

2012

The Virginia Avian Heritage Project: A report to summarize the Virginia Avian Heritage Database

M. D. Wilson

The Center for Conservation Biology

B. D. Watts

The Center for Conservation Biology, bdwatt@wm.edu

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Wilson, M. D. and B. D. Watts. 2012. The Virginia Avian Heritage Project: A report to summarize the Virginia Avian Heritage Database. CCBTR-12-04. Center for Conservation Biology Technical Report Series. College of William and Mary and Virginia Commonwealth University, Williamsburg, VA. 48 pp.

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A report to summarize the Virginia Avian Heritage Database**

Prepared by:

The Center for Conservation Biology
College of William and Mary & Virginia Commonwealth University
Williamsburg, VA

This project was made possible by funds provided by the State
Wildlife Grants Program through the Virginia Department of Game and
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A report to summarize the Virginia Avian Heritage Database**

**Michael D. Wilson
&
Bryan D. Watts**

**The Center for Conservation Biology
College of William and Mary & Virginia Commonwealth University
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The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints.

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Introduction and Project Purpose

Virginia plays a significant role in the life history of many of the bird species in Eastern North America. The diversity of habitats available to birds during the breeding, wintering, and migratory periods combined with its geographic position combine to make it one of the most diverse physiographic regions in North America. Virginia was the site for the first European colonization and since that time has become distinguished as the birthplace of the nation's ornithological history. Because of this, Virginia is the incomparable benefactor of having documentation on three centuries of avifaunal change.

Much of the ornithological information collected during the modern era exists in the form of scientific and popular publications, field diaries of noted ornithologists, museum collections, and unpublished databases. Collectively, these accounts chronicle the recent history of range expansions, population fluctuations, and changes in distribution for a wide range of bird species. Most importantly, this information serves as an invaluable tool for conservation because it provides historical benchmarks to the spatial and temporal patterns of declines for Virginia's imperiled species. For many species, historical data must be reconstructed to differentiate long-term population declines from short-term fluctuations associated with pulses in colonization.

Despite the relative importance of this rich ornithological history, there has never been a comprehensive aggregation of these various archives. The objectives of this project were to begin to assemble the historical and contemporary accounts of Virginia's avifauna into a geographically referenced database and to develop a method to capture new information on imperiled species as it is produced.

Approach:

1. Compile historical and contemporary information on imperiled species through literature review.
2. Create a geo-referenced database on distribution of Virginia's avifauna based on available literature that can display information on distributional changes over appropriate time scales.
3. Produce a summary document that chronicles an historical account of avifaunal change. This includes population fluctuations and distribution changes of selected species over time, estimates of current population sizes, and to compare avifaunal change with historical availability of habitats for species or communities if data permits.

Selecting Species for Investigation

A final pool of 65 species was chosen for investigation (Table 1). Species chosen included a list that prioritized as needing conservation attention and that could benefit from collection information from historical records.

Nearly 8,000 records were reviewed, processed, entered into an annotated database, and mapped into a Geographic Information System. Data collected and summarized into a database included literature citations, dates of observation, geographical locations, and the importance of any record to provide information on habitat use, breeding biology, confirmation levels of breeding evidence (e.g., confirmed, possible, etc), population status and trends, and relevance toward conservation (Appendix I).

The location of any occurrence record was mapped to the same level of detail provided in the literature source. For instance, we digitized many records that included specific locations such as road interactions, or portions of a habitat patch. Many records only provide a county or city name in the original source. For these records, we mapped the location to a county or city centroid that would eventually house all records at the same level of detail.

Table 1. List of species chosen for literature review and mapping occurrences.

Species Habitat Suites	Species Name	State Wildlife Action Plan tier I,II,III,IV, n/a	Season of Concern b = breeding w = winter m = migration
High Elevation			
Red Crossbill	<i>Loxia curvirostra</i>	I	b
Appalachian Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	I	b
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	II	b
Appalachian Winter Wren	<i>Troglodytes hiemalis</i>	II	b
Golden Crowned Kinglet	<i>Regulus satrapa</i>	n/a	b
Red-breasted Nuthatch	<i>Sitta Canadensis</i>	n/a	b
Pine Siskin	<i>Spinus pinus</i>	n/a	b
Dark-eyed Junco	<i>Junco hyemalis</i>	n/a	b
Olive-sided Flycatcher	<i>Contopus cooperi</i>	n/a	b
Swainson's Thrush	<i>Catharus ustulatus</i>	n/a	b
Pine Savanna and Grassland			
Upland Sandpiper	<i>Bartramia longicauda</i>	I	b
Red-cockaded Woodpecker	<i>Picoides borealis</i>	I	b,w
Henslow's Sparrow	<i>Ammodramus henslowii</i>	I	b
Bachman's Sparrow		I	b
Barn Owl	<i>Tyto alba</i>	III	b

Savannah "Ipswich" sparrow	<i>Passerculus sandwichensis</i>	n/a	w
Early Successional/Shrub			
Loggerhead Shrike	<i>Lanius ludovicianus</i>	I	b
Appalachian Bewick's wren	<i>Thryomanes bewickii</i>	I	b,w
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	I	b
Emergent Wetland			
Black rail	<i>Laterallus jamaicensis</i>	I	b,m
Saltmarsh Sparrow	<i>Ammodramus caudacutus</i>	II	b,w
American Bittern	<i>Botaurus lentiginosus</i>	II	b
Least Bittern	<i>Ixobrychus exilis</i>	III	b
Northern harrier	<i>Circus cyaneus</i>	III	b
King Rail	<i>Rallus elegans</i>	II	b
Nelson's Sparrow	<i>Ammodramus nelsoni</i>	III	w
Sedge Wren	<i>Cistothorus platensis</i>	III	b,w
Coastal Plain Swamp Sparrow	<i>Melospiza georgiana</i>	n/a	b
Yellow Rail	<i>Coturnicops noveboracensis</i>	n/a	w
Bay/Barrier Island			
Wilson's plover	<i>Charadrius wilsonia</i>	I	b
Piping plover	<i>Chradrius melodus</i>	I	b
Gull-billed tern	<i>Sterna nilotica</i>	I	b
American Black Duck	<i>Anas rubripes</i>	II	b
Little blue heron	<i>Egretta caerulea</i>	II	b
American oystercatcher	<i>Haematopus palliatus</i>	II	b
Black skimmer	<i>Rynchops niger</i>	II	b
Least tern	<i>Sterna antillarum</i>	II	b
Royal tern	<i>Sterna maxima</i>	II	b
Tricolored Heron	<i>Egretta tricolor</i>	III	b
Yellow-crowned night-heron	<i>Nyctanassa violacea</i>	III	b
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	III	b
Common tern	<i>Sterna hirundo</i>	III	b
Glossy Ibis	<i>Plegadis falcinellus</i>	n/a	b
Cattle Egret	<i>Bubuclcus ibis</i>	n/a	b
Greater Black Backed Gull	<i>Larus marinus</i>	n/a	b
Herring Gull	<i>Larus argentatus</i>	n/a	b
Laughing Gull	<i>Larus atricilla</i>	n/a	b
Caspian Tern	<i>Sterna caspia</i>	n/a	b
Sandwich Tern	<i>Sterna sanvicensis</i>	n/a	b
Forster's Tern	<i>Sterna forsteri</i>	n/a	b
Double-crested cormorant	<i>Phalacrocorax auritus</i>	n/a	b
Brown Pelican	<i>Pelecanus occidentalis</i>	n/a	b
White Ibis	<i>Eudocimus albus</i>	n/a	b
Forested wetland & upland deciduous forest			

Wayne's warbler (Black-throated green)	<i>Setophaga virens</i>	I	b
Swainson's warbler	<i>Limnothlypis swainsonii</i>	II	b
Cerulean warbler	<i>Setophaga cerulea</i>	II	b
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>	n/a	b
Great Blue Heron	<i>Ardea herodias</i>	n/a	b
Great Egret	<i>Ardea alba</i>	n/a	B
Other Species			
Peregrine falcon	<i>Falco peregrinus</i>	I	b
Bald eagle	<i>Haliaeetus leucocephalus</i>	II	b
Purple Sandpiper	<i>Calidris maritima</i>	IV	w

Species Accounts

Early Successional and Savanna Species

The current status, distribution, and importance of grasslands and their relationship to the conservation of open-habitat populations must be viewed in the appropriate historical context. Prior to European Settlement, open grasslands were uncommon within the Piedmont and only existed as relatively small patches embedded within a much larger forested landscape. Open lands likely increased in the years following European Settlement and by the nineteenth century broad-scale clearing of forested lands resulted in a flush of new open habitats. Subsequently, the availability of open lands has declined dramatically throughout the twentieth century following succession of land opened previously.

Grasslands in the Virginia are primarily derived from agricultural fields and pasturelands. Other managed grasslands may include airports, golf courses, military training areas, parks, and recreational fields. Without regular management, these open habitats will give way to woody vegetation and eventually succeed to shrublands then forest. The specific form of open habitats is influenced by land history, moisture, soils, and management technique. Oldfields, pasturelands, and grain and hay crops may provide breeding habitat for grassland birds when they provide compatible patch size, grassland structure, and when harvest intervals do not disrupt nesting.

Barn Owl

The Common Barn Owl is one of the most widely distributed bird species in the world and occurs throughout the Americas, Europe, Africa, Asia, and Australia. In recent year, populations of this species in North America have declined substantially. Explanations for these declines often are attributed to loss of early successional habitats from urbanization and reforestation, intensified agricultural management, and biocides.

The Barn Owl is an uncommon to rare resident of Virginia (Rottenborn and Brinkley 2005). Population strongholds have historically included the Shenandoah Valley, northern Piedmont, and

marsh lands of the coastal plain (Watts and Whalen 2004). Although Barn Owls require open habitats such as grasslands or marshes for foraging, they are most frequently associated with these areas when artificial substrates such as silos, barns, abandoned buildings, duck blinds, and nesting boxes are available for nesting. In 1986, there were 43 known sites that supported breeding pairs (Byrd et al. 1986). Due in part to some early success of a state nest box program the number of known active pairs increased to 65 by 1989 (Byrd et al. 1990). However, recent observations suggest that continued loss of suitable Barn Owl foraging habitat and nest sites may have resulted in a decline in the breeding population to below the level of 1989 (Watts and Whalen 2004).

Barn Owls are likely to decline without management intervention and the provisioning of nest boxes or other structures.

Upland Sandpiper

Upland Sandpipers are endemic to the upper Midwestern United States but were able to expand into the eastern U.S. during the 1800s following a wave of land clearing for agriculture. This species was once more common in Virginia but populations have declined rapidly throughout the region. Population crashes were recognized as early as the late 19th century and attributed to unregulated hunting pressure. After hunting regulations were legislated slight population increases were noted. Within some regions they were still considered common in appropriate habitat as recently as the 1950s (Smith 1966). Recent declines are most likely due to a loss of habitat and farm practices such as mowing and harvesting grasslands during a time that disrupts breeding. Currently, the Upland Sandpiper breeds only as isolated pairs throughout the eastern and northeastern U.S.

In Virginia, the Upland Sandpiper has predominantly nested in the Piedmont and Ridge and Valley physiographic regions. Throughout the 1930s and 1940s, most records were from Montgomery, Rockbridge, Albemarle, and Botetourt counties and the cities of Lynchburg and Harrisonburg. The largest and most regular population site was found at the college farm at Virginia Polytechnic Institute, Montgomery County (Handley 1941). This site once supported 15-20 pairs of Upland Sandpipers per year. Nearly all other observations typically consisted of only a few pair or of a single nest. By the mid-1980 only a few sites were known. The Virginia Breeding Bird Atlas period of 1989-1992 only revealed one potential nesting site in Loudon County (Rid 1990). At the time, Loudon County was recognized as the last remaining stronghold for Upland Sandpipers. This area supported breeding pairs from the mid-1930s through the early 1990s (Bazuin 1990). Records appear to peak in the late 1970s following more systematic efforts to locate breeding pairs. In 1989, an organized survey in Loudon county netted 21 birds (some individuals believe to be hatch year birds) (Bazuin 1990). The last known site for Upland Sandpipers was at the Remington Sod Farm in Fauquier County in 2001 (Iliff 2002).

Habitat for Upland Sandpipers in Virginia has historically included tall and short hayfields, pastures (Bazuin 1990), and very short grass fields at airports (Armistead 1983, Hall 1986,) and the Remington sod farm. This habitat use is consistent with observations across the broader region. Open habitat suitable for Upland Sandpipers is declining in Virginia as many areas are planted in pine or lost entirely to development. This pressure is greatest in Loudon County and other areas of the Piedmont near Washington D.C. and along the I-95 corridor. However, pastures and hayfield are still common throughout the Piedmont and appropriate habitat is not considered limiting. Declines can also be attributed to incompatible timing of hay and pasture harvest that destroy nests or young.

Bewick's Wren

The overall decline of Bewick's Wren in this region appears to be nearly as rapid as its expansion. Bewick's Wren expanded rapidly throughout the northeastern U.S. in the early 1800's coinciding with a large wave of forest clearing that occurred from the mountains to the coast. This land clearing provided a wealth of early successional habitats in areas previously not available. Breeding records rapidly increased in the mountains and piedmont of Virginia during this time (Smyth 1912, Bailey 1913). By the early 1900s, Bewick's Wren had expanded its range as far north as New York. Then by the mid-1900s, these recently expanded populations began to sharply decline. In Virginia, descriptions of Bewick's Wren changed from being common in places such as Montgomery County (Smyth 1912) to uncommon statewide (Murray 1952) within 40 years. By the mid 1970s, Bewick's Wren was considered rare throughout Virginia and already extirpated from New York and Pennsylvania. So, the period of expansion and withdrawal in Virginia would have spanned less than 100 yrs.

The Bewick's wren is most likely extirpated from Virginia. The most recent nesting record for Bewick's Wren was collected from Dickenson County in 1989 (Ridd 1990). Other recent nesting records were collected from Highland County in 1982 (Teuber 1985) and Montgomery County in 1974 (Conner 1975) and 1976 (Adkisson 1991). Unpublished breeding season observations were being reported throughout the 1980s and into the 1990s. Most of these were of single birds. The last known breeding season observations are from Highland County in 1998 (S. Thornhill, unpublished data – David Shoch, personal comm.) and 1991 (D. Schwab and T. Gwynn, personal comm.), and in Dickenson County in 1990 (Sauer et al. 2007). There were no birds detected in a systematic survey of 863 patches in in 2006 (Wilson et al. 2007).

The decline of the Bewick's Wren has also been associated with being outcompeted and displaced by expanding populations of House Wrens (*Troglodytes aedon*). This phenomenon has been speculated for many years based on the coincidental timing of Bewick's Wren population declines in areas where House Wrens were rapidly expanding. House Wrens began expanding their range into the southeastern United States in the 1940s (Odum and Johnston 1951). Reasons for the expansion may be many but have been attributed, in part, to an increase in habitat availability. Land clearing has probably benefited both species. Both House Wrens and Bewick's Wrens use anthropogenic habitats and often nest near human habitation. House Wrens are believed to compete with Bewick's Wrens for nesting sites and have been reported to directly destroy the eggs, nests, and nestlings of Bewick's Wrens. This would help explain why House Wrens continued to expand while Bewick's Wrens have declined despite similar habitat opportunities. Stevens reported two occurrences in Albemarle County, VA where he believed House Wrens displaced Bewick's Wrens during the breeding season (Gray and Stevens 1949). Although still speculative, the prospect that the decline of Bewick's Wren could be attributed to losing a competitive battle with House Wrens appears to have some similarity with the negative interactions of Golden-winged and Blue-winged warblers. The history of each species pair seems to be tied to broad scale changes in habitat over time. There are perhaps lessons that can be learned from the decline of Bewick's Wren that can be used to inform management decisions for Golden-winged Warblers faced with an expanding Blue-winged Warbler population.

There is still debate over the exact origin of Bewick's Wren population expansion in the northeast. The center of this debate is based on whether the Appalachian Bewick's Wren is truly a distinct Appalachian endemic (Phillips 1986, James and Green 2006). This taxonomic discrepancy

influences interpretation on the history of the species population origins in the eastern U.S. and has important implications regarding its protection and relative importance as a conservation priority. The principal claim for separation of Bewick's wren into an Appalachian subspecies, *A. b. altus*, and a western subspecies, *A. b. bewickii*, is based on differences in plumage color. James and Green (2006) questioned the validity of the *A. b. altus* subspecies based on this single criterion by contending that the darker plumage patterns of specimens collected in the Appalachians and typed as *A. b. altus* are actually *A. b. bewickii* specimens dirty from soot and in need of restoration. If *A. b. altus* is not a distinct subspecies endemic to the Appalachians, then expansion into the eastern U.S. during the early to mid-1800's were a result of *A. b. bewickii* populations from as far west as Kansas. Alternatively, if *A. b. altus* is truly an Appalachian endemic, it could have been the source for new populations in the Northeast that expanded at the same time that *A. b. bewickii* was moving into the Appalachians from the Midwest. For Virginia, the distinction of a true Appalachian endemic suggests that populations of the Bewick's Wren resided here at a time earlier than the late 1800's expansion.

Loggerhead Shrike

The Loggerhead Shrike is another example of a species that expanded rapidly into the northeastern U.S. with land clearing in the 1800's but then retreated almost as fast when reforestation and changes in land use practices altered the region's landscape. The Loggerhead Shrike utilizes pastures and other open grassy areas that contain hedgerows and scattered small trees. Many of these habitat features were lost following intensified agricultural practices that eliminated portions of land not in production. In addition to losses of habitat, a second wave of decline has been suggested to be a result of the use of biocides in agricultural management (Graber and Graber 1973).

Virginia supports two subspecies of the Loggerhead Shrike that include *L. l. ludovicianus* and *L. l. migrans*. Both subspecies have been documented to breed in Virginia (Addy and Handley 1940) with *L. l. ludovicianus* established as permanent residents that are found year round whereas individuals *L. l. migrans* being comprised of breeding, migratory, and winter populations. There is a relatively greater number of winter records of shrikes in Virginia compared to the breeding season because of the influx of wintering birds.

The Loggerhead Shrike reached its peak abundance in Virginia in the 1940's and 1950s and began a rapid decline in the decades following. This species could once be found in all physiographic provinces although were much more abundant in the Piedmont than in the coastal plain or Mountains and Valleys. Loggerhead Shrike breeding records are widespread, and reported from 75 counties, but most breeding occurrences were of scattered, isolated pairs. By the 1980s records were becoming rare. A statewide tally in 1981 documented only 8 pairs (Larner and Scott 1982). Breeding season records continue to become rarer with each passing decade. Since the year 2000, breeding occurrences have been documented in Augusta, Bath, Bedford, Clarke, Culpepper, Fauquier, Goochland, Loudoun, Middlesex, Mecklenburg, Russell Orange, Pulaski, Spotsylvania, Tazewell, Warren, Wise, and Sussex counties. There has not been a coastal plain breeding record since 2006 (Day 2006). A pair was consistently observed at Sky Meadows from 2006-2009 (Day 2006, unpublished records). Habitats of recent breeding season records often include general descriptions of pastures with scattered trees including hawthorns (*Crataegus spp.*).

Golden-winged Warbler

The Appalachian Mountains have long been considered a population stronghold for Golden-winged Warblers. In Virginia, Golden-winged Warblers currently breed in low densities throughout the Appalachian Plateau, Ridge and Valley, and Southern Blue Ridge provinces with the largest population center located in Highland County. Populations have been declining in Virginia and throughout the region for the last several decades. Several forces have worked together to cause the recent decline in early successional shrublands including direct losses caused by human development, re-forestation of farmland, fire suppression, and changes in agricultural and forestry practices. In addition, Golden-winged Warblers may be declining because of competition for breeding habitat and hybridization with Blue-winged Warblers. Blue-winged Warblers have been expanding their range eastward and into higher elevations that were once occupied exclusively by Golden-winged Warblers.

Golden-winged Warblers only reside in high elevations of Virginia. Populations have been concentrated at elevations > 900m but detected infrequently as low as 480 m (Stevens 1960, Scott 1966, 1974, Peake 1987, Wilson et al. 2007). Among the high elevation areas, Highland and Bath counties have historically and presently supported the greatest concentration of birds (Peake 1978, Larner and Scott 1982, Spahr 2003). Moderate populations were observed in other counties with single foray peaks of 37 birds in Craig County in 1979 (Scott 1981) and 23 birds in Tazewell County in 1972 (Scott 1973). Aside from these counties, densities of Golden-winged Warblers in Virginia have probably always been low but clustered around areas of appropriate habitat. For example, Washington, Grayson, and Lee counties have historically only contained small numbers despite wide ranging survey efforts to detect the species (Scott 1966, 1970, Dalmás 1993, 1999). Likewise, other counties typically have only a few records at any one time (Stevens 1960).

The decline of Golden-winged Warbler is prominent when comparing accounts across time. Prominent declines are evident in Dickenson, Buchanan, and Tazewell counties when forays conducted in the early 1970s are compared to those from the mid-1980s (Scott 1973, Peake 1986, 1987). More recently, Spahr (2003) shows a dramatic decline in Bath County from a high of 125 birds counted during a 1982 foray (Larner and Scott 1982) to a low count of only 17 birds in 2003. A systematic survey of 863 early successional patches in 2006 (Wilson et al. 2007) found Golden-winged Warblers with much lower abundance compared in core areas to historical findings and found no Golden-winged Warblers in many counties they were once present.

Reasons for the decline of Golden-winged Warblers may be many but the most likely explanations include the loss of early successional habitats and displacement by Blue-winged Warblers. Historically, Blue-winged Warblers were distributed primarily west of the Appalachians but have been expanding their range eastward and into higher elevations (Canterbury et al. 1993) over the last 150 years. Early breeding records for Blue-winged Warblers in the eastern U.S. date back to the late 1800's (Richmond 1888, Bailey 1913) but regular occurrence in the Appalachians is estimated to have taken place sometime in the 1950's (Gill 1980). Blue-winged Warblers now breed in many places where Golden-winged Warblers populations were formerly isolated. For instance, Dalmás (1995) reported the colonization of northwestern Virginia by Blue-winged Warblers when comparing results between forays in 1994 to those conducted in 1967 (Scott 1967). Spahr (2003) detected Blue-winged Warblers in Bath County in 2003 (Spahr 2003) but not during earlier forays in 1982 (Larner and Scott 1983). In 2006, Golden-winged Warblers and Blue-winged Warblers overlapped significantly in elevation (Wilson et al. 2007). Moreover, Blue-winged Warblers occurred in all but one of the counties except Highland County where Golden-winged Warblers occurred. However, older records suggest that Blue-winged

Warblers nest in Highland County as well (Peake 1978). Blue-winged Warblers also appear to be replacing Golden-winged Warblers in order of abundance in the Appalachian portion of Virginia. Peake (1986) provided early indications of this change in Buchanan, Wise, and Dickenson counties by reporting a general decline of Golden-winged Warblers coinciding with an increase in Blue-winged Warblers and hybrid warblers by 1982. Unpublished records from Buchanan County Bird Club indicate a very similar pattern with a recent and rapid turnover in rank abundance from this area (R. Mayhorn, personal comm.). In 2006, Tazewell and Russell counties supported the greatest concentration of Blue-winged Warblers in the state, suggesting their expansion into this area has continued (Wilson et al. 2007). Conservation of Golden-winged Warbler in Virginia should most likely focus on high elevation areas, principally in Highland and Bath counties.

Bachman's Sparrow

Bachman's Sparrow is one of four species that is endemic to the old-growth, southeastern pine savanna ecosystem (others include the Chuck-will's-widow, Brown-headed Nuthatch, and the Red-cockaded Woodpecker). This ecosystem once dominated the southeastern U.S. and covered nearly 65 million hectares. Centuries of deforestation for the naval stores industry, agriculture, and conversion of this habitat to other forest types has decreased the extent of this ecosystem to 3-4% of its former range. The southeastern pine savanna is characterized as an open forest with few trees and a ground cover of grasses and forbs. The open conditions were maintained by frequent fires caused by lightning strikes that burned areas at 3-5 year intervals. Bachman's require grassy understory conditions with small amounts of woody intrusion. They are also able to use other early successional habitats with similar conditions and are sometimes found in regenerating clear-cuts.

Bachman's Sparrow expanded rapidly into Virginia in the late 1800s due to land clearing and were able to occupy landscapes not previously included within in their range or and lacking old-growth savannas. Once only known from central Virginia (Bailey 1913), they began to be detected with increasing frequency in the Mountain and Valley counties such as Montgomery, Rockbridge, Craig, and Giles counties. (Murray 1931, Freer 1933, Grose 1938, Murray 1944, Wylie 1948) but ceased by 1948. Records continue into the 1990s in the Piedmont into the 1990s in Nottoway and Dinwiddie counties (Titus et al. 1997).

It seems likely that Bachman's Sparrow could currently be extirpated from Virginia. There have been no detections of the species since 2008. Dinwiddie County supported the last and only consistent population in recent years within a routinely burned training field at Ft. Pickett. A systematic play-back survey of 280 early successional habitats in portions of Brunswick, Dinwiddie, Greeneville, Sussex, and Southampton counties only detected Bachman's Sparrows occupying 4 clear-cuts (Watts et al. 1998). A foray conducted by the Virginia Society of Ornithology did not find the Bachman's Sparrow during a focused survey for the species in Sussex and Greensville counties in 2009(unpublished data).

The decline of Bachman's Sparrows in Virginia is likely attributed to lower rates of forest clearing that provided short-term habitats and the loss of oldfields. Clear-cuts and oldfields quickly proceed from a grassy stage to stands dominated by shrubs within 3-5 years. Because Bachman's Sparrows require grassy patches with low amounts of woody intrusion, regeneration areas are only available for a relatively short amount of time. Without stable habitats in the landscape, Bachman's Sparrow has been shown through simulations to be at risk of extirpation (Pulliam et al. 1992). Management for Bachman's

Sparrow to recover Virginia population would require stable habitats in the form of early successional patches kept in a grassy stage or within pine savannas that are the species endemic habitat

Henslow's Sparrow

The history of Henslow's Sparrow in Virginia is an account of two distinctly different breeding populations. An eastern coastal subspecies, *A. h. susurrans* was documented as a Chesapeake Bay region breeding populations as early as the 1860s (Hyde 1939, Herkert 2002). The coastal subspecies was restricted to salt and brackish marshes and isolated from the upland breeding subspecies, *A. h. henslowii* until that form expanded its range eastward from the mid-western U.S. into the Mid-Atlantic in the 1890's. Like other early successional species, the expansion of Henslow's Sparrow from the Midwest was facilitated by the widespread clearing of land for agriculture and other purposes.

The coastal subspecies inhabited high marsh habitats in the Chesapeake Bay region that were composed of saltmarsh cordgrass (*Spartina alterniflora*), salt-meadow hay (*Spartina patens*), saltgrass (*Distichlis spicata*) and black needlerush (*Juncus roemerianus*). Breeding season records for this form were regularly collected from Saxis Marsh in Accomac County (Ake and Scott 1975, Kinzie et al. 1983, Armistead 1991) through Dorchester County Maryland, and into Chincoteague Bay (Feinstein 1960). There have been no breeding season detections from Saxis Marsh since 1995 and no marsh records from Maryland for an even greater amount of time suggesting the possibility that the coastal subspecies may be extirpated. The number of birds at Saxis was always considered relatively low and never exceeded 8 singing birds (Armistead 1991). Reasons for the decline of the coastal subspecies are not known. One possible factor is phragmites invasion of the high marsh areas that Henslow's Sparrow requires for breeding. Another possible factor is high levels of nest predation. Nest predation is a significant threat for high marsh nesting species because the close proximity of the high marsh to the upland source of predators and low water levels make it easy for predators like foxes and raccoons to access this habitat.

Breeding season records for Henslow's Sparrows outside of marsh habitats are often considered to be comprised of the inland subspecies. However, taxonomic distinction has not been validated in any case and breeding season records from the coastal plain could possibly be of either form. One reason for the suggestion of birds in upland habitats a being the inland subspecies was the sudden increase of birds using upland habitats that only occurred when the western push of birds made it to the east. The coastal *A. h. surrans*, subspecies shared parallel adaptations with other marsh sparrows by having a longer, thinner bill (Grenier and Greenberg 2005). It is possible to investigate specimens collected in the coastal plain could be compared to investigate whether or not the coastal form ever moved into the upland habitats for breeding but has not been conducted.

Henslow's Sparrow use of upland habitats increased rapidly in the late 1800s and was considered to be a common breeder throughout the coastal plain and Piedmont into the 1950s (Murray 1955). Within the coastal plain, breeding season records were common throughout the 1930s from locations such as King and Queen (Haynes 1935), Hanover (Murray 1935), Prince George (Nelson and Greenfield 1936) counties, Chesterfield, and Virginia Beach (McIlwaine 1940). Detections of Henslow's Sparrows waned rapidly throughout the 1970s by the 1980s and 1990s only scattered pairs or individuals were noted. The last breeding season report for Fairfax was from the Atlas period (Ridd 1987). Six Henslow's Sparrows were found in Sussex County in 1991 (Dalmas 1992) and at two locations in 1998 (Watts et. al. 1998). Four birds were observed including birds feeding young were in Prince

William County as recent as 2005 (Day 2005). In the Piedmont, Henslow's Sparrow declined rapidly and only occurred regularly in Loudoun County. Here, the Dulles Airport supported the largest single population of Henslow's Sparrow ever recorded in the state with a total of 30 birds (Scott 1980). Most other records were of scattered pairs or single birds and included more recent observation in Campbell County in 1998 (Dalmas 1988) and Brunswick County in 1992 (Armistead 1992). Henslow's Sparrow had never been regularly detected in the Mountain and Valley province. However, the only location where the species is still regularly present is at the Radford Arsenal in Pulaski County (Titus et al. 1998).

Historical accounts of Henslow's Sparrow breeding habitat in upland location include general descriptions of oldfields, clear-cuts, and wet areas. Typical vegetation within old fields included plants such as broomsedge (*Andropogon spp.*) (Nelson and Greenfield 1936), orchard grass (Peacock 1975), and with several references to milkweed (Opengari 1980, Dalmas 1988). Regenerating clear-cuts used in Sussex County had dense shrubs and saplings of red maple (*Acer rubrum*), sweetgum (*liquidambar styraciflua*) and many drainage ditches with standing water (Watts et al. 1998). Radford Arsenal a unique location that is maintained in an early successional state by burning. Henslow's Sparrows are known to be area sensitive and it has been suggested they need very large open patches for breeding. Regenerating clear-cuts used were > 50 ha (Watts et al. 1998), and several breeding locations in history are simply commented on being large.

Ipswich Sparrow

The Ipswich Sparrow is a subspecies of Savannah Sparrow (*Passerculus sandwichensis*) that breed exclusively on Sable Island, Nova Scotia and winters along the Atlantic Coast. This subspecies is of high conservation concern because of its low population numbers and limited distribution. The current population estimate for the Ipswich Sparrow is 6,000 pairs (Smith and Stobo 2003). In winter, the Ipswich Sparrow is restricted to dune habitats along the coast. Virginia is near the southern winter range limit for the subspecies and a critical area for their conservation because of the breadth of dune habitats along the barrier islands.

Nearly all the winter records for the Ipswich Sparrow are from the barrier islands (e.g., Scott 1971) with a small number in Virginia Beach (Murray 1969) and Back Bay (Hacker 1971). Habitat descriptions for Virginia have always been general accounts of dune habitats. However, more specifically, unpublished observations can describe sparsely vegetated dune and secondary dune for this species.

Red-cockaded Woodpecker

The Red-cockaded Woodpecker is a federally endangered species. Within the past 100 years Red-cockaded Woodpeckers have disappeared completely from the northern portion of their breeding range. Historically, this species was recorded north into New Jersey and Pennsylvania. As recently as the 1930's and 1940's resident birds were known from the open maritime forests of Maryland. Since the recent loss of habitat in Kentucky, Virginia has supported the only population north of the Carolinas. In Virginia, breeding has continued to the present time but the number of both sites and birds has declined dramatically over the past 40 years. As recently as 1977, 23 clans were known scattered across 5 counties. In 1980, all clusters determined to be active in 1977 were surveyed in preparation for an investigation of habitat use (Bradshaw 1990). Of the 23 original clusters, only 9 were still forested. In

the 4 years from 1977 to 1980, more than half of the known state population had been lost. By 1990, only 5 of the original 23 clusters detected in 1977 were still active. The bulk of this decline occurred on commercial timberlands. Federal endangered status appears to have provided little protection at least through the mid-1980s. By 2000, this number had declined to only 2 clusters. During the breeding season of 2002, Virginia supported only 2 breeding pairs and 2 clusters with solitary males. A survey of lands within the historic range in 1998 revealed that the short-term potential for restoration is limited. However, several patch complexes with the potential to support territories will become available over the next 20 to 30 years if aggressive management is applied.

Published accounts of Red-cockaded Woodpecker do not likely cover the population numbers that once occurred. Red-cockaded Woodpeckers were only known to occur in the southeastern portion of Virginia but with a northerly record in Chesterfield County (DeGerma 1938) and Prince George County (Steirly 1957). Some of the oldest records report breeding pairs in Brunswick from the 1920s (Lewis 1938). Several occurrences were published from Virginia Beach and Pungo area (Gray 1950, Scott 1951, Murray 1957) and Norfolk (Scott 1952, Steirly 195, Sykes 1960).

Historical accounts of breeding habitats in Virginia as included old-growth pine stands (> 70 yrs – Steirly 1957) dominated by loblolly pine (*Pinus taeda*). Nesting trees have included loblolly pine, shortleaf pine (*P. echinata*), and pond pine (*P. serotina*) (Meanley 1977). Steirly (1957) characterized most stands as having a dense, shrubby understory of myrtle (*Myrica cerifera*), flowering dogwood (*Cornus florida*), huckleberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra anifolium*). Dense midstory trees often included black gum (*Nyssa sylvatica*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), and various oaks (*Quercus sp p.*). Sykes (1960) found the species nesting in a shrub-bog community located one-half mile from the Northlanding River in Virginia Beach.

High Elevation Forest Species

Virginia has as many as 1,727 high elevation peaks (> 900m elevation) that support diverse and unique biological communities. Plant communities vary according to elevation, slope, and aspect, and latitude. The natural vegetation of Virginia's Appalachian region was historically composed of various oaks and American chestnut (*Castanea dentate*). Elimination of the American chestnut from fungal blight has given way to a region dominated by oaks. The highest elevation regions of the southern Blue-ridge and Allegheny mountains are composed of red spruce (*Picea rubens*) and Fraser fir (*Abies fraseri*). At lower and middle elevations a mixture of mesophytic forest is formed among coves and conclaves. Mid-elevation forests are often dominated by sugar maple (*Acer saccharum*), yellow buckeye (*Aesculus flava*), basswoods (*Tillia spp.*), and white ash (*Fraxinus americana*). An array of other various mid-elevation forests form among other soil types and can include areas dominated by eastern hemlock (*Tsuga canadensis*), tulip poplar (*Liriodendron tulipifera*), birches (*Betula spp.*), and mangolias (*Magnolia spp.*).

Spruce-fir communities are restricted by geography and elevation and considered globally rare. Likewise, other mid to high elevations are restricted with narrow elevation ranges that are mediated by soil and climate. Because of this, the biological communities of Virginia's high elevations are sensitive to climate change and are at risk of being replaced by low elevation vegetation communities if the trend of global warming continues.

High elevation habitats are naturally fragmented with like patches often isolated from one another among the different mountain peaks. Bird communities among Virginia's high elevation forests represent rare and unique suites of species that form isolated populations or are comprised of species at the southern edge of their range. For example, the Northern Saw-whet Owl, Hermit Thrush, Magnolia Warbler, Golden-crowned Kinglet, Red-breasted Nuthatch, Winter Wren, and Red Crossbill rely exclusively on high-elevation coniferous forests for breeding in Virginia.

Northern Saw-whet Owl

The Appalachian population of Northern Saw-whet Owl is relatively isolated from nearest breeding population that extends south to the northern Pennsylvania. Very little is known on the population distribution and trends for this species in Virginia because of the difficulty in surveying their remote habitats at night.

Breeding season records in Virginia occur in Highland County (Hall 1997, Pagels and Baker 1997), on Mount Rogers in Smyth/Grayson counties (Scott 1974), Tazewell County (Peake 1987)

Northern Saw-whet Owls can be found in high elevation spruce-fir and high elevation hardwood (Barb 1995). It has been suggested that they may actually rely on the ecotone between these two habitats. Pagels and Baker (1997) described breeding habitats for several nesting sites in Virginia. One site (1158 m elevation) in Highland County was composed of red spruce, American Beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), black locust (*Robinia pseudocacia*), red maple and red oak. They described another site in Russell County (1097 m elevation) with a canopy of eastern hemlock, yellow birch (*Betula alleghaniensis*) and black birch (*B. lenta*) with a dense Rhododendron midstory that reached 9m in height.

Appalachian Yellow-billed Sapsucker

The Appalachian Yellow-bellied Sapsucker is a distinct subspecies (*S. v. appalachiensis*) that breed in high elevation hardwood habitats in the southern Appalachians from Virginia to Georgia. Virginia is often believed also believed to support a northern subspecies (*S. v. atrothorax*) through most of the Blue Ridge and northern Appalachians. The Appalachian subspecies is restricted to southwestern Virginia. Records from this region range are generally confined on Mount Rogers in Smyth and Grayson counties (Murray 1937, Scott 1974, Scott 1982, Day 2004), within the vicinity of Mountain Lake Giles County (Hostetter 1937, Burns 1960) and Tazewell County (Scott 1973).

Red-breasted Nuthatch

The availability of high elevation coniferous forests in the Appalachian region allow the Red-breasted Nuthatch to extend its breeding distribution southward down this mountain range. The Red-breasted Nuthatch breeds in spruce-fir habitats. Probable or confirmed breeding has been documented in Highland County (Stevens 1965, Scott 1975), Rockingham County (Stevens 1968), Giles County (Scott 1974), and Montgomery County (carrying food in July) (Abbot 1986). Additional breeding season presence is documented for Augusta (Larner and Scott 1979, Hall 1981), Dickenson (Hall 1981), and Wythe counties (Dalmás 1999).

Swainson's Thrush

Swainson's Thrush is associated with spruce-fir forests throughout its range. Its breeding presence in Virginia has never been confirmed but numerous records during the mid-breeding season in appropriate habitat have been documented. Records for Mount Rogers date back to 1966 (Scott 1974, Shelton 1976) and continued in several years including 1973 (Shelton 1976), and 1975 (Scott 1982). Unpublished records also document recently fledged young in 1978. Other records for the state include an August 1969 observation in Rockbridge County, Beartown Mountain in Tazewell and Mullenax Run in Highland County (Rottenborn and Brinkley 2005).

Olive-sided Flycatcher

The Olive-sided Flycatcher utilized open coniferous forests at high elevations. Records for Virginia are extremely rare. The only likely breeding record was the observation of adults with young in Highland County in 1938 (Brooks 1938). Birds were observed foraging in a stand recently burned by wildfire. The only other significant breeding season record includes the detection on June 21, 1976 at Mount Rogers (Smyth/Grayson counties). Most other observations of Olive-sided Flycatchers in Virginia are during the migratory season.

Appalachian Winter Wren

The Appalachian subspecies, *T. t. pullus*, of the Winter Wren is another example of a population that is relatively isolated from other populations of conspecifics. The small, isolated population is of high conservation priority like many other species or distinct forms that are geographically restricted to the Appalachian region. Winter Wren utilizes high elevation spruce-fir forest so are highly sensitive to climate change with rising global temperatures that could eliminate their habitats.

In Virginia, the Winter Wren is abundant in appropriate habitat and regularly found in historical records at locations such as Mount Rogers (Murray 1937, Scott 1974, ,Rockingham County (Stevens 1968), Wise County (Peake 2001),and Hawksbill Mountain in Page and Madison Counties (Stevens 1965).

Golden Crowned Kinglet

Golden-crowned Kinglet is another species among a small group that restricted to spruce-fir habitats in Virginia during the breeding season. In winter, Golden-crowned Kinglets are much more abundant and occupy a much broader geographic range and habitat types due to an influx of migrants from northerly breeding populations.

The breeding distribution of Golden-crowned Kinglets in Virginia follows its preferred habitat accordingly. Breeding season records exist from Mt. Rogers and Iron Mountain in Smyth/Grayson counties, (Handley 1940), Mountain Lake in Giles County (Brooks 1946) and more recent records for Madison and Augusta counties in 1996 and 2004, respectively (Rottenborn and Brinkley 2005).

Dark-eyed Junco

The Dark-eyed Junco is a common breeding bird of higher elevation coniferous forests that are generally above 900m in elevation. This includes some notable observations such as Whitetop Mountain (Brown 1933), Thunder Hill in Rockbridge County (Murray 1932), Augusta County (Hone 1932).

Red Crossbill

The Appalachian Region of North Carolina and Virginia supports two distinct and sympatric forms of Red Crossbill (Groth 1988). Taxonomic discrepancies exist on whether or not these two forms actually represent two (*L. c. pusilla* and *L. c. minor*). The Appalachian populations are restricted to high elevation spruce-fir forests and are geographically separated from populations breeding in New York and northward and from populations breeding in the Rocky Mountains.

Red Crossbills in Virginia have always been characterized as rare, irregular, and irruptive (Rottenborn and Brinkley 2005). Most records are of fleeting glimpses of small flocks of birds (Murray 1966, Stevens 1968). High counts include records of 105 birds on Mount Rogers (Stevens 1976), 32 birds on Pine Ridge (Peacock 1966) and 31 birds across the Abingdon Foray (Scott 1966). However, many records have occurred across the months of June-August suggesting possible breeding in those locations (e.g., Hall 1976). Overall, confirmed breeding records are rare. Scott (1970) reported Red Crossbill fledglings in Rockingham County in 1968. Other breeding records include a juvenal plumage bird in July 1976 on Mount Rogers (Scott 1974), fledgling birds in Giles County in 1983 (Kessler and Varner 1984), nest building in Rockingham County in 1989 (Ridd 1990), and nests observed in Montgomery and Rockingham counties (Rottenborn and Brinkley 2005).

Pine Siskin

The regular breeding range of the Pine Siskin is found in the most northern latitudes of the U.S. and into Canada. However, this species can be found much further south, including the Appalachians, during population irruptions. The irruptive nature of this species can make it locally abundant in extralimital portions of its range one season but absent the next season.

When Pine Siskins are present in the Appalachian region during summer they utilize high elevation spruce-fir and lower elevation mixed pine-deciduous habitats. There are only three nesting accounts for Virginia. Nest construction was observed at Mountain Lake Giles County in 1985 (Zigenfus 1987) and Augusta County in 1998 (Varner 1998), and confirmed breeding in Montgomery County (Dalmás 1988).

Emergent Wetlands

Emergent tidal marshes are a dominant feature of the Chesapeake Bay's estuarine environment and account for an approximate 123,100 ha of the 185,870 ha (66%) of classified wetlands. Tidal marshes vary in salinity, structure, and plant composition according to their geographic position in the

Bay. Salt marshes are found along the immediate Bay shoreline. These give way to brackish and freshwater marshes moving up the Bay's tributaries.

Chesapeake Bay marshes also support breeding bird populations that are of regional or national conservation significance. Marsh bird communities vary with marsh type, geographic position, salinity, patch size, and landscape context. Marsh loss has been significant over the past two hundred years primarily as a result of urban, industrial, and agricultural development. Protective legislation enacted in the 1970s has slowed the rate of loss but marshes continue to be degraded and population of marsh birds continue to decline from the invasion of exotic species, ground predators, poor management practices, encroachment by development, and sea-level rise. Despite these concerns, there is still relatively little information on the population trends of most marsh birds or on the distribution of some of the Bay's highest species of concern such as Black Rails (*Laterallus jamaicensis*), King Rails (*Rallus elegans*), Saltmarsh Sharp-tailed Sparrows (*Ammospiza caudacuta*), and Henslow's Sparrows (*Ammodramus henslowii*). Marshes along the bay's fringe, tributaries, and islands that currently support species at risk of extinction in the Bay are in immediate need of identification and protection. High marshes on the Delmarva Peninsula, support greatest concentrations of species at risk and are marshes among the most at risk of loss and degradation. Management to reduce or abate threats to marsh birds is critical to their long term survival.

American Black Duck

Virginia is near the southern end of this species breeding distribution that terminates in North Carolina. Populations of the American Black duck have been declining range wide and in Virginia. Several factors are likely responsible for this decline such as pesticides, ingestion of lead, and degradation of habitat. The American Black duck breeds in a variety of wetland habitats including freshwater, brackish, and saltwater. Wetland breeding habitat in Virginia has been negatively affected by development, erosion, and intrusion by nest predators.

The core of the Virginia population breeds in tidal reaches of the Chesapeake Bay. In the coastal plain, historical records are from Chesapeake Bay islands and tributaries. However, historical there are several breeding records for areas outside of the coastal plain in Charlotte (Handley 1937), Roanoke (English 1954), and Warren Counties (Scott 1967) for example.

Northern Harrier

The Northern Harrier breeds in saltmarshes in Virginia's tidal region and the potential to breed in upland grasslands. This species requires very large patches, typically > 100ha, for breeding. Nearly all of the breeding records are from marsh habitats. This pattern is not surprising since marsh patches of appropriate size can be found throughout the Chesapeake Bay but large grasslands of similar size are rare in Virginia.

Breeding records in coastal Virginia occur throughout the Barrier Islands, Bayside marshes of the Delmarva Peninsula, and Western shore marshes (Watts and Rottenborn 2001). There has never been a documented breeding record away from tidal areas. However, Watts and Rottenborn (2001) observed pairs of birds during the middle of the breeding season in both Henrico and Sussex counties in 1996, and Brown (1937) observed a pair near Blacksburg in late summer.

King Rail

The King Rail inhabits freshwater and oligohaline marshes with dense vegetation and shallow water. In tidal areas, habitats are typically composed of tall cordgrass (*Spartina cynosuroides*) and arrow arum (*Peltandra virginica*) and other emergent vegetation. Outside of the tidal region, King Rails can be found in a variety of wetland types such as wet meadows, drainage ditches, and managed impoundments. Vegetation of non-tidal wetlands often contains cattails (*Typha spp.*) or other tall, dense vegetation, raised areas for nesting, and shallow water for foraging.

King Rails are commonly found in tidal freshwater marshes but the general occurrence rates are poorly known. Most historical records are based on occurrences of single individuals despite the Chesapeake Bay region likely harbors a very large population based on the amount of habitat available. Breeding occurrences inland areas are known also occur across the Piedmont in scattered locations over time in locations such as Loudoun, Fairfax, and Spotsylvania counties (Scott 1953, Armistead 1980, 1983). There are few records for the Mountain and Valley region but they could breed more often than records indicate. Notable records for this region include documented breeding in Roanoke (English 1951).

Black Rail

The Black Rail may be the most endangered bird along the Atlantic Coast. Over the past 10-20 years, populations in Virginia and Maryland have declined more than 75% and have become dangerously low. There has been a reduction in both the number of breeding locations and a loss of individuals from historical strongholds. Recent evidence suggests that Black Rails may only breed in a dozen or fewer places in each state along the Atlantic coast. The reasons for the dramatic decline of the Black Rail are not completely understood but may be attributed to factors such as habitat loss and degradation, predation, low reproductive rates, overwinter survival, and environmental contaminants.

Black Rails also appear to have declined on the Delmarva Peninsula, both in the number of locations known to be occupied and the number of birds within occupied sites. Historically, Black Rails were distributed in appropriate habitat throughout both the bayside and seaside of the Delmarva Peninsula. Harold H. Bailey (1927) mentions his father, Harold B. Bailey, collected a nest with eggs on Cobb Island and six to seven nests on Hog Island in 1917. Charles Handley reported a nest on Gull Marsh (Northampton Co., west of Cobb Island) in 1938 (Clapp 1997). An individual was detected on the mainland of the seaside near Locustville in the early 1990s (Bob Cross, unpublished record). In 2007, Wilson et al. (2009) surveyed 110 points on the seaside, including places on Cobb and Hog islands and no Black Rails were detected.

Traditional strongholds such as the Saxis Wildlife Management Area have held more than 20 Black Rails in the past (Rottenborn and Brinkley, 2005). The only place we did not detect a Black Rail as Rottenborn had was on the north facing shore of Saxis in Pokomoke Sound (i.e. Pig Point). We surveyed two other points in the same vicinities as Rottenborn's 1991 effort and received the same result of no Black Rail detections as he did. Black Rails have been detected during previous years in Hyslop Marsh

(N. Brinkley, personal comm.) but were not detected there during the systematic 2007 effort (Wilson et al 2009).

The number of reports for Black Rails in the Piedmont to mountain areas has declined as well. However, this phenomenon appears to be a long-term decline dating back to the early 1900s rather than the rapid decline that is now observed along the coast. Whether or not populations outside the coastal plain were remnants of a long-standing population or a flush of birds that increased their range from tidal areas following a wave of land clearing in the late 19th century is unknown. These records are non-native plant communities such as wet hayfields so it is not known if natural habitats supported birds.

There are very few locations outside of the coastal plain with persistent breeding season records. Handley (1939, 1941) observed such an exception in Virginia with a report of an “number” of Black Rails in two Montgomery County wetlands over a period of 4 years but continued to comment that in the last year of this period that the numbers were reduced to only one site that may have only supported one bird. Most records outside the coastal plain are from a period of the 1930s through the 1950s (e.g., Murray 1931, Handley 1939, Stevenson 1946). Rottenborn and Brinkley (2005) summarize some of these older unpublished records as well as more recent unpublished records that document observations of single birds at the Dulles Greenways Wetlands (Loudon County) in 2001 (also see Cross 1999) and North Fork Wetlands (Prince William County) in 2002. Allen Bryan (personal comm.) detected one calling bird in late May, 2008 in Fluvanna County. The breeding status of Black Rails detected in the Piedmont and mountains of Virginia has never been determined but certainly there is the possibility of these birds nesting based on the number of occurrences and behavior of pairs on territories (Handley 1941).

Black Rails appear to have retracted completely from their historical distribution along the seaside of the Delmarva Peninsula. Moreover, known population strongholds at locations such as the Saxis Wildlife Management area have been dramatically reduced compared to past accounts. Black Rails are only occupying a small fraction of the available habitat. Overall populations appear to be dangerously low and may be at a risk of extirpation in the Commonwealth of Virginia. The future of this species is uncertain because Black Rails occupy habitats that are vulnerable to land-use change, in close proximity to upland nest predators, and sensitive to changes in climate and sea-level rise.

Yellow Rail

The Yellow Rail is one of the most secretive birds in North America. Very little is known on the distribution of this species in the breeding or non-breeding seasons. Its occurrence is probably overlooked because of the wetland habitats it uses and extreme difficulty in detection. Yellow Rails use a wide variety of emergent marsh habitats that include tidal marshes, wet meadows, and wet hayfields.

The breeding range of the Yellow Rail occurs mostly in Canada and can be found in Virginia during the non-breeding season. Yellow Rails generally are restricted to coastal regions during winter, however because they migrate along a broad front, they can often be found in inland areas during migration. Non-breeding records for Virginia generally reflect that notion. Published records are generally divided among coastal areas and west. General occurrences in coastal Virginia include Accomack and Northampton counties (Scott 1968, 1981), Williamsburg (Armistead 1981), Virginia Beach

(Scott 1982, Armistead 1992), Poquoson (Buckley 1967), and cities of Suffolk and Arlington (Johnston 1997). Most of these records are from tidal habitats. Yellow Rails in the Piedmont or Mountain and Valley provinces include locations such as Rockingham and Rockbridge counties (Murray 1936), Buckingham County (Scott 1948) and Mecklenburg County (Johnston 1997).

Least Bittern

The Least Bittern breeds throughout tidal freshwater and brackish marshes of the Chesapeake Bay region. Very little is known on their frequency of occurrence in non-tidal habitats. Breeding records outside of the coastal plain are rare. This likely reflects their lower relative abundance outside the coastal plain but may also be attributed to their secrecy and low calling rates, and less effort in surveying inland marshes that are often widely separated and scattered in a much broader upland landscape. Records outside of the coastal plain have been documented for Fairfax (McIlwaine 1934), Roanoke (English 1945), Ablemarle (Murray 1949), Montgomery (Murray 1974), Dinwiddie (Ridd 1990), Patrick counties Dalmas 1995), and Smyth counties (Decker 1995).

Sedge Wren

The Sedge Wren has been suggested as a nomadic species outside of its regular breeding range where it can appear in one season and not the next (Herkert 2001). Sedge Wrens breed across an array of marshes, wet meadows, and impounded areas.

Virginia represents the northern range limit of the species in winter. In the breeding season, Sedge Wrens breeding occurrence in tidal marshes has likely declined over the last 30yrs (Rottenborn and Brinker 2005). Historical records for the Chesapeake Bay region include breeding occurrences in Virginia Beach (Gray 1959, Scott 1952), repeated observations at Saxis Marsh and vicinity within Accomac County (Kinzie and Scott 1983, Armistead 1991), and Matthews County (Armistead 1987). Records outside the coastal plain are known from Ablemarle County (Stevens 1952), Montgomery County in 2003(Mays 2005), and Fairfax County in 1953 (Scott 1953).

Winter records for the Sedge Wren in Virginia are more regular and more widespread than the breeding season. Sedge Wrens were often detected during Christmas Bird Counts in coastal area including Virginia Beach, Norfolk, Newport News, Arlington, and the counties of Loudoun, Accomack, York, (e.g., Murray 1956, Scott 1963, Kain 1986,1988, 1991,1992)

Saltmarsh Sparrow

The Saltmarsh Sparrow is among a small set of marsh breeding species that requires the high marsh for breeding. The high marsh is inundated only during extremely high tides and intense storms and form a grass-like savanna dominated by vegetation such as smooth cordgrass, salt meadow hay, saltgrass, and black needlerush. Saltmarsh Sparrows are only found in very large marshes (> 50 ha). The Saltmarsh Sparrow reaches its southern distribution in Virginia at the Accomac – Northampton county line (Watts 2004). Nearly all breeding season records of this species are restricted to the seaside

and bayside marshes of the Delmarva Peninsula. The only exception is a breeding record from Gloucester County on the Western shore (Watts 2004).

Saltmarsh Sparrow may be extremely sensitive to sea-level rise because they inhabit high marsh habitats that are projected to be lost or transformed to low marsh over the next 100 years (Wilson and Watts unpublished data).

Nelson's Sparrow

The Nelson's Sparrow is only found in Virginia during the non-breeding season. They inhabit saltmarshes throughout the Chesapeake Bay region and managed impoundments in the coastal plain including Back Bay. Winter records can be expected anywhere in tidal reaches of the Chesapeake Bay. Inland records are generally extralimital. Nelson's Sparrow can also be found co-inhabiting marshes with the Saltmarsh Sparrow.

Coastal Plain Swamp Sparrow

This subspecies of Swamp Sparrow is only found within oligohaline marshes of the Mid-Atlantic region and geographically isolated from other subspecies (Greenberg and Droege 1990). This subspecies is also distinguished from other subspecies by possessing a longer bill and darker plumage among other adaptations for their marsh life history. The Coastal Plain Swamp Sparrow uses high marsh habitats within estuaries that are composed of salt-meadow hay and interspersed with shrubs such as marsh elder (*Iva frutescens*)

This range of this species was long considered to include only Delaware and Maryland until a breeding population was found in three marshes along the Rappahannock River in 2006 (Watts et al. 2008). Other subspecies of Swamp Sparrow remain in coastal Virginia until the first week of June making it difficult to ascertain breeding status from the presence of individuals alone without plumage recognition or other breeding evidence. Early June records exist for Accomac County (Kinzie and Scott 1983), and adults observed with young in Fairfax (Iloff 1997).

Forested Wetlands & Other Upland Deciduous Forests

Forested wetlands include a wide diversity of forests dominated by woody plant species 6m or taller that can tolerate inundation for various periods during the growing season (Cowardin et al. 1979). This can include a variety of forest wetlands commonly known as swamps, cypress swamps, riverine swamps, floodplain forests, levee forests, and bottomland hardwood forest. Forested wetlands are differentiated by their underlying soil and hydrology. Cypress swamps form in areas where soils are saturated for most of the growing season. Other forested wetland types exist across a gradient of hydro-periods.

Across the United States, forested wetlands are experiencing dramatic declines in area and changes in plant composition. Between the 1950's and 1970's, nearly 2.5 million ha of forested wetland were lost. Much of this loss was due to harvest of wetland forests and conversion to agriculture or urban development. Forested wetlands are not as prevalent or as extensive in the Piedmont compared to the

coastal plain. Nonetheless, forested wetlands in the Piedmont may account for 10-20% of each individual state's total wetland area (Tiner 1987). More recently within the Piedmont, forested wetland loss has ranged between 0-9% per watershed in a ten year span between 1980 and 1990 (USDA Southern Forest Resource Assessment 2003).

Swainson's Warbler

The Swainson's Warbler breeds in the southeastern U.S. where it inhabits forests with dense understory vegetation. Historically this species was only associated with bottomland hardwood forests of the coastal plain until a disjunct Appalachian population was discovered in 1939. Populations in each geographic area share the preference for dense understory vegetation but obviously use distinctly different forest communities based on the disparate geography. In the coastal plain, Swainson's Warblers are typically associated with bottomland hardwood forests composed of dense thickets of switch cane (*Arundinaria spp.*) or sweet pepperbush (Meanley 1977). In the Appalachians, habitat types most include montane cove forests with dense understory of rhododendron and mountain laurel (*Kalmia latifolia*).

The distribution of records in the coastal plain of Virginia is typically focused on the Dismal Swamp (Meanley 1976, 1977). Additional records have been collected outside of the Dismal Swamp but most authors believed these to be transient birds since their presence did not persist through the summer (Scott and Cutler 1975, Dalmas 1992).

Records from the Mountain and Valley Province of Virginia occur in Ablemarle (Merkel 1961, Murray 1962), Amherst (Larner and Scott 1982), Carroll (Dalmas 199), Dickenson (Peake 1986, Iliff 1995), Grayson (Dalmas 1999), Roanoke (Middleton 1981), Smyth (Decker 1999), Tazewell (Peake 1987), and Wise counties (Stevens 1976). The population in the Appalachian region is likely underrepresented in historical account due to the potential habitat of Swainson's Warbler being scattered widely and being in remote locations. There is no information available to make generalizations of its current status or population changes over time.

Wayne's Black-throated Green Warbler

The Wayne's Warbler (*Dendroica virens waynei*) is a unique, disjunct subspecies of the Black-throated Green Warbler that is restricted to the South Atlantic Coastal Plain from southeastern Virginia to South Carolina. The nominate form (*D. v. virens*) breeds in coniferous forests across the northern latitudes of North America and through the higher elevations of the Appalachians. The Wayne's population is 500 km east of the nearest Appalachian population and 1,200 m lower in elevation.

The factors that lead to the isolation of the Wayne's form from the nominate race are not known. It is possible that this subspecies was originally associated with the extensive stands of Atlantic white cedar (*Chamaecyparis thyoides*) that were once an important component of the region's plant community. These stands were similar in form to the coniferous forests where *D. v. virens* currently breeds. Wayne's appears to reach its highest density from southeastern Virginia through northeastern North Carolina. This was the former location of the most extensive tracts of white cedar.

Most of the extensive stands of Atlantic white cedar were harvested prior to the description of the Wayne's form to science. How much the current pattern of habitat use (and our perceptions of habitat requirements) is influenced by the absence of white cedar is unknown. In the latter half of the twentieth century, the Wayne's subspecies has been suggested to utilize the entire gradient of forest types from Atlantic white cedar to bald cypress to mixed deciduous forest (Sprunt 1953, Meanley 1977). The population has also been suggested to have a close association with non-alluvial cypress swamps.

The only regular occurrence of Wayne's Warbler in Virginia is from the Dismal Swamp (Meanley 1977). High counts from the Dismal Swamp have ranged from 12 birds (Murray 1931) to 23 birds (Meanley 1977). This population is believed to have declined since historical time. A recent foray detected 5 birds in June (LeClerc 2001), but the validation of these birds as Wayne's rather than mountain nesting migrants is not certain. Additional reports of breeding birds, presumed to be the Wayne's race include a pair of nesting birds in the Roanoke Creek swamp of Charlotte county in 1933 (Handley 1937). Although this record appears to be much further west than the typical breeding of Wayne's Warbler, the early nesting date of April 20 coincides with the earlier timing of this subspecies to initiate breeding as compared to mountain populations.

Cerulean Warbler

The Cerulean Warbler has received an increased conservation focus in the past few decades due to evidence of dramatic population decline. Loss and fragmentation of forest breeding habitats are principally attributed to explain these declines. Cerulean Warblers are associated with mesic forest with tall tree canopies and an open understory (Hamel 200). In Virginia, this forest type occurs from 300 to 1000m elevation and includes cove and slope forests dominated by deciduous species such as sugar maple, white ash (*Fraxinus americana*), and tulip poplar among others.

Breeding season observations occur throughout the Blue Ridge Mountains and along the Mountain-Piedmont edge. There are regular occurrences in Blue Ridge Mountain counties such as Rockbridge (Murray 1944, 1949) and Wise (Murray 1935). Records along the Mountain-Piedmont transitional region and into the Piedmont include Albemarle County (Barger 1930, Scott 1953), Botetourt-Bedford County (Freer 1930), and in Hanover County on the Chickahominy River (Scott 1958).

Bay and Barrier Island

Barrier island systems contain some of the most naturally dynamic landscapes on earth. Shoreline stability within these systems often varies dramatically and results from a relatively small set of physical parameters. Along the mid-Atlantic coast, winter storms are the principal source of disturbance and may create landscape pattern by producing a patch mosaic of successional stages. Barrier islands contain unique habitats that are critical to the persistence of many colonial and beach-nesting bird populations. Many of these species occupy a range of disturbance/successional niches that are defined by the relationship between beach erosion (due to storms) and beach recovery (via succession). Over the past 25 years, populations of several waterbird species have declined dramatically within the Virginia barrier island chain. These declines represent not only a reduction in the number of pairs but also a reduction in the distribution of breeding sites. The underlying factors causing these

population changes are poorly understood. In order to reverse recent population trends, it is essential that the relative influence of abiotic (e.g. disturbance-driven habitat change) and biotic (e.g. predation) factors be separated within this system.

The importance of the Virginia barrier islands to beach-nesting waterbirds has been recognized for generations. The islands attracted bird collectors from all over the world and later were the focus of one of the first conservation projects of the National Audubon Society to protect waterbird populations. Surveys by early ornithologists provide glimpses of what populations were like in earlier times (e.g., Chapman 1903, Bent 1907). However, it is only in recent decades that we have been able to place the islands in the appropriate regional context and to evaluate population trends. Williams et al. (1990, 2005) have conducted annual surveys of colonial waterbirds along the island chain since 1975 documenting the location, size, and composition of individual colonies. Annual surveys of Piping Plovers (*Charadrius melodus*) were initiated in 1986 and Wilson's Plovers (*C. wilsonia*) in 1989 (Watts et al. 1995). Annual surveys of American Oystercatcher (*Haematopus palliatus*) were initiated in 2000 (Terwilliger and Cross 2000).

In recent years it has become evident that the Virginia barrier islands are the most important chain of barrier islands to colonial and beach-nesting birds in the mid-Atlantic region. A survey conducted in 1993 revealed that the site supported nearly 70,000 pairs of colonial waterbirds including 23 different species (Watts and Byrd 1998). The site supported more than 50% of the known Virginia population for 18 of these species and over 80% for 11 species. Seven of these species have been proposed for a status of "special concern" and 4 have been proposed for a status of "threatened" in Virginia. In addition to the colonial waterbirds, the site supports significant populations of the federally threatened Piping Plover, state endangered Wilson's Plover (Williams et al. 1990, Watts et al. 1996, Boettcher et al. 2007), and the largest breeding population of American Oystercatchers known (Wilke et al. 2005).

Piping Plover

Virginia supported between 6% and 13% of the federally threatened Atlantic Coast Piping Plover between the years of 1986-2005 (Boettcher et al. 2007). The Virginia population remained relatively static for the period of 1986-2003 but then sharply increased to 192 pairs over the next two years (Boettcher et al. 2007). In addition to the barrier islands, breeding pairs have been present at Craney Island in Portsmouth and the Grandview Nature Preserve in the City of Hampton. Piping Plovers have benefitted from a systematic protection and management of nesting sites that exclude nest predators.

Piping Plovers use wide, sparsely vegetated beaches that have recently been over washed from storm activity. In addition, used beach segments provided more direct access to backside island mudflats and marshes. Direct access to these habitats is most often associated with extensive breaks in the dune line caused by storm over wash. Access to backside wetland habitats has been shown to be an important modifier of space use in other populations of Piping Plovers (Haig and Oring 1985). Piping Plovers likely use these areas to gain greater access to additional foraging areas. In addition, backside mudflats and wetlands are considered important habitat for foraging and survival by recently fledged chicks

Historical records for this species are not as useful since they rarely contain systematic survey results but rather represent reports of presence/absence or small numbers of pairs. These records do not add much to the history of the species in Virginia.

Wilson Plover

Virginia represents the northern breeding range of the Wilson's Plover. It only occurs along the barrier island chain where it requires open, sparsely vegetated beaches that have been disturbed by storm wash over. The Virginia Barrier Islands have supported a range 35-49 breeding pairs (Watts et al. 1996). Between the periods of 1989-1995, Wilson's Plovers were found on 15 of the barrier islands and were from Fisherman and Cobb Islands. By contrast, Murray (1937) had 24-30 pairs likely nesting on Cobb islands in 1937. This comparison provides good example of the shifting of birds between islands across years in response to the opening and closing nature of ephemeral wash over habitats.

American Oystercatcher

At the beginning of the twentieth century, Virginia was considered the northern breeding range limit for the American Oystercatcher (Wilke et al. 2007). Populations to the north were eliminated from compounding effects of market hunting, egg collection and human disturbance. Bailey (1913) once commented that the American Oystercatcher in Virginia has become so scarce that it is likely the next species to be extirpated in the state. By the mid-1960s, this species began to expand northward into historical areas.

Virginia now supports the largest percentage of the American Oystercatcher population among the Atlantic Coast states. Wilke et al. (2005, 2007) estimated 588 pairs breeding along the Barrier Islands, Coastal Bays, and the Chesapeake Bay eastern and western shores. Most historical accounts for this species are limited to the Barrier Islands (McIlwaine 1939, Steirly 1954). Aside from more recent systematic surveys for the species (Wilke et al. 2005), the older records account for the appearance of a few individuals to larger concentrations. Watson (1983) documented 51 pairs along the Barrier Islands in 1983. William et al. (1990) counted nearly 800 birds in any one season during colonial waterbird surveys on the Barrier Islands. Historical accounts of habitat include shell beaches, salt marshes, and dredge spoil islands in locations that provide habitat for food and roosting (Wilke 2005).

Colonial Nesting Species

The Virginia Barrier Islands support a diverse assemblage of beach nesting colonial waterbirds. Population status and trends for this group are more complete than most other species because of annual systematic surveys from ground counts (Williams et al. 1990, 2005) and aerial survey efforts (Watts and Byrd 1998, Watts and Paxton 2009). These surveys have been able to document changes in population distribution, colony size, and overall population trends.

Results from these surveys have shown the collective waterbird community has declined 33% between 1993 and 2008 (Watts and Paxton 2009). Snowy Egret, Tricolored Heron, Cattle Egret, Green Heron, Yellow-crowned Night Heron, Glossy Ibis, Herring Gull, Laughing Gull, Gull-billed Tern, Royal Tern, Forster's Tern, Common Tern, and Black Skimmer all showed a consistent decline across this period.

Only species that have colonized the area since 1970 including White Ibis, Great Black-backed Gull, Double-crested Cormorant, and Brown Pelican have exhibited consistent increases.

Glossy Ibis

The Glossy Ibis was first found breeding in Virginia on Hog Island in 1956 (Bock and Terborgh 1957). The breeding population increased dramatically throughout the 1960s reaching a high by the mid-1970s (Custer and Osborn 1977). Since this time the species has steadily declined on the barrier islands (Williams et al. 1990). By 1993, the coastal plain population had been reduced by more than 50% from historic highs (Watts and Byrd 1998). Between 1993 and 2008, the population has declined by nearly 35% (Watts and Paxton 2008).

Great Blue Heron

Great Blue Herons appear to have increased dramatically over the past 30 years. In 1964As recently as 1964, only 5 colonies were reported for the Coastal Plain (Scott 1964). By 1984, the number of colonies known had increased to 31 colonies and was containing nearly 3,600 pairs (Beck unpubl. data). The 1993 survey detected 156 colonies supporting > 9,000 pairs (Watts and Byrd 1998). Since that time, Great-blue Herons have not been systematically surveyed because of fiscal constraints in covering the broad areas they now occupy. Over time, Great-Blue Heron colonies have increasingly nested closer to human habitation.

Great Egret

The Great Egret population has increased dramatically over the past 30 years and this trend appears to be continuing to present. Great Egrets have continued to move inland and now breed beyond the fall line into the Piedmont (Watts, per. Obs.). They often breed with mixed colonies with Great Blue Herons and other species. Between 2003 and 2008, the population has increased with both the seaside of the Delmarva and urban areas but has declined within the Bay island colonies (Watts and Paxton 2008).

Snowy Egret

Snowy Egret populations declined greatly due to demand of feathers from the millinery trade. During this time, they became extirpated from Virginia. The first evidence of recolonization was in 1941 when birds were discovered breeding on the seaside of the Delmarva (Murray 1952). By the mid-1950s, this species was documented in all geographic areas of coastal Virginia except the southside region (e.g. Grey 1950, Abbott 1955). However, since the 1970s breeding has been restricted to the seaside of the Delmarva and the offshore islands of the upper Bay. Numbers have declined steadily on the barrier islands since the mid-1970s. The coastal plain-wide survey in 1993 was comparable to the surveys of the mid-1970s (Watts and Byrd 1998). Between 1993 and 2003 the population declined by more than 60% (Watts and Paxton 2008).

Tricolored Heron

The Tricolored Heron was first documented to nest in Virginia when breeding birds were discovered on the seaside of the Delmarva in 1941 (Murray 1952). The species has declined on the barrier islands since that time (Williams et al. 1990). The population estimate of 1993 (Watts and Byrd 1998) was more than 50% reduced from that of the mid-1970s (Custer and Osborn 1977). Between 1993 and 2008, the population declined by 59.3% or an additional 25% since 2003. The decline is widespread with reduced numbers in most of the historic colonies.

Little Blue Heron

Historic breeding records for this species exist for all of the geographic regions of coastal Virginia (Grey 1950, Murray 1952, Abbott 1955). The species declined dramatically from the 1950s to the 1970s (and is now found only on the seaside of the Delmarva Peninsula and within 3 colonies on Chesapeake Bay islands (Watts and Paxton 2008).

Cattle Egret

The Cattle Egret was first found breeding in Virginia in 1961 (Scott and Cutler 1961). Colonization of Virginia was part of a rapid, broad-front range expansion that followed first establishment in North America. The Virginia population increased rapidly during the 1960s. Cattle Egrets experienced a dramatic decline between 1993 and 2008 within all breeding areas (Watts and Paxton 2008). Only 25 pairs were detected on islands within the Chesapeake Bay. Breeding is now restricted to just 4 colonies in Virginia.

Black-crowned Night Heron

The breeding population of Black-crowned Night Herons in coastal Virginia declined by an estimated 80% between 1975 (Custer and Osborn 1977) and 1993 (Watts and Byrd 1998). Within the barrier island/lagoon system, this trend continued through the 1998 survey (Truitt and Schwab 2001). However, the species increased throughout the broader Coastal Plain between 1993 and 2003 and this trend has continued through the 2008 survey (Watts and Paxton 2008).

Yellow-crowned Night Heron

The Yellow-crowned Night Heron likely bred in Virginia in the 1800s but was apparently absent by the early 1900's. The first modern breeding record for Virginia was in 1947 (Darden 1947). In Virginia, Yellow-crowns increased within urban areas of Norfolk, Hampton, Virginia Beach, and Portsmouth at least through the early 1990s (Watts unpublished data). Since 1993, the population has declined by more than 45% (Watts and Paxton 2008). Additional nesting has been documented in the Piedmont and Mountains and Valley provinces (Rottenborn and Brinkley 2005) as far back as 1933 in Roanoke (Handley 1937) and still exists near that town.

Great Black-backed Gull

The first evidence of breeding by the Great Black-backed Gull was found on Fisherman Island in 1970 (Scott and Cutler 1975). Since the 1970s, this species has rapidly colonized other locations on both the seaside and Chesapeake Bay islands (Watts and Paxton 2008). Between 1993 and 2008, the population has more than tripled in size and continued to expand in distribution. Although the stronghold continues to be within the seaside, nearly 20 colonies now occur within the Virginia portion of the Chesapeake Bay. New colonies can be found at the Hampton Roads Tunnel Island and along the Guinea Marshes in Gloucester County (Watts and Paxton 2008).

Herring Gull

The first nesting incidence for the Herring Gull occurred by the finding of a single nest near Cobb Island in 1948 (Murray 1952). The 1993 survey located 35 colonies supporting an estimated 8,800 pairs (Watts and Byrd 1998).. The breeding population on the barrier islands apparently reached a high in the late 1980s and has shown evidence of a decline since that time (Williams et al. unpublished data). Between 1993 and 2008 the Coastal Plain population declined by an estimated 66.9% or an additional 20% since 2003. Consistent declines were observed in both regions where breeding was documented in 1993. The 2003 survey (Watts and Paxton 2008) showed continued declines within the barrier island/lagoon system between 1993 and 1998 (Truitt and Schwab 2001). In recent years, new colonies have been recorded on the Hampton Roads Tunnel Island.

Laughing Gull

Laughing Gulls are the numerically dominant colonial waterbird in Virginia (Watts and Paxton 2008). Between 1993 and 1998, there was a very small decline in numbers on the seaside of the Delmarva Peninsula (Truitt and Schwab 2001). The barrier island population has exhibited considerable variation since the mid-1970s but overall has shown declines through 2008 (Watts and Paxton 2008). Historic colony sites within the southern portion of the Delmarva seaside continue to go unused or are much reduced. The strongholds for the population continue to be supported within patches of high marsh but these habitats may be experiencing changes in tidal influence.

Royal Tern

Royal Terns have apparently always been the most abundant of the large terns in Virginia. Like many of the other terns, their numbers have fluctuated widely through the years due to natural and human perturbations. Royal Terns have declined on the barrier islands since the early 1980s (Williams et al. 2005). Since 1993, the number of breeding pairs has declined 48.1%. Since 2003, numbers have increased slightly on the seaside, have declined dramatically on the Bay islands, and have colonized urban areas. The expanding colonies on the Hampton Roads Bridge Tunnel Island and Grandview Beach now represent more than 25% of the state population.

Least Tern

Least Tern colonies have been documented the most widely among the tern species. They have been documented to occur up major tributaries near tidal fresh portions of the Bay. Scott has 42 Least Tern nests in Seaford in (Scott 1953). Grey documented multiple colonies ranging from 12-65 nests in Virginia Beach between the years of 1938-1945. Scott reported a 150 bird colony on Craney Island in Portsmouth in 1969. Between 1993 and 2003 the population declined 28% from 1171 to 843 breeding pairs. However, between 2003 and 2008 the population increased 42% to 1258 (Watts and Paxton 2008). For the first time in Virginia, colonies were located on roof tops in urban areas with colonies located on both Lynnhaven and Patrick Henry Malls in Virginia Beach and Newport News, respectively.

Gull-billed Tern

The Gull-billed Tern has experienced extreme population swings in coastal Virginia. In the mid-1800s this species was considered to be abundant along the barrier islands but were reduced by the early 1900s by hunters supplying the millinery trade (Bailey 1913). Throughout the early 1900s numbers remained very low (Austin 1932). By the mid-1970s numbers appear to have recovered to those comparable with the 1800s. By 1993, the population had declined once again to approximately 20% of 1970s levels (Watts and Byrd 1998). Between 1993 and 2008 the number of occupied colonies declined from 30 to 10 and the number of breeding pairs declined by 48.7% (Watts and Paxton 2008). The species is now restricted to shell piles within the barrier island/lagoon system and to a single colony on the Hampton Roads Bridge Tunnel.

Caspian Tern

There is some evidence that Caspian Terns once bred in greater numbers along the Virginia barrier islands than they have from 1900 to present (Weske et al. 1977). Egging and hunting apparently reduced their numbers in the 1880s to a low from which they have never fully recovered. Since 1900, Caspian Terns have been documented in very low numbers breeding in scattered locations along the seaside and occasionally on Chesapeake Bay islands (Watts and Paxton 2008). They appear to be present consistently since the mid-1970s. In 1993 only 7 pairs were documented in 5 locations. During the 2003 survey, only a single pair was documented. In 2008, 2 pairs were documented in the upper Bay.

Double-crested Cormorant

Breeding of the Double-crested Cormorant in Virginia was first confirmed in 1978 on a small vegetated island in the James River near Hopewell (Scott 1978). Colonization of Virginia represents an expansion beyond the historic range following a low during the DDT era (1940s-1972) (Hatch and Weseloh 1999). After 1984, the Virginia population expanded rapidly to 5 colonies by 1995 containing more than 400 pairs (Watts and Bradshaw 1996). The seaside of the Delmarva was not colonized until 1995 (Watts and Paxton 2008). Between 1993 and 2008 the population increased by 5-fold from 354 to 1,991 pairs (Watts and Paxton 2008). Three colonies now exist on the seaside including 2 on duck blinds in Chincoteague Bay.

Brown Pelican

The Brown Pelican was first found breeding in Virginia on Fisherman Island and Metompkin Island in 1987 (Williams 1989). Since that year, breeding colonies on the barrier islands has been restricted to Fisherman Island. In recent years, a colony has formed on Sandy Island near the north end of Hog Island on the seaside (Watts and Paxton 2008). Colonization of Virginia represents a northward range expansion from North Carolina that extends beyond the historic range and follows recovery of southeastern populations from contaminants. Between 1993 and 2008 the Virginia population increased over 5 orders of magnitude from an estimated 368 to 1,924 breeding pairs. The Fisherman Island colony has increased and then declined over this time period.

Other Species

Purple Sandpiper

The Purple Sandpiper breeds in the Canadian Arctic but has the most northward winter range limit of any shorebirds species that includes the Great Lakes and the Atlantic Coast from Newfoundland to South Carolina. In winter, this species utilizes rocky coastlines. The creation of man-made habitats such as rocky jetties, break waters, and rip rap placed along shorelines has enabled this species to extend its southern winter range into new areas. In Virginia, winter records for this species are almost always documented in artificial rocky habitats. Purple Sandpipers were regularly observed in places such as Little Creek, the Chesapeake Bay Bridge Tunnel Islands, Craney Island, and Norfolk.

Because this species is generally found scattered in various locations in small flocks in winter (a few to 30 birds at a location) the best general accounts have been documented from Annual Christmas Bird Counts. The highest annual count in winter was in 1884-1885 when 270 birds were observed (Kain 1986). Counts during other years are generally similar and can include 100-220 birds.

Bald Eagle

The Chesapeake Bay region is a significant support area for breeding, wintering, and migratory Bald Eagles in the eastern United States. In addition to supporting a resident population, the Bay is a convergence area for birds that emanate from the Northeast and the Southeast U.S. during their non-breeding season. Prior to European Settlement, the Bay was estimated to be the largest population center for Bald Eagles outside of Alaska (Watts et al. 2007). In 1936, the Bald Eagle population in the bay was estimated to be 600-800 breeding pairs (Byrd et al. 1990). The population declined dramatically after that point in response to multiple factors that includes land development, hunting , collecting, persecution, and the bioaccumulation of biocides such as DDT (Watts et al. 2007). Aerial surveys suggested that the breeding population in the Bay declined to 150 pairs by 1962. This included an estimate of 80-90 pairs in Virginia (Abbot 1978). After reaching a low in the mid-1970s, Bald Eagles in the Bay have recovered to levels documented in the 1930s (Watts et al. 2007). In 2011, the Virginia Bald Eagle population within the coastal reached 726 occupied territories (Watts and Byrd 2011).

Historical records for Bald Eagles outside of systematic surveys conducted by Tyrell (1936), Abbot (1978) and Watts and Byrd (2011) do little to tell the conservation story of the species in Virginia. This species has been provided one of the most focused efforts for conservation by federal and state agencies and the conservation community than any other species in Virginia.

Peregrine Falcon

The historic status of Peregrine Falcons in Virginia is not completely known. From published records and accounts, there have been 24 historical Peregrine eyries documented in the Appalachians of Virginia (Gabler 1983). These sites were all located on rocky mountain faces. Two additional nesting sites were documented on old osprey nests along the Virginia portion of the Delmarva Peninsula.

The Virginia Peregrine Falcon population has gone through both a decline and recovery phase that included a shift from historical eyries natural locations in the mountains to a current status of utilizing artificial nesting structures. The historic population of peregrine falcons was impacted by a host of factors. Great-horned owls are known to be a natural enemy of peregrines and prey on chicks. Humans collected eggs from eyries, hunted both adults and young, and destroyed many nesting sites. However, prior to the 1940's, the breeding population appears to have been relatively stable. It was not until the post-World War II period that peregrine populations began to show signs of a precipitous decline. The principal factor in this decline was the widespread use of organochlorine pesticides, such as DDT and DDE among others that began in the 1940s. These compounds are stable, persistent compound that are stored in fatty tissues that can cause direct mortality of adults and responsible for reproductive failures to their effect on egg-shell thinning. The decline in the Peregrine Population was widespread and was believed to be extinct in Virginia as a breeding species by the early 1960's.

Following the ban of DDT and similar compounds in the 1970's and an intense reintroduction effort in the state, the peregrine falcon population in Virginia has made a slow but steady recovery. From a single breeding pair in 1981 on Assateague Island, the breeding population is now 25 pairs (Mojica et al. 2011). The current population of peregrine falcons known to breed in Virginia is currently centered on the Coastal Plain. All known pairs in the coastal plan nest on artificial structures. A concurring program to reintroduce Peregrine Falcons into the mountains has had early success and resulted in 4 breeding territories in 2011 (Mojica et al. 2011).

Acknowledgements

This project was funded by the State Wildlife Grants Program through the Virginia Department of Game and Inland Fisheries (VDGIF). We thank Rick Reynolds, Raymond Fernald, and Fred Leckie of DGIF for administration and oversight of the project. We also are grateful for the literature search and GIS digitizing performed by data technicians at the Center for Conservation Biology including Carla Schneider, Emily Brault, and Andrew McCann. In addition, we thank Erica Lawler, Jane Lopez, and Cindy Corbett in

the William and Mary Sponsored Programs Office for additional administrative help throughout the project.

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Appendix I – Metadata with examples for attributes of the Virginia Avian Heritage Database.

Database Fields

(field names in bold; text in *Italics* are provided for examples; definitions for variables marked with * provided at end of list):

Species *GWWA*

Source *Raven*

Year of Publication 1982

Issue *Raven 53:3-15*

Author *Scott, F. R.*

Title *The third foray to Mt. Rogers, June 1980*

Observer *Unknown, many, author, the name*

Year Observed *1981*

Date of Observation *6/19*

Season *Breeding, Winter, Migration*

***Breeding Status** *confirmed, probable, possible, observed*

Number Observed *15 pairs*

Study Area *10 ha*

***Type of Information** – *Census, anecdotal, other scientific study (e.g., breeding study), checklist*

***Extent of Information** – *comprehensive census, subsample*

Geographic Accuracy - *County, TopoQuad, Atlas Grid, Proper Name, Coordinate*

Location

1) County

2) Topo Quad

3) Atlas Grid

4A-1) Proper Name (*e.g., Mountain Peak, Cove, Park, Refuge*)

4A-2) Secondary Proper Name

4B-1) Site Description

5) Road or Intersection

6) Geographic Coordinates

*Habitat

- 1) Level I
- 2) Level II

*Keywords (enter either y or n for each)

Anecdotal Record
Distribution
Habitat Requirements
Breeding Biology
Nesting Record
Nest Site Characteristics
Foraging Ecology
Mortality
Population Size
Trend
Conservation and Management
Study Techniques

*Definitions

Breeding Status: This field is only used for breeding season records to describe the level of observation. There are four possibilities;

- 1) Observed – a species is observed during the breeding season but there is no specific information to determine its breeding status.
- 2) Possible – a species or singing male was observed in suitable nesting habitat
- 3) Probable - a pair of birds was observed in suitable nesting habitat
 - a permanent territory was presumed through behavior and two or more sightings days apart.
 - Courtship behavior or copulation was observed
 - Bird was seen visiting a probable nest site
 - Agitated behavior from adults in response to nest area intrusion
- 4) Confirmed
 - Adults carrying nest material
 - Nest building observed
 - Physiological evidence (brood patch)
 - Distraction display observed
 - Nests or eggshells found
 - Precocial or flightless young observed
 - Recently fledged young found
 - Occupied nests found
 - Adults seen carrying food
 - Adult feeding fledglings
 - Nest with eggs or young discovered

Type of Information: This field describes general context of a report. There are three possibilities

- 1) Census is a broad-based survey specifically intended to provide information on population size or distribution.

- 2) Anecdotal describes a single observation. This is typically limited to a nest being discovered, visitation to a feeder, or a quick “off the cuff” observation
- 3) Scientific study describes a source where the information was part of an investigation not intended to provide geographical distribution or abundance information. One example could include a breeding productivity or habitat use study of a species.

Extent of Information: This field is used to describe population-based surveys. There are two possibilities

- 1) Comprehensive survey – a foray or broad-based effort to determine abundance or distribution. Examples are the VSO forays or a multi-county survey of Bachman’s Sparrow conducted by CCB
- 2) Subsample – a relatively smaller, isolated effort that examines population density in one or only several habitat patches. A good example is a scientific study that examines Brown-headed Nuthatch breeding density by surveying a systematic sample of habitats. This study was not intended to provide broader scale population information even if it can be used to do so.

Keywords: The fields will be used as keywords in a bibliographic database. Each Y in the field will be recoded by the variable name after the database is complete.

Anecdotal Record – provides only a single observation

Distribution – provides information to the geographical position of a record

Habitat Requirements – description of habitat use provided

Breeding Biology – information on reproductive rates (eggs, young, fledglings produced), courtship behavior

Nesting Record – a nest, nest building, or young were observed

Nest Site Characteristics – description of nest or nesting habitat

Foraging Ecology – data on diet or foraging methods

Mortality – data on death rates, observations of dead birds, or causes of mortality

Population Size – data on abundance over broad area

Trend – information on changes in population size including general comparisons with historical patterns (e.g., a statement in the source that a species was not observed during the foray of 1979 but was found in 1962).

Conservation and Management – record has specific recommendations towards conserving, protecting, or managing species.

Study Techniques – record provides information that can be used to study a species. For example, “the effect of moonlight on detection rates of marsh birds”, or even less specific such as an anecdotal record that states a species was never heard after 10am.

Habitat (Level I and Level II indented) (USGS Anderson System Level II *plus*)

1 Urban

2 Agricultural

21 Cropland and Pasture

22 Orchards, Groves, Vineyards, Nurseries, Ornamental Horticulture

23 Confined Feeding Operations

24 Other Agricultural Land

3 Early Successional

31 Grassland

32 Shrub and Brush

33 Mixed Early Successional

4 Forested Land

41 Deciduous Forest

42 Evergreen Forest

421 Planned/Planted Evergreen Forest

422 Natural Evergreen Forest

43 Mixed Forest Land

5 Water

51 Streams and Canals

52 Lakes

53 Reservoirs

54 Bays and Estuaries

6 Wetland

61 Forested Wetland

611 Pocosin (aka shrub bogs, have: pond, loblolly and longleaf pines,

612 Cypress Swamps

613 Bottomland Hardwood Forest

62 Nonforested Wetland

621 Shrubby Wetland

622 Freshwater Wetland

623 Salt Marsh

6231 High Marsh

6232 Intertidal Marsh

6233 Subtidal Marsh

7 Barren Land

71 Dry Salt Flats

72 Beaches

73 Sandy Areas other than Beaches (includes sand bar, dune)

74 Bare Exposed Rock

75 Strip Mines Quarries, and Gravel Pits

76 Transitional Areas

761 Barrier Island Wash-over

77 Mixed Barren Lan