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Birds (Introduction)

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Birds

by

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Introduction

The avifauna of Virginia presently consists of 411 species of which 390 occur regularly, and 21 might occur hypothetically, in the state. Of these species, 209 are known to breed in Virginia and several others likely do so. Many of these species occur in all of the five physiographic provinces of the state whereas others are restricted to only one or some of the provinces. In 1978, the Committee on Birds for the Symposium on Endangered and Threatened Plants and Animals of Virginia, developed a list of 40 species for special consideration that were classified as either endangered, threatened, or of special concern. Of the species on that list, 11 were not listed in 1989 for a variety of reasons.

In 1989, the Committee developed a list of 54 species for special consideration of which 12 were classified endangered, 5 threatened, and 14 of special concern. An additional 23 species were listed as status undetermined. Further study and information about the population levels of this latter group of species may justify their placement at a later date in one of the other categories. Thus, 15 percent of the breeding species of

the state are considered to be either threatened, endangered, or of special concern. Data on an additional 11 percent of these species are not adequate to permit assigning them to one of the three categories at this time.

The Committee felt that it could not adequately evaluate the status of a species which does not breed within the state. Species designations were, therefore, considered only for those species which breed within the Commonwealth. Of all the species which occur in the state, none is endemic solely to Virginia.

There are many species for which detailed distributional and breeding data are not available. The Virginia Breeding Bird Atlas Project, financed by the Virginia Department of Game and Inland Fisheries, has filled many gaps in our knowledge of breeding birds as have data from the Virginia Natural Hertiage Program.

All of these data made it possible to delete species from the 1978 list and to change the status of others. New and expanded knowledge also permitted the addition of species to the list in 1989. A comparative ranking of the species listed during the two symposia are presented in Table 1 and a discussion of each group follows.

Table 1. Bird species classified as endangered, threatened, of special concern, and status undetermined in Virginia, 1978 and 1989.

	1978	1989
PELECANIFORMES		
Pelecanidae		
Brown pelican (*Pelecanus occidentalis*	not listed	threatened
CICONIIFORMES		
Ardeidae		
American bittern (*Botaurus lentiginosus*)	status undetermined	not listed
Least bittern (*Ixobrychus exilis*)	status undetermined	status undetermined
Great blue heron (*Ardea herodias*)	special concern	not listed
Great egret (*Casmerodius albus*)	special concern	special concern
Little blue heron (*Egretta caerulea*)	special concern	special concern
Tricolored heron (*Egretta tricolor*)	not listed	special concern
Black-crowned night heron (*Nycticorax nycticorax*	special concern	not listed
Yellow-crowned night heron *Nycticorax violaceus*)	status undetermined	threatened
Threskiornithidae		
Glossy ibis (*Plegadis falcinellus*)	special concern	special concern
FALCONIFORMES		

	1978	1989
Accipitridae		
Osprey (*Pandion haliaetus*)	threatened	not listed
Bald eagle (*Haliaeetus leucocephalus*)	endangered	endangered
Northern harrier (*Circus cyaneus*)	not listed	endangered
Sharp-shinned hawk (*Accipiter striatus*)	threatened	status undetermined
Cooper's hawk (*Accipiter cooperii*)	status undetermined	status undetermined
Red-shouldered hawk (*Buteo lineatus*)	special concern	not listed
Falconidae		
American kestrel (*Falco sparverius*)	threatened	not listed
Peregrine falcon (*Falco peregrinus*)	endangered	endangered
GRUIFORMES		
Rallidae		
Black rail (*Laterallus jamaicensis*)	not listed	status undetermined
King rail (*Rallus elegans*)	not listed	status undetermined
Virginia rail (*Rallus limicola*)	not listed	status undetermined
Common moorhen (*Gallinula chloropus*)	status undetermined	status undetermined
CHARADRIIFORMES		

	1978	1989
Charadriidae		
Wilson's plover (Charadrius wilsonia)	threatened	endangered
Piping plover (Charadrius melodus)	threatened	endangered
Scolopacidae		
Spotted sandpiper (Actitis macularia)	not listed	status undetermined
Upland sandpiper (Bartramia longicauda)	threatened	endangered
Laridae		
Gull-billed tern (Sterna nilotica)	threatened	threatened
Caspian tern (Sterna caspia)	not listed	special concern
Royal tern (Sterna maxima)	special concern	not listed
Sandwich tern (Sterna sandvicensis)	special concern	special concern
Forster's tern (Sterna forsteri)	special concern	special concern
Least tern (Sterna antillarum)	threatened	threatened
CUCULIFORMES		
Cuculidae		
Black-billed cuckoo (Coccyzus erythropthalmus)	status undetermined	not listed
STRIGIFORMES		
Tytonidae		
Common barn-owl (Tyto alba)	status undetermined	special concern

	1978	1989
Strigidae		
Long-eared owl (*Asio otus*)	not listed	status undetermined
Short-eared owl (*Asio flammeus*)	not listed	status undetermined
Northern saw-whet owl (*Aegolius acadicus*)	not listed	status undetermined
PICIFORMES		
Picidae		
Yellow-bellied sapsucker (*Sphyrapicus varius*)	status undetermined	not listed
Red-cockaded woodpecker (*Picoides borealis*)	endangered	endangered
PASSERIFORMES		
Tyranidae		
Yellow-bellied flycatcher (*Empidonax flaviventris*)	not listed	status undetermined
Alder flycatcher (*Empidonax alnorum*)	status undetermined	status undetermined
Hirundinidae		
Bank swallow (*Riparia riparia*)	not listed	special concern
Cliff swallow (*Hirundo pyrrhonota*)	special concern	special concern
Sittidae		
Red-breasted nuthatch (*Sitta canadensis*)	not listed	status undetermined
Certhiidae		
Brown creeper (*Certhia americana*)	not listed	status undetermined

	1978	1989
Troglodytidae		
Bewick's wren (Thryomanes bewickii)	threatened	endangered
Winter wren (Troglodytes troglodytes)	not listed	status undetermined
Sedge wren (Cistothorus platensis)	special concern	endangered
Muscicapidae		
Golden-crowned kinglet (Regulus satrapa)	not listed	status undetermined
Eastern bluebird (Sialia sialis)	special concern	not listed
Swainson's thrush (Catharus ustulatus)	not listed	status undetermined
Hermit thrush (Catharus guttatus)	not listed	status undetermined
Laniidae		
Loggerhead shrike (Lanius ludovicianus)	threatened	endangered
Vireonidae		
Warbling vireo (Vireo gilvus)	special concern	not listed
Emberizidae		
Golden-winged warbler (Vermivora chrysoptera)	not listed	status undetermined
Magnolia warbler (Dendroica magnolia)	not listed	status undetermined
Black-throated Green Warbler (Dendroica virens)	special concern	not listed
Swainson's warbler (Limnothlypis swainsonii)	not listed	threatened

	1978	1989
Mourning warbler (*Oporornis philadelphia*)	not listed	special concern
Dickcissel (*Spiza americana*)	status undetermined	status undetermined
Bachman's sparrow (*Aimophila aestivalis*)	not listed	endangered
Grasshopper sparrow (*Ammodramus savannarum*)	special concern	not listed
Henslow's sparrow (*Ammodramus henslowii*)	threatened	endangered
Sharp-tailed sparrow (*Ammodramus caudacutus*)	not listed	special concern
Swamp sparrow (*Melospiza georgiana*)	not listed	status undetermined
Fringillidae		
Purple finch (*Carpodacus purpureus*)	not listed	special concern
Red crossbill (*Loxia curvirostra*)	not listed	special concern

Endangered Species

The 1978 symposium listing included three endangered species, the bald eagle (Haliaeetus leucocephalus), peregrine falcon (Falco peregrinus), and red-cockaded woodpecker (Picoides borealis). All of these species are still considered endangered although the bald eagle has shown impressive gains in the number of breeding pairs and the peregrine falcon has been successfully reestablished as a breeding species.

Nine new species appear on the endangered list including the Northern harrier (Circus cyaneus), Wilson's plover (Charadrius wilsonia), Piping plover (Charadrius melodus), Upland sandpiper (Bartramia longicauda), Bewick's wren (Thryomanes bewickii), Sedge wren (Cistothorus platensis), Loggerhead shrike (Lanius leudovicianus), Bachman's sparrow (Aimophila aestivalis), and Henslow's sparrow (Ammodramus savannarum).

The northern harrier has been found to breed regularly in small numbers in the coastal marshes of Virginia. Its limited numbers and restricted breeding habitat place it in endangered status. Both Wilson's and piping plovers continue to exhibit population declines and both live largely on the fragile environments of barrier island beaches. Upland sandpiper populations are confined to a few widely separated breeding habitats. Changing agricultural conditions threaten this species and limit its distribution. Bewick's wren numbers have declined to a level at which it is questionable that a viable population exists in the state. The reasons for this decline are not at all clear. Sedge wrens breed only in a few marsh environments. The

loggerhead shrike population has reached very low numbers and is confined largely to the Shenandoah Valley. Bachman's sparrow populations were never large and it now appears that this species may only breed sporadically in the state. Henslow's sparrow formerly breed at a number of Virginia localities but now appears to occur at only two locations in the state.

Threatened Species

The 1978 symposium proceedings listed eleven species as threatened. Six of these species have been elevated to endangered status as indicated in Table 1 and as discussed above.

The osprey (Pandion haliaetus) population essentially has tripled since 1975, resulting in its being delisted. Increased knowledge of the breeding distribution of American kestrels (Falco sparverius) resulted in its being removed from the list of species.

Meagre and conflicting information on the breeding distribution of the sharp-shinned hawk (Accipiter striatus) suggested that it be considered of uncertain status.

Both the gull-billed tern (Sterna nilotica) and the least tern (Sterna antillarium) continue as threatened species because of population numbers and the fragile and restricted nature of their sandy beach habitat.

Special Concern

A number of changes in the status of species previously of special concern in 1978 were made. Eight species, including the great blue heron (Ardea herodias), black-crowned night heron (Nycticorax nycticorax), red-shouldered hawk (Buteo lineatus),

royal tern (Sterna maxima), eastern bluebird (Sialia sialis), warbling vireo (Vireo gilvus), black-throated green warbler (Dendroica virens), and grasshopper sparrow (Ammodramus savannarum) were delisted because new data indicated that this was justified on the basis of population data that became avilable during the intervening years.

Six species that were of special concern in 1978 were continued in this category in 1989. Five of these species, the great egret (Casmerodias alba), little blue heron (Egretta caerulea), glossy ibis (Plegadis falcinellus), sandwich tern (Sterna sandvicensis), and Forster's tern (Sterna fosteri) occupy sensitive marsh and beach habitats where they are subject to impact from tidal innundation, erosion, and modification by a rapidly growing human population, necessitating their retention as species of special concern. The cliff swallow (Hirundo pyrrhonota) continues as a species of special concern because of declining habitat and often, poor reproductive success.

One species, the sedge wren (Cistothorus platensis) has shown serious declines in both numbers and breeding range. This species is now so rare in Virginia that it should be considered endangered.

Status Undetermined

A total of 24 other species which were not on the 1978 list was considered for listing. After careful deliberation by the Committee, it was felt that information on the distribution and population numbers of 23 of these species was inadequate to evaluate. Some of these species have only recently been

confirmed as breeding within the states but their total distribution and number are unknown. Some of them such as the northern saw whet owl (Aegolius acadicus), Swainson's thrush (Catharus ustulatus), hermit thrush (Catharus guttatus), and purple finch (Carpodacus purpureus) breed at high altitudes and should be sought at these elevations. All are listed in Table 1 as species of unndetermined status in 1989. All are candidates for consideration for listing in the future as more is learned about them.

Bachman's sparrow (Aimophila aestivalis) was not listed in 1978 because of inadequate knowledge of the species. Extensive study of the species has been conducted in the last decade. These studies indicate that this species is confined to a few localities in southside Virginia. For this reason it was listed as endangered.

The 1989 Committee on Birds consisted of Mitchell A. Byrd (Chairman), Ruth A. Beck, Dana S. Bradshaw, James L. Fraser, Sue E. Ridd, and John W. Williams. Special appreciation is extended to Jamie Doyle for assistance with editing the species accounts.

Endangered Birds in Virginia

Birds do, of course, represent a highly mobile component of the Commonwealth's fauna. Many of the species which breed in Virginia have a wider breeding distribution that includes other parts of the country. Many additional species do not breed in Virginia but occur in the state either as transients or winter residents.

There are many species for which detailed distributional and breeding data are not available. The Virginia Breeding Bird Atlas Project, financed by the Virginia Department of Game and Inland Fisheries, has filled many gaps in our knowledge of breeding birds as have data from the Virginia Natural Heritage Program.

There are at least two species of now extinct birds which formerly occurred in Virginia during the historic period. Both the passenger pigeon (Ectopistes migratorius) and Carolina parakeet (Conuropsis carolinensis) were reported in Virginia. Although there appear to be no documented records of the great auk (Pinguinus impennis) in the state during the historic period, the wintering area for the species extended along the Atlantic coast to Florida, and it is likely that the great auk appeared infrequently in the coastal waters of Virginia.

The peregrine falcon (Falco peregrinus) was extirpated as a breeding bird in the state by the mid-1960s and exists today only through reintroduction. The roseate tern (Sterna dougallii) has not been documented as a breeding bird in Virginia since 1927 and Bachman's sparrow (Aimophila aestivalis) has not been documented as nesting in the state since 1986. Both of these species may have been eliminated as breeding birds within the state.

A number of species reach the limits of their breeding range in Virginia where they are uncommon. Many of these species do not appear to be in serious trouble in other parts of their breeding range. If the species appears to be a regular established breeder in the state but has shown erratic or

declining numbers in recent years, it is included on the list.

Four species which breed or have occurred in Virginia are on the Federal List of Endangered Species. The peregrine falcon formerly bred in the mountains of Virginia and, in a few cases, in eastern Virginia. Most of the North American population of this falcon is currently listed as endangered. The species now breeds each year in Virginia only as a result of extensive reintroduction efforts.

The southern bald eagle (Haliaeetus leucocephalus) is considered endangered throughout its range. Because of high levels of pesticide contamination, the Chesapeake Bay bald eagle population declined dramatically by the early 1970s. From a minimal estimated population of 150-200 pairs in 1936 (Tyrrell, 1936), the number of breeding pairs declined to 66 in 1971. This population had increased to 80 pairs in 1977. Thirty two of these pairs occurred in Virginia. The number of breeding pairs had increased to 92 in 1989. Bald eagle habitat is being eliminated at an alarming rate in the Chesapeake Bay basin. For this reason, the population should be carefully monitored in the future.

The third endangered species on the Federal List is the red-cockaded woodpecker (Picoides borealis). It essentially reaches the northern limit of its present breeding range in Virginia although the breeding range once extended into Maryland. There are few historical data to document the extent of its former breeding range in the state, although there is some evidence that formerly it was more abundant from Suffolk to Brunswick County

than is now the case. It depends entirely on large stands of live, mature loblolly pine (Pinus taeda) for nesting habitat. Its long-term survival in Virginia appears unlikely at best.

A fourth species, Bachman's warbler (Vermivora bachmanii), has been reported rarely in the state at a few localities but does not breed in Virginia.

A number of species of wading and beach nesting birds are listed as being of special concern. Some of these species, particularly the gull-billed tern (Sterna nilotica) and the little blue heron (Egretta caerulea) have shown population declines over the past 10 years. The glossy ibis (Plegadis falcinellus) has shown a population decline in Virginia during the past decade, but this may reflect only a population shift to more northern areas. All of this group of species, including the gull-billed tern, least tern (Sterna albifrons), great egret (Casmerodius albus), tricolored heron (Egretta tricolor), sandwich tern (Sterna sandvicensis), Forster's tern (Sterna forsteri), and Caspian tern (Sterna caspia) are associated with restricted coastal habitats, particularly the barrier islands.

During the past decade there also appears to have been major shifts of populations of some beach nesting species such as the common tern (Sterna hirundo) and black skimmer (Rynchops niger) which have moved to marsh habitats as well as man-made habitats such as the artificial islands of the Hampton Roads Bridge Tunnel. Although these two species are not on the list of endangered or threatened species, they do demonstrate the ability of some coastal species to shift from typical, natural habitats

to less typical, natural and sometimes artificial habitats. Most sand nesting species exist in greatest numbers on the outer barrier islands and on dredge spoil areas. Since the barrier islands are protected to a great extent through ownership by the Nature Conservancy and state or federal governments, they are protected from high levels of human intrusion and development activities. These islands, however, are very tenuous and fragile environments and are highly susceptible to erosion and innundation by tidal waters. In artificially disturbed environments, such as dredge spoil areas, natural vegetative succession frequently makes these areas unsuitable over time for sand nesting species of birds. In turn, however, these disturbed areas may become suitable nesting habitats for species of herons which utilize bushes for nesting. These areas should be managed properly to maintain them in the most suitable state for species of concern.

Because so many species of birds have reached very low population numbers, biologists have found it necessary to seek new and innovative techniques for their management. These procedures may well extend beyond conventional management systems which usually include such actions as legal protection and habitat manipulation. The reintroduction of species such as the peregrine falcon through the innovative technique of hacking is an example of such a management strategy. Hacking involves the slow introduction of captive-reared birds from captivity to a wild state. Fostering and cross fostering of eggs and young are other examples of effective management techniques.

Most of these techniques are usually implemented as a last resort when populations have reached very low levels. Although they may be effective in reestablishing or stabilizing a population, they may not bring about a long range secure future for the species unless the environmental problems which placed it in danger in the first place are corrected.

Population Decline in Birds

There are many reasons why populations of bird species have declined within the state and nation to a point at which they have reached endangered or threatened status. Most of these reasons relate directly to the intentional or unintentional manipulations of natural ecosystems by man. Most of these factors which relate to changing dynamics of populations may be categorized into two groups (Temple, 1977):

(1) factors that reduce survivorship in the population (e.g., overharvesting, increased rates of predation, reduction of suitable habitat); and

(2) factors that reduce fecundity in the population (e.g., competition for nesting sites, reproductive dysfunctions caused by toxic chemicals, and reduction of habitats required for breeding or for other phases of the life cycle).

Recovery of any endangered species will be contingent on the degree to which these detrimental factors may be reduced or eliminated.

Two factors which appear to be fundamental to the decline of a number of species of birds in Virginia are

(1) the presence of environmental contaminants, especially

synthetic pesticides, and (2) the modification and destruction of habitats.

Contaminants - Synthetic Pesticides

Prior to World War II, most organic pesticides were derived from plant tissues. Thus, pyrethrum was obtained from chrysanthemums, nicotine from tobacco and rotenone from the roots of legumes. Since World War II, the great majority of pesticides have been organic compounds synthesized in chemical laboratories. Many of these pesticides, such as the chlorinated hydrocarbons, were persistent and remained active or toxic for many years either in soil or water (Owen, 1985).

The organic pesticide industry grew at a fantastic rate during the post war years. By the mid-1980s more than four billion pounds of pesticides were being used annually worldwide . This amounted to one pound of pesticide for each person on earth. In 1981, for example, the United States produced 1.4 billion pounds of synthetic organic pesticides; the level of production has increased since then. On a global basis, the use of pesticides will probably continue to expand because of the food requirements of the sharply increasing population of humans.

One of the more significant synthetic pesticides, DDT, was developed during World War II for mosquito control. Other related chlorinated hydrocarbon pesticides are dieldrin and endrin. The adverse effects on birds of some of these compounds have been well documented. With the production of persistent chlorinated hydrocarbons in the mid-to-late 1940s and their introduction into the environment, there was a parallel decrease

in the populations of raptors in Europe and North America.

In Britain's peregrine falcon, golden eagle (Aquila chrysaetos) and sparrowhawk (Accipiter nisus) populations, anomalies such as increased numbers of cracked or broken eggshells of unhatched young were observed in nests during the period 1951 to 1966, as compared to those in the period 1940 to 1950 (Ratcliffe, 1967). Ratcliffe (1967), using a "thickness index", found that peregrine falcon, golden eagle, and sparrowhawk eggs had significantly lower values (i.e., the egg shells were thinner), during the period 1947 to 1967 than in the period 1900 to 1946.

In controlled laboratory experiments, dosing American kestrels (Falco sparverius) with dieldrin and DDT resulted in a significant decrease in eggshell thickness (Porter and Wiemeyer, 1969). Similar results in American kestrels were also found when DDE was used (Porter and Wiemeyer, 1970). The conclusive evidence for shell thinning came when Peakall (1970) and Bitman et al. (1970) simultaneously reported that DDE caused decreased levels of carbonic anhydrase which controls hydration of carbon dioxide, providing carbonate ions for shell formation in the oviduct. With reduced levels of these ions, the calcium carbonate fraction of the egg was lowered. In both cases, blood calcium level was not lowered while eggshell thinning was observed. Anderson et al. (1969) first stated that DDE appeared to be the environmental pollutant most responsible for the eggshell syndrome.

Of the 54 species of birds on the 1989 Virginia list, the

peregrine falcon, bald eagle and brown pelican (Pelecanus occidentalis) were the species that have been most seriously affected by these compounds.

The peregrine falcon was extirpated as a breeding bird in the 1960s. Although brown pelicans are a recent addition to the avifauna of the state, reduction in the thickness of pelican eggshells in other areas was disclosed by Blus (1970) and Risebrough et al. (1969). The latter workers measured a 53 percent mean reduction in shell thickness of pelicans in California, with an extreme reduction of 95 percent. DDE levels in California pelican eggs reached 2,500 parts per million.

Bald eagle populations in Chesapeake Bay reached an estimated 150-200 pairs in 1936 (Tyrrell, 1936), based on a survey that covered 25 percent of the available habitat. By extrapolation of these figures to 100 percent of the available habitat, estimates as high as 600-800 pairs in 1936 have been derived.

Based on an aerial survey conducted by J. M. Abbott and F. R. Scott, the number of territories occupied by bald eagles in Chesapeake Bay declined to 150 in 1962 and the population reached a level of 55 active nests in 1970 (Byrd et al., 1990). Productivity in 1962 was only 0.2 young per active nest, about one-eighth the level of productivity found in 1936. Abbott (1957) first reported that the Chesapeake Bay bald eagle population appeared to be declining. Brody (1957, 1958) hypothesized that the cause of the population decline and reproductive failure in Florida at that time might be DDT

contamination of the environment. The extremely low rate of production by the Chesapeake Bay population in 1962 provided additional support for this hypothesis.

Subsequently, residue levels of several organochlorines found in eggs of bald eagles around Chesapeake Bay for the years 1973-1979 were among the highest for any population of bald eagles in the United States (Wiemeyer et al., 1984). Wiemeyer et al. (1984) found that DDE in bald eagle eggs was much more closely associated with egg shell thickness and production of young than other toxicants.

In addition, a number of bald eagles acquired in the Mid-Atlantic region showed residue concentrations of organochlorines in their brains and carcasses. The concentrations in these bald eagles indicated that this population was one of the more highly contaminated ones in the United States (Reichel et al., 1969, 1984; Mulhern et al., 1970; Belisle et al., 1972; Cromartie et al., 1975; Prouty et al., 1977; Kaiser et al., 1980; Reichel et al., 1984).

In 1972, DDT was banned from use in the United States, and elimination of this contaminant has been the major reason for the steadily increasing population and productivity of eagles around Chesapeake Bay. All the other contaminants that were implicated in the depression of productivity from the 1950s through the 1970s have been banned. There are positive indications that DDT residues have declined significantly in the biota of eastern North America since the mid-1960s (Johnston, 1974; Peakall, 1976). It appears that at this time neither organochlorines nor

metals such as lead and mercury pose threats to Chesapeake Bay eagles and other raptors which feed at high trophic levels (Byrd et al., in press).

The biological role of Kepone, a chemical related to DDT, was never thoroughly documented with respect to birds. Usually, contamination of ecosystems with pesticides is a result of agricultural use of the chemicals. In 1975, a major environmental disaster became a public issue when it was discovered that an estimated 100,000 pounds of Kepone had been discharged into the James River over the previous nine years from a chemical plant located at Hopewell, Virginia. This discharge contaminated the entire lower part of the estuary and eventually reached much of the Chesapeake Bay (Owen, 1985). It probably was not fortuitous that all breeding bald eagles and ospreys (Pandion haliaetus) had disappeared from the James River by 1972.

Less persistent insecticides such as the carbamates pose threats to species which have not been thoroughly documented nor evaluated. These are highly toxic chemicals which have resulted in 15 known deaths of bald eagles in the Chesapeake Bay in the last few years and the loss of an estimated 2 million birds per year in the United States as a whole. The carbamate compounds function primarily as cholinesterase inhibitors and usually are acquired by raptors through their feeding on contaminated prey and by other birds through their direct ingestion of granules.

Anticholinesterase poisoning in raptors was seldom detected in earlier years because brain cholinesterase activity was rarely examined, and because secondary poisoning was thought to have

been unlikely. As analytical techniques for the measurement of cholinesterase have improved, it is clear from the results that carbamates may play an important role in the mortality of raptors, including threatened and endangered species.

Habitat Modification and Destruction

The past century has been characterized by large increases in the world population of the human species. To support this burgeoning population, severe modification of many natural vegetative types has taken place, usually resulting in the replacement of native plant species and communities with those of agricultural systems. Those avian species, particularly passerines, which could not adapt to these changing conditions usually declined and in some cases, became extinct. Increasing human populations also have caused reduction in bird numbers through direct harvesting of the birds for food. Such harvesting may well have led to the demise of the passenger pigeon.

At the present time, a major limiting factor for many species of birds in Virginia is the loss or modification of their habitats. This fact is commented upon in virtually all of the species accounts contained in this chapter. The human population in the Chesapeake Bay region, for example, has grown steadily over the past several decades. The population of Virginia alone doubled to 5.7 million between 1940 and 1985 and continues to grow.

A recent report on growth in the Chesapeake Bay basin (Year 2020 Panel, 1988) clearly expresses the problem with its potential impact on many avian species which utilize the habitats

within the area. Living in proximity to water remains a very high priority for many people. The report suggests that in the next 30 years the Pennsylvania, Maryland and Virginia portion of the Chesapeake Bay watershed is projected to grow by 2.6 million people (nearly 20 percent) from 13.6 million in 1990 to 16.2 million in 2020. This projected growth will add tremendously to the existing stress on the region's environment.

Undeveloped land in the basin has been converted to developed land at a rate that exceeds the rate of population growth by more than 100 percent. In other words, land is being converted for development more than twice as fast as the human population is increasing (Year 2020 Panel, 1988).

Many of the birds of this area of the state depend on wetlands for their survival. Nearly 1.2 million acres of wetlands, 75 percent being inland wetlands, are found in the Chesapeake Bay drainage basin. Between the mid-1950s and the late 1970s, more than 2,800 acres of wetlands were lost annually, principally to urban development and agriculture. Between 1956 and 1977, Virginia, with slightly over 1 million acres of wetlands, lost 63,000 acres (6 percent) of these lands. Nontidal wetlands are disappearing at a more rapid rate than tidal wetlands (Year 2020 Panel, 1988).

As areas within the Chesapeake Bay basin are developed, there will be concomitant demands for additional recreational areas and resources, creating additional pressures on sensitive but relatively protected areas such as the barrier islands. The potential impact of these heightened demands on species of beach

nesting colonial birds could be very great.

Conversion of land to urban or agricultural uses along the major estuaries of the basin is progressing at a frightening rate with dozens of planned developments in most of the counties bordering these waterways. Much of this development is in optimal bald eagle habitat. Bald eagle nesting, roosting, and feeding habitat thus continues to give way to housing, highways, parks, airports, and public utilities. Approximately 10-15 percent of bald eagle nests in Virginia are adversely impacted directly each year by developments, leaving little possibility that this species will ever be removed from its present endangered status.

Development activities also create habitat fragmentation; large blocks of once contiguous habitat such as hardwood forests have had their continuity broken by the construction of homes, offices, or other structures. Many species of birds occupy very specialized habitats that often, because of these changes, are now found in small tracts which are widely separated from each other. The human land use practices mentioned above which have fragmented forest habitats now necessitate that many species exist under conditions of unnatural, patchy occurrences of suitable environments. Species under these conditions may require a distinctive habitat which has become surrounded by a sea of unsuitable habitats. Many species also have been identified which have both behavioral and population characteristics which make them sensitive to specific minimum area thresholds (termed area-sensitive species) and for which the

necessary minimum areas to maintain a viable poulation have been calculated (Hayden et al., 1985).

A variety of factors may be at work in determining minimum area requirements, including reproductive characteristics and competition for food and nest sites. Decreasing numbers of some species of birds, particularly passerines, has been correlated with decreasing size of blocks of suitable habitat. A pair of ovenbirds (Seiurus aurocapillus) may raise a brood on only a few hectares hence a 100 hectare tract should appear adequate to support a number of breeding pairs of this species. Data suggest, however, that a tract of 100 hectares cannot support a sustained population over time of this species. In studies conducted in central Missouri, 300 hectares are needed in a contiguous block to sustain a population. Unfortunately, our knowledge of minimum areas required to support viable populations of most species is very limited. It seems clear, however, that unless present land use trends in Virginia are reversed, there will be declines in many species populations in the state as a result of continued habitat fragmentation.

A third critical habitat problem is the timber management system which results in tree monocultures. Most modern agricultural systems, such as those typified by corn fields, also are monocultures. In both cases, the monocultural system lacks the floral composition and diversity to provide good habitat for a large number of avian species.

Pine monocultures have been developed on hundreds of thousands of acres in Virginia, on corporate, government and

private lands. This is an efficient method for growing and harvesting a large volume of timber. Growth usually is rapid and harvesting can be done early. Recent technological developments such as tree planters, chip harvesters, and one man loggers have increased the efficiency of monoculturing.

However, a tree monoculture is an artificial, simplified ecosystem which lacks most of the balancing mechanisms of a more complex natural ecosystem such as an uneven aged, multiple-species forest system. The single-species, single-aged tree plantation primarily serves one function - wood production. Such a monoculture provides little habitat for birds nor does it provide any esthetic qualities. Such functions are better provided by a multi-species, multi-aged forest. In its more developed stages of growth, a tree monoculture supports few bird species but at some point, it will be clear cut - a harvesting method guaranteed not to provide even marginal habitat for a number of years. The impact of forest monocultures on certain species of birds, particularly passerines, is difficult to measure but almost certainly has been substantial.

A fourth habitat factor affecting many migratory species is the destruction of the tropical rainforests. The effect of this destruction on migratory species is only presently being evaluated but appears to be related to large declines in populations of a number of migratory birds which breed in Virginia and other parts of the United States.

Tropical rain forests represent one of the world's great biomes. They represent a very rich source of food, fiber, fuel,

timber and medicine, all essential to human well-being (Owen, 1985).

Human activities, such as removal of forests for cattle ranching, conversion to other agricultural use, and industrial logging, have already reduced tropical forests by more than 40 percent. At present rates of destruction, nothing but scattered remnants will remain by the year 2025, except for parts of the Amazon Basin and Central Africa (U.S. Interagency Task Force on Tropical Forests, 1980). The adverse impacts of this removal of tropical forests on species of birds which migrate to the tropics for the winter can only become greater. This removal of the tropical forests may eventually result in the extinction of many tropical residents and, possibly, of migrants that spend part of the year in the tropics.

Despite the limited success in effecting population recovery which we have had with birds such as the bald eagle and peregrine falcon, the future looks bleak for many species.

The pressures on habitats throughout the Commonwealth will be enormous in the future. Our ability and tenacity in planning and utilizing our land resources will surely dictate the future of our avifauna. At this point, there appears to be little reason for optimism.

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ENDANGERED AND THREATENED SPECIES OF BIRDS OF VIRGINIA

Common Name	Linnaean Name	Legal Status		Recommended Status
		Federal	State	
Brown pelican	Pelecanus occidentalis	Protected	Protected	Threatened
Least bittern	Ixobrychus exilis	Protected	Protected	Status Undetermined
Great egret	Casmerodius albus	Protected	Protected	Special Concern
Little blue heron	Egretta caerulea	Protected	Protected	Special Concern
Tricolored heron	Egretta tricolor	Protected	Protected	Special Concern
Yellow-crowned night heron	Nycticorax violaceus	Protected	Protected	Threatened
Glossy ibis	Plegadis falcinellus	Protected	Protected	Special Concern
Bald eagle	Haliaeetus leucocephalus	Endangered	Endangered	Endangered
Northern harrier	Circus cyaneus	Protected	Protected	Endangered
Sharp-shinned hawk	Accipiter striatus	Protected	Protected	Status Undetermined
Cooper's hawk	Accipiter cooperi	Protected	Protected	Status Undetermined
Peregrine falcon	Falco peregrinus	Endangered	Endangered	Endangered
Black rail	Rallus lateralis	Protected	Protected	Status Undetermined
King rail	Rallus elegans	Protected	Protected	Status Undetermined
Virginia rail	Rallus limicola	Protected	Protected	Status Undetermined

Common Name	Linnaean Name	Legal Status Federal	State	Recommended Status
Common moorhen	Porphyrula martinica	Protected	Protected	Status Undetermined
Wilson's plover	Charadrius wilsonia	Protected	Endangered	Endangered
Piping plover	Charadrius melodus	Threatened	Threatened	Endangered
Spotted sandpiper	Actitis macularia	Protected	Protected	Status Undetermined
Upland sandpiper	Bartramia longicauda	Protected	Protected	Endangered
Gull-billed tern	Sterna nilotica	Protected	Protected	Threatened
Caspian tern	Sterna caspia	Protected	Protected	Special Concern
Sandwich tern	Sterna sandvicensis	Protected	Protected	Special Concern
Forster's tern	Sterna forsteri	Protected	Protected	Special Concern
Least tern	Sterna antillarum	Protected	Protected	Threatened
Common barn owl	Tyto alba	Protected	Protected	Special Concern
Long-eared owl	Asio otus	Protected	Protected	Status Undetermined
Short-eared owl	Asio flammeus	Protected	Protected	Status Undetermined
Northern saw-whet owl	Aegolius flaviventris	Protected	Protected	Status Undetermined
Red-cockaded woodpecker	Picoides borealis	Endangered	Endangered	Endangered

Common Name	Linnaean Name	Legal Status Federal	State	Recommended Status
Magnolia warbler	Dendroica magnolia	Protected	Protected	Status Undetermined
Swainson's warbler	Limnothlypis swainsonii	Protected	Protected	Threatened
Mourning warbler	Oporornis philadelphia	Protected	Protected	Special Concern
Dickcissel	Spiza american	Protected	Protected	Status Undetermined
Bachman's sparrow	Aimophila aestiivalis	Protected	Protected	Endangered
Henslow's sparrow	Ammodramus henslowii	Protected	Protected	Endangered
Sharp-tailed sparrow	Ammodramus caudacutus	Protected	Protected	Special Concern
Swamp sparrow	Melospiza georgiana	Protected	Protected	Status Undetermined
Purple finch	Carpodacus americana	Protected	Protected	Special Concern
Red-crossbill	Loxia curvirostra	Protected	Protected	Special Concern

Protected - Protected under the Migratory Bird Treaty

Common Name	Linnaean Name	Legal Status Federal	Legal Status State	Recommended Status
Yellow-bellied flycatcher	Empidonax flaviventris	Protected	Protected	Status Undetermined
Alder flycatcher	Empidonax alnorum	Protected	Protected	Status Undetermined
Bank swallow	Riparia riparia	Protected	Protected	Special Concern
Cliff swallow	Hirundo pyrrhonota	Protected	Protected	Special Concern
Red-breasted nuthatch	Sitta canadensis	Protected	Protected	Status Undetermined
Brown creeper	Certhia americana	Protected	Protected	Status Undetermined
Bewick's wren	Thryomanes bewickii	Protected	Endangered	Endangered
Winter wren	Troglodytes troglodytes	Protected	Protected	Status Undetermined
Sedge wren	Cistothorus platensis	Protected	Protected	Endangered
Golden-crowned kinglet	Regulus satrapa	Protected	Protected	Status Undetermined
Swainson's thrush	Catharus ustalatus	Protected	Protected	Status Undetermined
Hermit thrush	Catharus guttatus	Protected	Protected	Status Undetermined
Loggerhead shrike	Lanius ludovicianus	Protected	Endangered	Endangered
Golden-winged warbler	Vermivora chrysoptera	Protected	Protected	Status Undetermined