Bewick's Wren (*Thryomanes bewickii altus*). Thus, approximately 2.5% of the state's former breeding bird fauna is extinct. One extant species of the birds discussed here, the Red-cockaded Woodpecker, is listed as endangered by the US Fish and Wildlife Service. The Black-capped Chickadee is represented by a regionally endemic subspecies.

None of the species discussed here are range limited: All are, or were, wide-ranging on both specific and subspecific levels. The merganser and falcon have Holarctic distributions. The dove ranges through the southern United States, the West Indies, and into South America. The flycatcher, chickadee, wren, and Vesper Sparrow range throughout much of temperate North America. The parakeet, both woodpeckers, and Bachman's Sparrow occurred throughout most of the southeastern United States and lower Mississippi basin. The Black Rail is primarily a species of the eastern seaboard, but it also nests in the north-central states.

The reasons for decline are varied. There is no common theme to the range reductions or disappearance of these birds from North Carolina, other than most appear to be related to man's activities. The species themselves represent a variety of orders and families and share no common geographical distributional patterns. Four species are southeastern, two are boreal, one occurs throughout most of the United States, and two have global distributions extending well outside of North America. These birds do not share similar habitat requirements, and all have distinctive ecological roles and occupy a variety of trophic levels. The species discussed include sedentary species, short range migrants, and neo-tropical migrants.

Much of the change in bird distributions during the last century results from the dynamic nature of the birds themselves. Five to seven of the species discussed here actually expanded their distributions within the state as a result of past land-use practices, only later to retract to ancestral distributions when the man-induced factors causing landscape change were no longer in place. Pioneering in birds is a well established behavior, and it is natural that many of the pioneering species are inevitability unsuccessful. Black Rails benefitted from the creation of mowed wet meadows used for hay harvest and disappeared from the interior portions of the state when this practice became outdated. Four other species apparently expanded their range into or within North Carolina within historic times and contracted back to ancestral distributions (Common Ground-Dove, Red-cockaded Woodpecker, Bachman's Sparrow, and Vesper Sparrow). The ground-dove had previously expanded its range into the state in the 1880s as well. The reasons for both the expansion and contraction of the ground-dove in North Carolina are unclear. The Red-cockaded Woodpecker benefitted from an emerging successional Loblolly Pine (*Pinus taeda*) forest that grew up in the Piedmont on abandoned farms after continual failure of cotton crops resulting from boll weevil damage. The wide-scale abandonment of farm land in the early part of this century resulted in pine forests that were maturing in the 1970s. Those forests are now being succeeded by hardwood forests, while much of the Piedmont is also undergoing rapid development. Both factors were detrimental to the expanded ranges of Red-cockaded Woodpeckers and Bachman's Sparrows. Additionally the Appalachian Bewick's Wren rapidly expanded its distribution throughout the mountains and well into the Piedmont as a result of land clearing for small farms, only later to be eliminated partly through competitive exclusion by the House Wren (*Troglodytes aedon*). The House Wren, a species that formerly did not occur in North Carolina as a breeding species (*e.g.*, Smithwick 1897), or occurred only rarely, was ultimately more successful in exploiting developed landscapes. The House Wren invasion, however, does not explain the loss of Bewick's Wrens from its primoral habitat.

While man-induced habitat change, mainly from logging, resulted in the expansion of some species, it caused the decline of the Ivory-billed Woodpecker, Olive-sided Flycatcher, and Black-capped Chickadee. An 1888 report of Jeffries and Jeffries (1889) suggests that the Black-capped Chickadee may not have been as dependent on high elevation habitats in the past as it is today. Logging of mature forests and the suppression of fire from fire dependent plant communities resulted in the decline of the Red-cockaded Woodpecker and Bachman's Sparrow, but for the contractions of distribution discussed here, the decline is more a result of the unstable nature of man-induced communities on the Piedmont. Pesticides, collecting birds for falconry,

and in earlier times the removal of eggs by collectors from established eyries were, in part, responsible for the decline of the Peregrine Falcon in eastern North America, while hunting and pest control resulted in the disappearance of the parakeet.

The timing of historical extinctions and range retractions of breeding birds in North Carolina is protracted, and there seems to be no single time period that accounts for the declines. The last report of a Carolina Parakeet was in 1782, but based on other reports from the Southeast, it is possible that the species survived in North Carolina through the mid-1800s. The last known credible reports of Ivory-billed Woodpeckers were from the 1800s, although it is possible that the species persisted in the southeastern portion of the state into the 1900s. The last known nesting of the indigenous eastern race of the Peregrine Falcon was in 1957, and the Appalachian race of the Bewick's Wren was last reported as breeding in North Carolina in 1971. All of the other species discussed here (except the Common Merganser and Common Ground-Dove) still breed in the state, and some currently occupy much of their ancestral range.

Extinction and local disappearance of native species is something that should be viewed with concern. When carried to extreme, we are left only with the monotonous uniformity of a few hardy, adaptable species. Yet, in some areas faunal assemblages have been shown to be stable for at least a half-century (Haney *et al.* 1998). Furthermore, local avian diversity is actually increasing in North Carolina. Today, North Carolina has a breeding avifauna which is approximately 45% richer (expansions into and within the state) than what was believed to be here in the pre-colonial period. Still, who would think that the addition of cowbirds, grackles, House Finches, and other ubiquitous species to the state's fauna, or the expansion of various species of swallows throughout North Carolina, is adequate repayment for the loss of Ivory-billed Woodpeckers and Carolina Parakeets?

The popularity of the term biodiversity is in many ways unfortunate in that most people are only aware of the portion of the concept dealing with documentation of large species assemblages. Consequently, many conclude through the logic of simple arithmetic that three is better than two or that 208 (approximate current number of breeding species recorded for North Carolina) is better than 159 (approximate number of historically reported indigenous breeding species). Along similar lines the ranking of species by assigned relative importance within an area (*e.g.*, the Blue Ridge, or the state of North Carolina) and the totaling of the rankings of specific faunas to document important faunal assemblages (*e.g.*, Partners in Flight ranking scores) can give high marks to areas and habitats that have become infested with immigrant species. In fact in some cases, because rankings are done on regional levels, new arrivals have been assigned numerical values which are as high as those

of the original indigenous species. Such may be faunal assemblages worthy of management, but seldom do they reflect the composition of the historical avifauna.

Some of the faunal elements discussed here can never be restored, and for others restoration may be impractical or unwise. The concept of managing for primoral faunal assemblages is unrealistic even if we could know what those assemblages were. This is not a simple exercise in assimilating pre-colonial lumbering landscapes. Prior to European contact, eastern North America had been drastically modified by native Americans during a 12-15,000-year occupancy of the continent. What time period would one use as a base line for management?

Long-range conservation strategies cannot continue to be reactive. The real test is our ability to promote wise conservation and management of avian resources, to learn from the failures of our ancestors, and to separate -- to whatever degree possible -- man-induced change from natural fluctuations of geographic limits. From past lessons we can hope to learn how to sort problems that are influencing populations and how to maintain a balanced historical perspective and commonsense approach to management of current faunas. When choices are available most would favor management in the direction of primordial faunas at the expense of ones which are invasive and diverse. While this seems aesthetically desirable, it is the most difficult option and a route not likely to be often taken.

All this being said it is informative to note that even under the worst case (*i.e.*, inclusion of a number of species in this report which should only marginally be considered as losses or range reductions of breeding fauna), the breeding birds of North Carolina remain for the most part resilient to human activity.

Acknowledgments

I thank Chuck Hunter, Eloise Potter, and Herb Hendrickson for comments on my original draft of this manuscript. Becky Browning prepared the maps. Chris McGrath supplied information on historical Peregrine Falcon nesting sites.

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