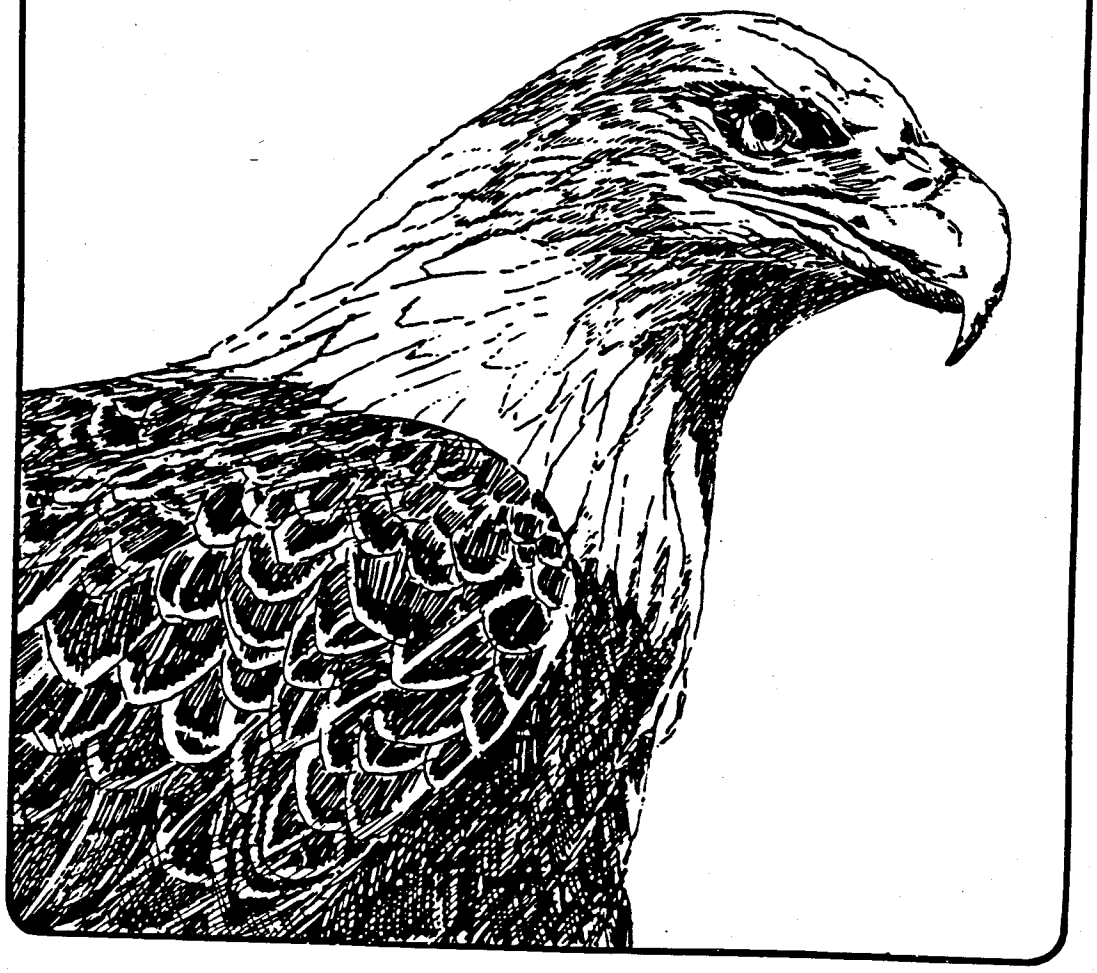
RECOVERY PLAN



Southeastern States Bald Eagle

SOUTHEASTERN STATES BALD EAGLE

RECOVERY PLAN

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RECOVERY PLAN EXECUTIVE SUMMARY

1. What is the point or condition when the species can be considered recovered?

   The Southeastern States bald eagle can be considered for downlisting to threatened when there are 600 occupied breeding areas distributed over at least 75 percent of the historic range. This must be accompanied by 3 years of data indicating reproductive success is greater than 0.9 young per occupied nest, greater than 1.5 young per successful nest, and at least 50 percent of the nests are successful in raising at least one young. There should also be additional documentation of population vigor and adequate support habitat. The criteria for delisting will be developed when the species is reclassified from endangered to threatened.

2. What must be done to reach recovery?

   Steps must be taken to protect and manage eagle populations and their habitats. It will also be necessary to improve and maintain public awareness, concern, and support for the recovery of the species.

3. What management/maintenance needs have been identified to keep the species "recovered"?

   Appropriate management of nesting, feeding, loafing and wintering habitat must continue after recovery has been achieved. The greatest challenge for the future will be to prevent further destruction of habitat. Monitoring of nesting success must be continued to facilitate detection of problem contaminants in the environment.

TABLE OF CONTENTS

PART IV: APPENDIX

A. Detailed State-by-State Historical Data on Nesting of Bald Eagles in the Southeast

B. Techniques and Terminology for Surveys of Nesting Bald Eagles

C. Current and Recommended Recovery Levels of Eagle Occurrence by State

D. Bald Eagle Management Guidelines

E. Essential Habitat Recommendations

F. Handling and Disposition of Eagles Found Dead in the Wild

G. Emergency Care of Injured and Diseased Bald Eagles

H. Bald Eagle Translocation Policy

I. "Restoring the Bald Eagle"

J. List of Reviewers for Southeastern States Bald Eagle Recovery Plan

PART I: INTRODUCTION

Background

The bald eagle (Haliaeetus leucocephalus) has been protected under the Eagle Protection Act (16 U.S.C. 668-668d) of June 8, 1940, as amended on October 23, 1972. The bald eagle below the 40th parallel was listed as endangered on March 11, 1967, and subsequently received protection under the Endangered Species Act of 1973 (16 U.S.C. 1531-1543). On February 14, 1978, its listing status was changed to endangered throughout the conterminous United States except for Washington, Oregon, Minnesota, Wisconsin, and Michigan, where it was designated as threatened. This recovery plan shall address the bald eagle in the Southeast portion of the United States, including Florida, Georgia, South Carolina, North Carolina, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, and Texas west to the 100th meridian.

Natural History

Of the 289 species of hawk-like birds, there are 59 species of eagles (Grossman and Hamlet 1964). The sea and fish eagles account for 11 species comprising 3 genera, of which 8 species are in the genus Haliaeetus. The bald eagle is the only species of sea eagle regularly occurring on the North American continent. Two subspecies or races of leucocephalus are described based on size and weight. These are of questionable merit because of a continuous gradient in size from north to south throughout the range.

The bald eagle adapts poorly to radical changes in its environment, and has a relatively low reproductive rate with deferred maturity and a small clutch size. The bald eagle uses a large area for hunting and is sensitive to chemical contaminants in the food chain.

In the Southeast, nesting activities generally begin in early September. Nests are often in the ecotone of forest and marsh or water, and are constructed in dominant or codominant living pines or bald cypress 3 km (kilometers) or less from open water (McEwan and Hirth 1979). In the Everglades National Park, eagles nest in low mangroves and, in some cases, use nests that have fallen on the ground. Most nests, however, are located in the upper 30 feet of the tree with canopy cover above and a clear view of open water. The cone-shaped nest may be 6 feet in diameter and 6 to 8 feet from top to bottom. The nest may be lined with Spanish moss, corn husks, or grasses.

Egg laying may begin as early as late October with a peak occurring in the latter part of December. Varying with latitude within the Region, incubation may be initiated from October to March. Clutches usually consist of one or two eggs, but occasionally three. Incubation is approximately 35 days and fledging takes 10 to 12 weeks. Parental care may extend 4 to 6 weeks after fledging. As is typical for raptors, young eagles are fully developed at the time of fledging.

Post-fledging movements of Florida nesting eagles were first documented by the monumental banding work of Broley (1947). These band recoveries demonstrated an extensive northward movement, with more than one-third of the recoveries made 1,000 miles or more north of Florida, all during the non-nesting season. Color-marked eagles fledging in South Carolina have been reported north to the Chesapeake Bay, along the Susquehanna River into New York, and on the Great Lakes (T.M. Murphy, unpubl. data).

The bald eagle in the Southeast lives up to its name as a sea eagle, as the bulk of its diet is fish. The eagle is opportunistic, and regularly supplements its diet with a variety of vertebrate species. Broley (1947) found catfish, mullet, and turtles, to be the most common food items found at nests in Florida. He also found that the variety of prey items differed among individual pairs. McEwan (1977) reported 79 percent fish and 17 percent bird prey, by occurrence, based on 788 animal remains recovered from nests. Of these, the dominant items were catfish and the American coot. In South Carolina, prey items observed in nests during banding of young were primarily fish, American coot, gallinule, and waterfowl in early spring, with increased use of fish in late spring (T.M. Murphy, unpubl. data). Dugoni (1980) studied bald eagle food habits at nests in Louisiana. He collected and identified the remains of food items at 10 active nests following the 1978-1979 nesting season. Of those remains, birds represented the largest proportion (42.38 percent), followed by fish (41.57 percent), mammals (15.69 percent), and reptiles (0.41 percent). Freshwater catfish and American coots comprised 41.97 percent of all remains; waterfowl contributed 16.46 percent.

Various aspects of bald eagle life history have been reported by Herrick (1924a,b,c, 1932a,b, 1933, 1934), Brown and Amadon (1968), Laycock (1973), and Snow (1973), and do not require further description here. In the Region, Broley (1947, 1952) provided information on banding and movements. A working bibliography of the bald eagle is provided by Lincer et al. (1979).

Reasons for Decline

Habitat alterations and human encroachment resulted in a slow eagle population decline for many decades. It is, however, the accelerated pace of development of eagle habitat and the extensive area involved today that are the most significant limiting factors in the Southeast.

There has been a rapid increase in the human population in the Region. Between 1980 and 1986, human populations grew in all Southeastern states, ranging from 2 percent in Kentucky to 23 percent in Florida (U.S. Bureau of the Census 1987). Immigration to the "sun belt" has resulted in extensive alterations in land use. Compounding that situation is the fact that both man and eagle prefer waterfront locations (Wood et al. in press; Harris et al. 1987). Water control projects may greatly alter eagle habitat characteristics. Shapiro et al. (1982) documented a 74 percent decrease in nesting in an area following completion of a flood control project. Habitat alteration, including disturbance at nest sites, is the single most

significant limiting factor inhibiting recovery today. The cumulative effects of many projects impinge on our ability to maintain current nesting populations and ultimately may limit the extent to which recovery may occur.

It should be mentioned, however, that a significant amount of new habitat has been created in the form of man-made reservoirs. Reservoirs now primarily provide wintering and non-nesting habitat, but are gradually receiving more use by nesting eagles. This may result in a major redistribution of nesting.

Shooting has long been known as a major factor in the mortality of bald eagles. Reduction in shooting mortality is the current trend. The following figures indicate percentage of total reported mortalities caused by shooting mortalities: 62 percent from 1961-1965 (Coon et al. 1970), 41 percent from 1966-1968 (Mulhern et al. 1970), 46 percent from 1969-1970 (Belisle et al. 1972), 35 percent from 1971-1972 (Cromartie et al. 1975), 25 percent from 1973-1974 (Prouty et al. 1977), 20 percent from 1975-1977 (Kaiser et al. 1980), and 18 percent from 1975-1981 (Locke 1982). Thus, during a 21-year period, 25 percent of the documented bald eagle mortality has been caused by shooting. While this downward trend is encouraging, the current level of mortality is unacceptable and may be limiting, particularly in areas of remnant nesting populations.

Perhaps the most dramatic declines in eagle populations nationwide resulted from environmental contaminants. Organo-chlorine compounds (DDT and its metabolites) inhibited calcium deposition, which resulted in eggshell thinning and ultimately reduced reproductive success (Radcliffe 1967; Hickey and Anderson 1968; Anderson and Hickey 1972; Krantz et al. 1970). Mulhern et al. (1970) found widespread occurrence of DDT, DDE, and DDD in eagle carcasses, and at least one female had lethal levels of DDT and DDD. Similarly, cyclodiene dieldrin was documented at lethal levels in eagles by Mulhern et al. (1970). Reviews of pesticides in eagles are presented in Snow (1973), and Newton (1979). Since a ban on the use of DDT in the U.S. in 1972, a slow recovery in eagle productivity has occurred. Currently, most populations appear to be producing chicks at the expected rate. Preliminary results on measurements of 87 egg shells collected from 1984 to 1987 from Florida nests show that the shells are only slightly thinner, on average, than pre-1947 eggs. However, there were a few eggs with shells as much as 29 percent thinner which indicated that there may be problems with some pairs or areas (Wood et al., in press). Although pure DDT cannot be sprayed legally in the United States, pesticides with DDT as a component are allowed. (Gerrard and Bortolotti 1988). Of recent concern is a growing body of evidence that lead poisoning may be a significant source of mortality in eagles (Pattee et al. 1981, Locke 1982). Feirabend and Myers (1984) diagnosed 109 bald eagles from across the country as lead poisoned between 1966 and 1984. Sublethal lead contamination may contribute to mortality from other sources (Redig et al. 1983). Chronic low levels of lead produce neurological dysfunction, behavioral and learning aberrations, anemia, and increased susceptibility to disease and other mortality factors (Reiser and Temple 1981).

Historic and Current Status

Historically, the bald eagle was a common nesting species throughout the coastal plain of the Southeast as well as along major lakes and rivers. Hence, the breeding range was uninterrupted along the east coast from the Chesapeake Bay to the Florida Keys and north along the west coast of Florida to the panhandle. The nesting range also appears to have been continuous along the entire Mississippi and other major rivers, through Louisiana and into east Texas with a low density along the Gulf Coast. The breeding range has been reduced to the remnant populations in South Carolina, Louisiana, and east Texas, with apparently secure nesting only in Florida. Most breeding populations are now reported to have an adequate level of production and appear to have achieved stability. A state-by-state summary of historic and current nesting appears below. More detailed information is provided where possible in Appendix A.

Alabama: The historical occurrence of seven nests in Alabama has been documented. Nests have been reported from the Gulf Coast and from the Tennessee River. On the coast, eagles nested in Baldwin County and in Mobile County prior to 1962 (Imhof 1976). On the Tennessee River, a successful nest was last present in 1949. It was abandoned after that, probably due to human disturbance (T. Atkeson, pers. comm.). During the 1982-1983 nesting season, nests were constructed in two breeding areas, but no eggs were laid (K. O. Guyse, pers. comm.). During the nesting season of 1987-1988, Alabama had no bald eagle breeding attempts (J. Myers, pers. comm.).

Arkansas: Approximately 22 bald eagle breeding territories are known to have occurred at various times in Arkansas. Until the early 1950's, bald eagle nests in the state were scattered along the lower Mississippi and Arkansas River Valleys. From 1957 to 1977, no nesting activity was reported. Several unsuccessful nesting attempts were reported from 1978 to 1980. A single nest territory has produced young each year since 1981-1982 with the exception of the seasons of 1982-1983 and 1987-1988 (S. Barkley, pers. comm.).

Florida: Bald eagle nesting in Florida has been widely studied and published accounts are available from a variety of sources. Charles Broley first noted a decline in eagle nesting in the late 1940's (Broley 1952). A further decline from 73 to 43 active nesting areas was reported for west central Florida by Broley (1958) between 1936 and 1956. Sprunt (1972) was able to locate only 35 pairs in 1964 for the same area. Howell (1937, 1941, 1949, 1954, 1958, 1962, 1968, 1973) reported a decline in nesting around Merritt Island from 24 to 4 nesting areas during the period from 1935 to 1971. A state-wide survey conducted from 1973 to 1988 showed that during this period the population generally reproduced at a healthy rate. The 1988 production of 448 young from 399 occupied breeding areas was the highest of any year since the survey began (Nesbitt 1988).

Georgia: Burleigh (1958) reported eagles as once being common residents along the Georgia coast. They also nested in the Okefenokee (Wright and Harper 1913 and Hebard 1941). During the 1986-1987 nesting season, there

were seven active breeding areas in the state. Five of these were successful in producing a total of 9 young (K. Riddleberger, pers. comm.).

Kentucky: Mengel (1965) stated that it was unlikely that more than 5-10 pairs nested in the state as of the 1950's. During the 1987-1988 nesting season, Kentucky had three occupied breeding areas, however, no young were fledged. Only one of these areas has produced young in the recent past (J. MacGregor, pers. comm.).

Louisiana: In Louisiana a total of 37 bald eagle nests have been documented. Bald eagle nests in the state have occurred primarily along the Mississippi River Valley, the Gulf Coast, and the Sabine River. In the 1987-1988 nesting season, there were 36 occupied breeding areas in Louisiana. Twenty-three of these fledged a total of 41 young (W. Dubuc, pers. comm.).

Mississippi: Bald eagle nests in Mississippi were historically situated along the Mississippi River, along the coast, and in Oktibbeha County. A total of 17 historic nest sites have been documented in the state. In 1988, there were two occupied breeding sites; however, only one of these was known to have produced young.

North Carolina: Pearson et al. (1942) stated that the bald eagle "is not uncommon in the coastal region of North Carolina" and that "...the bald eagle probably breeds throughout the coastal country." By 1962, only one breeding area was reported as active by Sprunt and Cunningham (1962) but four were active in 1963 (Sprunt and Ligas 1963). In 1988, there were three occupied breeding areas. One of these produced two young (T. Henson, pers. comm.).

South Carolina: Sprunt and Chamberlain (1977) reported that the bald eagle in South Carolina was "a fairly common permanent resident and more frequent on the coastal plain." In a supplement to that volume, Burton reported the eagle as becoming scarce due to pesticides, shooting, and other causes. A total of 59 breeding sites have been documented as active in South Carolina over the past 30 years. Of these areas, 28 were occupied for at least 1 year between 1977 and 1983 (T. M. Murphy, unpubl. data). From 1977 to 1983, 22 additional breeding areas were located. During the 1982-1983 nesting season, 23 young fledged from 23 breeding sites. By 1988, there were 50 occupied breeding sites in the state, 41 of which produced 68 fledged young (T. M. Murphy, pers. comm.).

Tennessee: Alsop (1979) summarized historical bald eagle nesting in Tennessee as occurring along the major river systems. Ganier (1931) found evidence of only five or six pairs breeding in 1930. Additional breeding records are provided by Ganier (1932, 1938a,b, 1951), Shaver (1931), and Spofford (1945) for scattered localities in the state. By 1961 or possibly 1962, only one successful nest remained in the state (Hatcher and Miller 1982). During 1988, there were 9 occupied breeding areas, 8 of which fledged a total of 15 young (B. Hatcher, pers. comm.).

Texas: Lacey (1912) reported the eagles as formerly not uncommon. Oberholser (1974) stated that eagles are scarce and local on or near the central coast and rare and local in the southeastern part of Texas. Surveys by the Texas Parks and Wildlife Department (Smith 1974, 1975) found seven breeding areas known to have been active during the 1974-1975 nesting season. Surveys conducted during the 1987-1988 breeding season located 20 occupied breeding areas, 13 of which fledged a total of 20 young (D. Mabie, pers. comm.). This includes nesting on inland reservoirs, which suggests recent colonization of this man-made aquatic habitat.

PART II: RECOVERY

A. Recovery Objective

Objective: To remove the bald eagle from endangered and threatened status.

The criteria for the change to threatened status for the bald eagle will be documentation of 600 occupied breeding areas distributed over at least 75 percent of the bald eagles historic range (9 of 12 states in the Southeast). This reclassification will be contingent upon reproductive success being greater than 0.9 young per occupied nest, greater than 1.5 young per successful nest, and at least 50 percent of the nests successful in raising at least one young. These figures should be based on at least a 3-year average. There should also be additional documentation of population vigor and adequate support habitat. Delisting may be considered if the recovery trend continues for another 5 years. The criteria for delisting will be developed when the species is reclassified from endangered to threatened.

The figure of 600 occupied eagle breeding areas is about 40 percent of the historic level and is an approximately 50 percent increase over current numbers. An occupied breeding area is defined as the presence of a pair of eagles during the breeding season in an area which contains a nest. If a nest is occupied by an incubating eagle or if eggs or young are seen, the presence of an adult pair can be assumed (see Appendix B).

The distribution of nesting eagles over at least 75 percent of the historic range is necessary to preclude localized negative impacts from jeopardizing the entire population. The Southeastern population is currently at greatly reduced numbers and has disjunct breeding centers in Florida, Louisiana, South Carolina, and Texas. The restoration of breeding continuity at a sustained level over 75 percent of the remaining habitat is needed to stabilize the population. Nesting over a wide geographic area would substantially decrease the level of threat to the species. This plan recognizes the need for a measurable delineation of the distributional requirements for recovery and includes estimates of the minimum number of occupied breeding areas for each state (Appendix C). These numbers are our best estimate of 40 percent of the historic nesting levels. The estimates are not meant to preclude increases beyond these numbers or colonization of non-historic areas where habitat has been enhanced. The requirements for nesting distribution within the Region would be met if 9 of 12 (75 percent) of the states achieved their minimum levels. Although they are based on the available information, these numbers are somewhat arbitrary, and may be adjusted as additional information becomes available.

The goal of minimum productivity is based on three numerical criteria. Each is a necessary component and provides a means to evaluate techniques and determine the differences among study areas. The numbers selected as minimums are considered just above subsistence

levels and are considerably below historic figures and the reproductive potential of an expanding eagle population. These figures are, in fact, just above the sustained reproductive performance of the long-time stable population in southern Florida. The use of at least a 3-year average is to assure that data from boom or bust years do not result in erroneous interpretations.

Factors of population vigor include, but are not limited to: presence of a viable adult-juvenile ratio, rapid replacement of individuals when adult mortality occurs within nesting territories, establishment of new nesting territories in an unsaturated population, fidelity to a territory, high rate of feeding success, and high rate of survivorship. The need for adequate support habitat includes hunting areas, roosting sites, and flight corridors.

The emphasis on reproduction activities in the recovery plan is the result of the historical difficulties which led to the present endangered status of the species. In addition, nesting activities result in a dependence on specific areas which are vulnerable. It is not our intention to imply that nesting areas are the only habitats that are needed for recovery of the species.

Achieving the stated recovery goals would result in reclassification to threatened status. If the recovery trend is continued for 5 additional years, complete delisting could be considered. It should be cautioned that the eagle is a species which is easily impacted by environmental alterations and will always require monitoring and management.

B. Step-Down Outline

OBJECTIVE: To remove the bald eagle from endangered and threatened status.

1. Protect and Manage Eagle Habitat

1.1. Gather information on physical degradation of habitat.

1.1.1. Identify negative alterations to aquatic habitat.

1.1.2. Identify negative alterations to terrestrial habitat.

1.1.3. Quantify essential characteristics of occupied habitat.

1.1.4. Quantify responses of eagles to habitat alterations.

1.2. Provide habitat protection through site management.

1.2.1. Implement and adhere to "Habitat Management Guidelines for the Bald Eagle in the Southeast Region." (Appendix D)

1.2.2. Develop specific management plans for each breeding area.

1.2.3. Protect significant areas through cooperative agreements, easements, acquisition, or other appropriate means.

1.2.4. Identify and incorporate essential habitat in land use plans and planning.

1.2.5. Develop specific management plans for important feeding and roosting sites and eagle concentration areas.

1.2.6. Utilize the regulatory authority of Section 10 (Rivers and Harbors Act) and Section 404 (Clean Water Act) to conserve bald eagle habitat where appropriate.

1.2.7. Protect wintering eagle habitat in a manner coordinated with FWS Northcentral and Northeast Regions.

1.3. Prevent or mitigate degradation of eagle habitat from environmental contaminants.

1.3.1. Make appropriate recommendations to regulatory agencies regarding the use of steel shot for waterfowl hunting in areas receiving high use by eagles.

1.3.2. Submit eagle carcasses to the FWS National Wildlife Health Research Center for necropsy and chemical analysis.

1.3.3. Apply appropriate constraints under permit review procedures.

1.3.4. Review current laws and regulations to determine which apply to control of toxic substances in eagle habitat.

1.3.5. Participate in contingency planning for emergency pollution abatement.

2. Protect and Manage Eagle Populations

2.1 Monitor populations.

2.1.1. Monitor nesting and productivity using standardized terminology in Appendix B.

2.1.2. Conduct banding and color marking projects.

2.1.3. Conduct mid-winter eagle surveys.

2.2. Prevent or mitigate the effects of behavioral degradation.

2.2.1. Identify and quantify effects of disturbance on nesting eagles and incorporate into management plans as indicated in Task 1.2.2.

2.2.2. Identify and quantify the impact of disturbance on feeding and roosting sites and incorporate into management plans as indicated in Task 1.2.5.

2.2.3. Continue to require permits for all research activities which have the potential to negatively impact eagles.

2.2.4. Develop and implement guidelines for the use of Military Areas of Operation (MOA).

2.3. Reduce eagle mortality.

2.3.1. Maintain and/or augment active enforcement of existing laws and take actions designed to reduce the number of violations (see task 3).

2.3.2. Establish and maintain adequate rehabilitation facilities.

2.3.3. Reduce mortality from collisions through structural modifications and/or project permit review in documented problem areas.

2.3.4. Reduce mortality from electrocution through appropriate design and location of power lines.

2.3.5. Reduce incidental trapping mortality by regulation of trapping method and/or sites.

2.3.6. Prevent mortality by regulating use of poisons for predator control in areas used by feeding eagles.

2.4. Re-establish the historic breeding continuity and supplement reduced populations through translocation and fostering projects where necessary.

2.4.1. Implement translocation projects to re-establish the breeding continuity within the Region.

2.4.2. Implement translocation projects to re-establish the breeding continuity between the Southeast and other breeding populations.

2.4.3. Obtain a sustained source of eagles of regional genetic origin for translocation projects.

3. Improve and Maintain Awareness, Concern, and Support for the Recovery of the Species

3.1. Public information and education.

3.1.1. Use permanently incapacitated eagles for information presentations.

3.1.2. Incorporate information on the laws, penalties, rewards, and identification of eagles in hunter safety programs.

3.1.3. Prepare general information brochures.

3.1.4. Include eagle information in hunter regulation brochures.

3.1.5. Prepare and distribute public service announcements.

3.1.6. Encourage news coverage of eagle shootings and subsequent investigation, prosecution, and disposition of the case.

3.1.7. Prepare a flyer for distribution with ammunition and firearms.

3.1.8. Produce an information brochure for landowners.

3.1.9. Develop and distribute information to pilots concerning the potential for disturbance of nesting eagles by aircraft.

3.1.10. Produce films and slide shows for use at schools, civic clubs, and special interest groups.

3.1.11. Maintain or provide guided tours of eagle use areas where possible.

3.1.12. Establish displays at public boat landings to provide information on laws, penalties, rewards, and identification of eagles.

3.1.13. Encourage public displays at zoological gardens and public natural history museums.

3.2. Professional information exchange.

3.2.1. Establish an eagle committee representing the State wildlife agencies.

3.2.2. Establish or maintain a working committee between Regions.

3.2.3. Provide for information transfer to managers.

3.2.4. Support national coordination actions.

3.2.5. Identify and designate one individual within FWS Southeast Region to be responsible as coordinator and contact between FWS and other entities.

C. Recovery Outline Narrative

1. Protect and Manage Eagle Habitat. Preventing further habitat degradation where possible and mitigating the negative effects of historic or unavoidable alterations are essential to the recovery of the bald eagle in the Southeast. Past habitat degradation has resulted in reduced populations and was paramount in the listing of the bald eagle as endangered.

The current rate at which occupied and potential eagle habitat is being degraded continues to impinge on the species' potential for recovery. The most significant impacts appear to involve occupied nesting habitat. Nesting areas are characteristically used on an annual basis, and strong fidelity to nesting territories is normal for the species. These areas receive sustained use during the nesting season for courtship, incubation, nestling period, fledging of young, and post-fledging care. This requires a dependence on an area for over 6 months.

Based on our current knowledge, the priority for habitat protection should be given to nesting areas, especially when occupied. This will allow for stabilization of the current nesting population. Additional habitat protection must also be provided to areas required for species expansion and recovery. Of these areas, recently occupied breeding sites should have first priority, followed by historic sites with suitable habitat. It is also important to maintain habitat similar to current and historic breeding areas, particularly when such habitat is adjacent to currently used sites or sites that would be important to re-establishing disjunct breeding populations. Finally, although managing nesting habitat is a high priority, it is not assumed to fulfill all requirements for recovery. Protecting feeding and other support habitat for immatures, sub-adults, and non-nesting adults is also important.

1.1. Gather information on physical degradation of habitat. Physical degradation of eagle habitat involves mechanical alteration which reduces the suitability of the area to support eagle activity. The physical degradation of habitat usually results in a long-term change in the character of the vegetation and prey species distribution, abundance, and availability. Physical alteration of eagle habitat has been occurring with a concurrent reduction in the number of eagles since before the turn of the century. However, the recent acceleration in the rate of physical alterations poses the greatest threat to the long-term survival of the species. The habitat alterations involve a multitude of unrelated projects at many different localities. While the impact of each project may appear inconsequential, the cumulative effects clearly preclude the recovery of the species. To prevent or mitigate these effects, negative alterations must be identified and the level of impact quantified in projects

of all sizes. Tasks 1.1.1., 1.1.2., 1.1.3., and 1.1.4. are intended to identify negative alterations which must be regulated through fulfillment of Task 1.2.

1.1.1. Identify negative alterations to aquatic habitat. Alterations of aquatic habitat have affected eagles in a variety of ways. Development of deep water channels increases the accessibility of remote areas often selected for nesting by eagles, and results in a high potential for disturbance. Increased accessibility also increases the likelihood of additional or secondary development.

Channel dredging in coastal areas may also cause extensive saltwater intrusion. In turn, saltwater intrusion may cause changes in vegetation and prey species availability, as well as loss of occupied and potential nest trees.

Habitat alterations related to spoil disposal occur during construction of projects which require dredging. Siltation and increased turbidity of aquatic habitat result in reduced visibility and probably decrease eagle feeding efficiency. Spoil disposal may also result in the filling of aquatic habitat or the overburdening of forested habitat and the death of occupied or potential nest trees.

Canal, ditch or channel construction often increases the volume of water flow, resulting in drainage of aquatic habitat and loss of feeding areas. Alteration of flow rates for irrigation may also result in habitat loss. Conversion of wetlands to agriculture, forestry, industrial, and residential development poses a major threat to the ability of eagles to sustain themselves in a significant part of their historic range.

1.1.2. Identify negative alterations to terrestrial habitat. The major types of land use changes which affect eagles are silvicultural, agricultural, residential, recreational, and industrial. Modern silvicultural practices include shorter rotations, sanitary cuttings, increased harvest acreages, and even-age management. These practices can result in loss of potential nest and perch trees if coordination measures are not incorporated. Where timber is harvested, the land is often converted to farms in lieu of the long-term investment required for timber. Land clearing for agricultural use has also accelerated in many areas. Residential and recreational development are often in direct

competition with eagles, since humans and eagles both prefer to inhabit areas adjacent to water. Industrial development is variable in its impact and must generally be considered on a case-by-case basis. Further, it is important to consider the secondary development which is associated with industrial facilities.

1.1.3. Quantify essential characteristics of occupied habitat. Quantification of the characteristics of habitats, undertaken in a systematic and uniform format, is a research need. Such characteristics should be determined by comparing differences between historic and currently occupied territories. In addition, areas of high productivity should be compared and contrasted to areas of low productivity. This should provide for the accurate prediction of impacts during early planning stages and allow for the protection of potential as well as occupied habitat. Currently, a conservative approach is recommended which must include a case-by-case evaluation. These projects need to be completed if intelligent resolution of conflicts and informed management decisions are to be expected.

1.1.4. Quantify responses of eagles to habitat alteration. Individual eagles, pairs, or groups of eagles vary widely in their response to alteration of habitat. Eagles habituated to disturbance may appear to discredit the validity of protection needs. While legal and aesthetic interpretations may continue to present controversy, there are biological questions that should and must be answered in order to reduce conflict and provide resolution based on quantification. Research is needed to address the effects of disturbance including the duration, frequency, and intensity as they relate to each stage of reproduction.

1.2. Provide habitat protection through site management. Habitat management is the first priority of recovery. Nowhere else in its range is the eagle under greater threat from habitat changes than in the Southeast.

1.2.1. Implement and adhere to "Habitat Management Guidelines for the Bald Eagle in the Southeast Region" (Appendix D). The current level of knowledge for bald eagle habitat management is reflected in the FWS booklet "Habitat Management Guidelines for the Bald Eagle in the Southeast Region." It is recommended that these guidelines be used in resource planning. It is also recommended

that these guidelines be reviewed and updated regularly as new information becomes available. While these management guidelines are generally developed for high-use eagle habitat, protection of potential eagle habitat is also required in order to re-establish breeding continuity in the Region.

1.2.2. Develop specific management plans for each breeding area. It is recommended that individual management plans be developed for each breeding area when possible. This should include occupied, recently occupied, and historic nesting areas. These plans should be designed to accommodate local factors of habitat use, use-area configuration, and previous level of habituation and nesting success.

1.2.3. Protect significant areas through cooperative agreements, easements, acquisition, or other appropriate means. Implementation of management plans may be accomplished by cooperative agreements, easements, fee title acquisition, or zoning. Cooperative agreements have functioned well in providing short-term authority to protect and manage endangered species habitat on private property. Cooperative agreements are often non-binding, but create a channel of information exchange between the landowner and the management authority. An individual management plan is recommended for each area where an agreement is obtained.

Eagle habitat may also be protected through easements. The protection of eagle habitat may result in an incurred financial loss to the landowner, and, in some cases, an easement or subsidy may be appropriate to offset such losses.

Fee title acquisition of eagle habitat should provide for the long-term management of important areas. Tax incentives and multiple species priorities often enhance the justification of the purchase. Purchase is, however, often difficult to justify because of high cost and the mobility of eagles. Acquisition should therefore be attempted only where sustained use has been documented.

1.2.4. Identify and incorporate essential habitat in land use plans and planning. The identification of important habitat and essential elements of that habitat is needed so that accurate information may be provided during the development of land use plans. Recommendations for essential habitat areas are presented in Appendix E.

1.2.5. Develop specific management plans for important feeding and roosting sites and eagle concentration areas. Habitat management for the non-breeding eagles of Regional natal origin should be given priority. The progeny of remnant breeding centers would appear to be of critical importance to the future of the Regional population, yet it is often difficult to identify these birds. Little is known of their seasonal movements, and they are often mixed with birds from populations nesting outside the Region. Information is needed on the seasonal distribution and habitat use of this population segment as well as the breeding adults during the non-breeding season. All non-nesting concentrations of eagles and communal night roosts should be identified, and individual management plans should be developed for significant sites.

1.2.6. Utilize the regulatory authority of Section 10 (Rivers and Harbors Act) and Section 404 (Clean Water Act) to conserve bald eagle habitat where appropriate. These laws provide the major habitat protection for bald eagle populations in Louisiana. The agencies currently involved in administering these laws should be recognized for their efforts. Increased coordination (sharing of information) will further enhance eagle habitat conservation.

1.2.7. Protect wintering eagle habitat in a manner coordinated with FWS Northcentral and Northeast Regions. This plan has focused attention upon the nesting bald eagles of the Southeast. However, the Southeast also provides highly significant wintering habitat for bald eagles which nest north of this Region as well as non-reproductive eagles of southern origins (See Appendix E). The needs of these wintering eagles and the threats to their well-being while in the Southeast are poorly understood. Therefore, appropriate strategies to adequately research and manage these populations and their habitat in the Southeast must be developed and implemented in concert with the similar efforts to protect wintering bald eagle habitat in States north of the Southeast Region. This task will be interrelated with Task 1.2.5, Task 2.1.3 and Task 2.2.2.

1.3. Prevent or mitigate the degradation of eagle habitat from environmental contaminants. The problem of preventing or mitigating the degradation of eagle habitat by toxic substances is an enormous one. It involves thousands of

substances and their metabolites. These substances represent the product of multi-million dollar industries, and the benefits derived from their use represents millions of dollars more. It is clear that there is enormous economic incentive ensuring the continued development and use of toxic substances in the environment. The substances which impinge on the recovery of eagles must be identified and then isolated, or in some way the effects must be mitigated. To determine the effects of all known toxic substances and their metabolites on eagles is unreasonable. Because of this, we must monitor eagle numbers, nesting effort, fecundity, and selected contaminants in eggs, eagle carcasses, and prey items. Monitoring priorities should be established based on known problem substances, similar substances, and substances likely to cause problems. Substances likely to cause problems are those which are persistent in the environment, are transported and accumulated through the food chain, and are extensively used.

It is known that pesticides, particularly organo-chlorines such as DDT, and cyclodienes such as dieldrin, have directly, or through their metabolites, reduced the reproductive success and/or survivorship of eagles. This has accelerated population declines and has contributed to the current disjunct breeding distribution of eagles in the Region. Since restrictions began on the use of organo-chlorines, eagle populations have stabilized or increased in many areas. In the Southeast, productivity appears adequate; however, remnant breeding populations remain disjunct from major breeding areas. While the current situation appears improved, our ability to prevent a reoccurrence is questionable. The detection and identification of problem compounds and problem areas is difficult. The synergistic effects of contaminants are largely unknown. Contamination of the Regional nesting population by migratory prey species or the movement of eagles into areas where the use of organo-chlorine compounds is still widespread creates a difficult problem. The control of industrial by-products such as PCB's, as well as regulation of harmful pesticides, will undoubtedly present a management problem for years to come.

Heavy metal compounds of mercury and lead have been linked to avian mortality. Of particular concern for bald eagles in the Southeast is the toxic effect of lead (Pattee et al. 1981), which is ingested as lead shot with prey. Wintering waterfowl and nesting eagles often utilize the same habitat creating a situation where crippled waterfowl from hunting become available as prey to eagles. Lead toxicity resulting from secondary ingestion may represent as much as 7 percent of the observed mortality of eagles in the Southeast.

1.3.1. Make appropriate recommendations to regulatory agencies regarding the use of steel shot for waterfowl hunting in areas receiving high use by eagles. The target year for the total exclusion of lead shot for waterfowl hunting in the lower 48 States is 1991 (USFWS 1986).

1.3.2. Submit eagle carcasses to the FWS National Wildlife Health Research Center for necropsy and chemical analysis. A valuable service is being provided by the FWS National Wildlife Health Research Center at Madison, Wisconsin. It is recommended that all eagle carcasses be submitted to this facility as described in Appendix F. The use of this facility has produced a standardized procedure for determining the cause of death, and, in cooperation with the FWS Patuxent Wildlife Research Center, the facility has taken the lead in identifying and monitoring contaminants in eagles. A series of published reports from these facilities has provided the means by which we may evaluate the progress of toxic substance management. Examination of documented toxic effects and undiagnosed mortality should be made by area and season. This should aid in documenting trouble areas and provide correlations to possible new toxic materials.

1.3.3. Apply appropriate constraints under permit review procedures.

1.3.4 Review current laws and regulations to determine which apply to control of toxic substances in eagle habitat.

1.3.5. Participate in contingency planning for emergency pollution abatement.

2. Protect and Manage Eagle Populations

2.1. Monitor populations. Population monitoring is necessary in order to determine the status and distribution of the species. Such information may be used to determine the factors limiting the population and the level and intensity of management necessary for recovery. Once management plans are implemented, it is also necessary to evaluate their effectiveness.

2.1.1. Monitor nesting and productivity using standardized terminology in Appendix B. Standard terminology provided in this Appendix is recommended so that direct comparisons can be made between studies and areas. This is not to limit the data collected or

preclude the use of other terminology, it is to assure that regardless of what terminology is used, terminology will be standardized for extraction and comparison.

2.1.2. Conduct banding and color marking projects. Band recoveries and visual identification of individual eagles would provide needed information on movements, mortality, recruitment into the breeding population, territory formation and stability, and age at sexual maturity.

2.1.3. Conduct mid-winter eagle surveys. Regional participation in standardized national surveys on non-nesting eagles, such as the mid-winter eagle survey sponsored by the National Wildlife Federation, is also recommended. The fact that the survey is conducted during the nesting season in the Southeast does not negate its value.

2.2. Prevent or mitigate the effects of behavioral degradation. Behavioral degradation is the modification of normal eagle activity by any disturbance which reduces an area's ability to support eagles. These disturbances may result in increased energy expenditures, decreased feeding efficiencies, reduced reproductive potential, or decreased habituation by eagles. In each case there is a reduced fitness of the population which is related to human activity and not directly related to physical or chemical alterations. The effects of disturbances are generally cumulative and difficult to quantify. Many disturbances are unintentional or judged to be minor when viewed in isolation; however, the cumulative effects of these disturbances may severely degrade the area.

2.2.1. Identify and quantify effects of disturbance on nesting eagles and incorporate into management plans as indicated in Task 1.2.2. Disturbance is often difficult to quantify because the factors of distance, intensity, frequency, and timing are all interrelated. Based on our current knowledge, disturbance at the nest site is most likely to be detrimental during incubation. Embryonic mortality may result from chilling of eggs or from addling or breaking of eggs by the adults when they are disturbed on the nest. Chilling of eggs is most likely to occur during cold and wet conditions or in response to a prolonged disturbance. Breakage, on the other hand, would more likely occur during a response to a radical disturbance and would be related to the frequency and intensity of the response.

2.2.2. Identify and quantify the impact of disturbance on feeding and roosting sites and incorporate into management plans as indicated in Task 1.2.5. While little is known about the non-nesting habitat use of eagles from the Southeast, there is increasing evidence of significant wintering concentrations within the Region. The importance of these sites to survivorship is uncertain, but it is logical to assume that the use of areas on a repeated or sustained basis would enhance efficiency through familiarity. The protection of these areas from disturbance should minimize energy expenditures by eagles.

The ultimate impact of disturbance to feeding areas and roosts is not clear, and a systematic study of feeding efficiency and energy expenditures on protected and disturbed sites is needed. There is a further need to understand the relationship between survivorship and disturbance at feeding and roosting areas.

2.2.3. Continue to require permits for all research activities which have the potential to negatively impact eagles. It would be naive to assume that many of the procedures associated with research activities do not disturb eagles. It is therefore incumbent on the researcher to minimize such disturbance, to quantify the effect of any unavoidable disturbance, and to communicate such effects to other researchers. The effects of disturbance from research projects should be evaluated against the information to be gained and the project's enhancement of the recovery potential of eagles.

The value of the information gained must be judged greater than the potential disturbance. The information gains should relate to recovery, there should be a demonstration of researcher experience and research planning, and the research goal should be realistically attainable.

2.2.4. Develop and implement guidelines for the use of Military Areas of Operation (MOA). Information on the location of active nest sites, historic nest sites, and potential nesting habitat should be provided during the planning stages of MOA's. Prohibited acts should be outlined with a priority list which includes the time of year and the activities to be avoided.

2.3. Reduce eagle mortality. Many of the activities of man result in unintentional or incidental mortality. The closer the eagles are to man, the greater this rate of mortality. The habituation of eagles to man's activities increases incidental mortality such as collisions with vehicles. In this area of recovery particularly, there is a need for a cooperative effort to find the least disruptive solutions. Solutions will involve documentation of the level and location of mortality, determination of the source of mortality, and the development of a reasonable resolution to the problem.

2.3.1. Maintain and/or augment active enforcement of existing laws and preventive actions designed to reduce the number of violations (see Task 3). The importance of preventive law enforcement cannot be overemphasized. A well-planned preventive law enforcement program will result in public attitudes which openly condemn eagle shooting, encourage cooperation with investigations, and produce witnesses willing to testify. Information and education actions (see Task 3.) should target identified groups and be timed ahead of seasonal peaks in violations. Law enforcement personnel at the State and Federal levels should be informed and trained concerning the problem. The significance of the problem should be demonstrated to persons involved in the judicial process so that maximum penalties may be obtained.

Active law enforcement should be concentrated in areas with previous shooting mortality and areas where eagles concentrate. All efforts should be made to adequately investigate and prosecute violators, and successful prosecutions should be publicized.

2.3.2. Establish and maintain adequate rehabilitation facilities. Mortality may be reduced through the use of rehabilitation facilities. Regional facilities should be established to assure prompt veterinary care. Facilities should be afforded the maximum opportunity for success by communication with already established facilities. Raptor rehabilitation is a specialty which requires special training and expertise and, should be regulated to ensure the best prognosis for eagles. Procedures for emergency care of injured or diseased eagles is presented in Appendix G.

2.3.3. Reduce mortality from collisions through structural modifications and/or project permit review in documented problem areas. The frequency of collision

of eagles with towers and powerlines may be reduced by: (1) not locating structures in areas of high eagle use where possible, and (2) altering structures to increase their visibility.

2.3.4. Reduce mortality from electrocution through appropriate design and location of power lines. Poles and lines should be designed to prevent electrocutions in areas of high eagle use or areas of remnant breeding populations as outlined in Olendorff (1981).

2.3.5. Reduce incidental trapping mortality by regulation of trapping method and/or sites. The use of leg-hold traps for the commercial capture of fur-bearing animals is a widespread industry in the Southeast, but is not a significant source of incidental capture of eagles. The incidental capture of eagles is sporadic and generally of local significance and is related to the use of the sight-baited (exposed bait) method of trapping. Incidental capture of eagles in sight-baited leg-hold traps has been reported in North Carolina (B. Sanders, pers. comm.) and in Arkansas (R. McMasters, pers. comm.). Measures have been taken in Arkansas to prohibit the use of any form of sight bait composed of animal matter within 20 feet of a trap (State Regulation 10.02). It is recommended that the use of sight-baited leg-hold traps be discouraged in all areas receiving frequent eagle use.

2.3.6. Prevent mortality by prohibiting use of poisons for predator control in areas used by feeding eagles. This problem involves secondary or unintentional ingestion of poisons which are being used for the control of other species.

2.4. Re-establish the historic breeding continuity and supplement reduced populations through translocation and fostering projects where necessary (see Appendix H). The current breeding range of the eagle should be expanded to insure the security of the species within the Southeast. Translocation could be a useful technique for accelerating natural population expansion.

The most logical approach to meeting this goal is to:

(1) maintain current breeding areas at self-sustaining levels;

(2) re-establish the breeding continuity between these areas within the Region; and

(3) re-establish the breeding continuity between the Southeast Region and other breeding populations.

2.4.1. Implement translocation projects to re-establish the breeding continuity within the Region. The order of priority for translocation efforts should be coastal Georgia, southwest Louisiana, and coastal Alabama and Mississippi. If nesting eagles were returned to those areas, the historic breeding continuity within the Region would be returned. The basis for this priority is: (1) remaining available habitat; (2) the historic level of nesting and the time span since extirpation occurred; (3) the size of the populations in adjacent breeding areas; and (4) the distance between the breeding areas. These four conditions delimit areas which would most likely result in successful translocations or a self-sustaining population.

2.4.2. Implement translocation projects to re-establish the breeding continuity between the Southeast and other breeding populations. In order of priority, coastal North Carolina, Tennessee, Kentucky, and Arkansas represent areas which would re-establish historic breeding continuity. Priority was based on the conditions set forth in Task 2.4.1.

2.4.3. Obtain a sustained source of eagles of regional genetic origin for translocation projects. To fill this need, an experimental egg removal/captive rearing/hacking program was conducted from 1984 to 1988. Over the four years of the project, 86 bald eagle nestlings were hacked successfully in Alabama, Georgia, Mississippi, North Carolina, and Oklahoma from a total of 124 eggs collected. Donor bald eagles in Florida recycled readily and produced young at a rate comparable to control nests simultaneously monitored in the same Region (Simons et al. 1988, see Appendix I). This technique has been demonstrated to be a useful management tool. Its implementation now depends upon obtaining sufficient funds to allow task 2.4 to be carried out.

3. Improve and Maintain Awareness, Concern, and Support for the Recovery of the Species. All of the factors identified in this plan as limiting recovery are directly related to the actions of man. While eagles have been able to adapt to man's activities to some extent, it will be man's alteration of his own activities which will be required for the long-term recovery of the bald eagle. Many actions necessary for recovery have associated costs, and the dispersal of funds must be supported by an informed public.

Education and information transfer serves a fundamental and broad-based role in recovery. Implementation of recovery actions related to information and education often includes specialists who are not involved in other aspects of recovery. Therefore, information and education needs are separated in order to present an accessible and complete approach.

3.1. Public information and education. Public information programs should be geared to provide updated, accurate information on the status and needs of eagles and the relationship between eagle recovery and the well-being of man. While the eagle is held in high esteem by the majority of people, there continues to be a significant impact on recovery by a small segment of the population which, through ignorance or malice, continues to jeopardize recovery efforts. While support must be evoked from the general public, specific problems such as indiscriminate shooting of eagles must be resolved by focusing efforts at specific user groups.

There are many general information materials available from a wide variety of sources concerning eagles. It is hoped that these materials can be freely exchanged and modified to meet specific needs with a minimum of duplication and cost. Specific materials should be made available for use where problems are identified.

3.1.1. Use permanently incapacitated eagles for information presentations. Exhibiting crippled eagles during lectures is an effective mode of teaching and invariably results in the presence of a receptive audience. Such activities should, however, be carefully limited to qualified individuals and employ only eagles which may not be returned to the wild or used in captive breeding programs that provide stock for reintroduction or other purposes.

3.1.2. Incorporate information on the laws, penalties, rewards, and identification of eagles in hunter safety programs. This would provide information access to an important target group.

3.1.3. Prepare general information brochures. This should include life history information relative to the Southeast since many general accounts depict only characteristics of northern populations. This brochure should present accurate status information as well as recovery needs. It should give sources for additional informational materials.

3.1.4. Include eagle information in hunter regulation brochures. State and Federal hunting regulations brochures containing seasons and hunting laws should include information on eagle protection.

3.1.5. Prepare and distribute public service announcements. Mass media communication is needed to provide coverage of current and/or locally significant information; for example, news releases acknowledging landowner agreements to protect eagle habitat.

3.1.6. Encourage news coverage of eagle shootings and subsequent investigation, prosecution, and disposition of the case. Local events often receive more attention and carry more impact than nationally reported accounts. Occurrences of eagle shootings should be used to disseminate information of a general nature on the species as well as on the individual bird. Knowing the ultimate fate of the shot eagle and those involved in the case may have a lasting impression on the community and provide long-term protection for the species in that area.

3.1.7. Prepare a flyer for distribution with ammunition and firearms. The use of a card containing pertinent information on laws, penalties, rewards, and identification information should be considered for inclusion with ammunition and arms sales.

3.1.8. Produce an information brochure for landowners. Many landowners are willing to manage their land to enhance eagle use or at least to avoid degradation where possible. Thus, land management information and guidelines should be prepared for landowners including information on where to obtain additional professional assistance. State foresters should be included in this effort since they provide silvicultural expertise to private landowners.

3.1.9. Develop and distribute information to pilots concerning the potential for disturbance of nesting eagles by aircraft. A poster should be developed and distributed to all public, private, and military airports. This poster should discuss prohibited acts and a statement of violations and associated penalties. Information on eagle and eagle nest protection should also be included in the Airman's Information Manual in the section on bird strike hazard.

3.1.10. Produce films and slide shows for use at schools, civic clubs, and with special interest groups. Nature films and slide shows are a popular and effective means of reaching special groups. Care must be taken in writing scripts so that films are not outdated too quickly. Slide shows should be produced so that they can be updated easily. Both films and slide shows to be shown by laymen should be self-contained with material that is appropriate for each age group.

3.1.11. Maintain or provide guided tours of eagle use areas where possible. Carefully planned and controlled group tours should be encouraged where possible. These tours should accurately inform the public, minimize the disturbance, and provide an opportunity for the individual to gain a first-hand appreciation for eagles.

3.1.12. Establish displays at public boat landings to provide information on laws, penalties, rewards, and identification of eagles. Many boaters utilize public landings for access to aquatic habitat used by eagles. This includes use by hunters and fishermen as well as by recreational and commercial boaters. These user groups should be provided with information on identification and legal protection of eagles. Local phone numbers where violations may be reported should also be included.

3.1.13. Encourage public displays at zoological gardens and public natural history museums.

3.2. Professional information exchange. An effective system of information exchange among professionals should prevent unnecessary duplication, ensure full use of available information, and accelerate implementation.

3.2.1. Establish an eagle committee representing the State wildlife agencies. Much of the responsibility for implementation of recovery planning ultimately resides with the State wildlife agencies. As such, it would be desirable to establish a working group of State representatives to ensure a flow of information between management agencies. This might be a function of a committee established under the Southeastern Association of Fish and Wildlife Agencies.

3.2.2. Establish or maintain a working committee between Regions. A working group composed of a representative from each of the Regions or recovery teams should be established. This group will attempt to resolve problems common to all Regions and to coordinate Regional recovery planning.

3.2.3. Provide for information transfer to managers. The participation of land managers (from the U.S. Forest Service, National Park Service, Tennessee Valley Authority, Fish and Wildlife Service, Corps of Engineers and State agencies) in developing and implementing recovery actions is essential, and participation should be encouraged in eagle working groups.

3.2.4. Support national coordination actions. Several private groups have been instrumental in coordinating various activities. The Audubon Continental Bald Eagle Survey of the 1960's and the Raptor Information Center (NWF) mid-winter eagle surveys are excellent examples of the projects which can be accomplished by such groups and should be encouraged and supported.

3.2.5. Identify and designate one individual within FWS Southeast Region to be responsible as coordinator and contact between FWS and other entities. Lack of coordination often results in a duplication of effort among the various agencies and groups involved with eagles. A single individual would coordinate the recovery implementation activities outlined in this plan to assure that all priorities are met and to prevent duplication.

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PART III: IMPLEMENTATION SCHEDULE

Priorities in column four of the following implementation schedule are assigned as follows:

Priority 1 - All actions that are absolutely essential to prevent extinction of the species.

Priority 2 - All actions necessary to maintain the species' current population status.

Priority 3 - All other actions necessary to provide for full recovery of the species.

LIST OF ABBREVIATIONS

Endangered Species Program (FWS) = SE
Federal Assistance (FWS) = FA
Law Enforcement (FWS) = LE
Public Affairs (FWS) = PAO
Refuges (Wildlife Resources, FWS) = WR
Research (FWS) = R

Corps of Engineers = CE
Department of Defense = DOD
Federal Aviation Administration = FAA
Federal Energy Regulatory Commission = FERC
National Park Service = NPS
Rural Electrification Administration = REA
Tennesse Valley Authority = TVA
U. S. Coast Guard = USCG
U. S. Forest Service = USFS

State forestry agencies = AFA
State wildlife agencies = SWA

National Wildlife Federation = NWF

FWS Regions:

4 - Southeast
3 - Northcentral
5 - Northeast

Part III Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS						
					Region	Division	Other	FY 1	FY 2	FY 3	
I-3	Identify negative alterations to aquatic habitat	1.1.1	2	3 years	4	R	FL, SC, LA, TX	40,000	40,000	40,000	Funding estimate includes tasks 1.1.1 thru 1.1.4. Major emphasis on FL; isolated special problems elsewhere.
I-3	Identify negative alterations to terrestrial habitat	1.1.2	2	3 years	4	R	FL, SC, LA, TX				
R-3	Quantify essential characteristics of occupied habitat	1.1.3	2	3 years	4	R	FL, SC, LA, TX				
R-3	Quantify responses of eagles to habitat alterations	1.1.4	2	3 years	4	R	FL, SC, LA, TX				
M-3	Implement and adhere to "Management Guidelines for the Bald Eagle in the Southeast Region".	1.2.1	2	Indefinite	4	SE WR	SHA, CE, NPS, USFS, DOD, TVA				
M-3	Develop specific management plans for each breeding area.	1.2.2	2	Indefinite	4	SE	SHA, CE, NPS, USFS, DOD	40,000	40,000	40,000	
A1-7	Protect habitat through coop. agreements, easements and other means.	1.2.3	2	Indefinite	4	SE	SHA	15,000	15,000	15,000	
I-3	Identify and incorporate essential habitat in land use plans and planning.	1.2.4	2	Ongoing	4	SE	SHA, CE, NPS, USFS, DOD				
M-3	Develop management plans for feeding & roosting sites.	1.2.5	2	Ongoing	4	SE	SHA, CE, NPS, USFS, DOD				
M-3 O-3	Utilize Section 10/404 authority to conserve eagle habitat.	1.2.6	2	Ongoing	4	SE	CE				
M-3	Protect wintering eagle habitat.	1.2.7	2	Indefinite	4	SE	SHA, CE, TVA, USFS				

Part III Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency FWS Region	FWS Division	Other	Estimated Fiscal Year Costs FY	FY	FY	Comments/Notes
O-3	Make recommendations regarding use of steel shot.	1.3.1	2	Continuous	4	WR					There is an immediate need for this action.
I-12	Necropsy and chemical analysis of eagle carcasses.	1.3.2	2	Ongoing	3	R					National Wildlife Health Lab is presently involved.
O-3	Apply constraints under permit review procedures.	1.3.3	2	Ongoing	4	SE					
I-12, O-2	Review laws & regulations which may control toxic substances in eagle habitat.	1.3.4	3	1 year	4	SE					
I-12	Contingency planning for emergency pollution abatement.	1.3.5	3	Ongoing	4	SE	USCG, SWA				
I-1	Monitor nesting & productivity	2.1.1	1	Continuous	4	R	SWA				
I-1	Banding & color marking.	2.1.2	1	10 years	4	R	SWA	54,000	45,000	45,000	
I-1	Conduct mid-winter eagle surveys.	2.1.3	2	Continuous	4	WR SE	NHF, USFS, TVA, CE, NPS				
I-3, I-14	Identify & quantify effects of disturbance on nesting eagles & incorporate into management plans.	2.2.1	2	3 years	4	SE	SWA, CE, NPS, USFS, DOD				
I-3, I-14	Identify & quantify impact of disturbance on feeding and roosting sites & incorporate into management plans.	2.2.2	2	3 years	4	SE	SWA, CE, NPS, USFS, DOD				
O-3	Require permits for all research activities with potential to impact eagles.	2.2.3	3	Continuous	4	SE	SWA				

Part III Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS Region	Division	Other	FY	FY	FY	
M-3 O-3	Develop & implement MOA guidelines	2.2.4	3	1 year	4	SE	DOD				
O-2	Maintain/augment active enforcement of existing laws.	2.3.1	1	Continuous	4	LE	SWA, CE, NPS, USFS, DOD				
M-7	Establish & maintain adequate rehabilitation facilities	2.3.2	2	Continuous	4	LE	SWA				
M-3 O-3	Reduce mortality from collisions with powerlines and towers.	2.3.3	3	Continuous	4	SE	FERC, REA				
M-3 O-3	Reduce mortality from electrocution	2.3.4	3	Continuous	4	SE	FERC, REA				
O-3	Reduce incidental trapping mortality.	2.3.5	3	Continuous	4	LE	SWA, CE, USFS, DOD				
O-3	Prevent mortality by regulating use of poisons for predator control.	2.3.6	3	Continuous	4	LE	SWA, CE, USFS, DOD, NPS				
M-2	Implement translocation projects to re-establish the breeding continuity within the region	2.4.1	3	10 years	4	SE	SWA, USFS, NPS				Tasks 2.4.1 and 2.4.2 would cost $500,000 a year for about 5 years.
M-2	Implement translocation projects to re-establish the breeding continuity between the Southeast and other breeding populations.	2.4.2	3	10 years	4	SE	SWA, TVA, USFS, NPS				

Part III Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS Region	FWS Division	Other	FY	FY	FY	
M-1	Obtain a sustained source of eagles of regional genetic origin for translocation projects.	2.4.3	3	Continuous	4	R	SWA				Florida is the likely source of eggs to produce eagles for translocation. See Appendix I
O-1	Information lectures using eagles.	3.1.1	3	Continuous	4		SWA,NPS, USFS,CE, TVA				
O-1	Hunter safety program.	3.1.2	2	Continuous	4	FA	SWA				
O-1	Prepare general information brochures.	3.1.3	3	1 year			SWA				
O-1	Hunter regulation brochures.	3.1.4	2	Continuous	4	WR	SWA				
O-1	Public service announcements	3.1.5	3	Ongoing	4	PAO	SWA				
O-1, O-2	News coverage of violations.	3.1.6	2	Ongoing	4	LE	SWA				
O-1	Information flyer with munitions.	3.1.7	3	1 year			Private Industry				
O-1	Brochure for landowners	3.1.8	2	1 year	4	SE	SWA,SFA				
O-1	Information to pilots concerning nesting eagles.	3.1.9	3	1 year			FAA				
O-1	Eagle films & slide talks	3.1.10	3	Ongoing	4	WR	SWA				

Part III Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS						
					Region	Division	Other	FY	FY	FY	
O-1	Maintain/provide guided eagle tours where possible.	3.1.11	3	Ongoing	4	SE	SWA, TVA				
O-1 O-2	Boat landing displays.	3.1.12	3	2 years			SWA, TVA, NPS, USFS				
O-1	Public displays.	3.1.13	3	Ongoing			SWA Museums				
O-1 O-4	Regional eagle committee.	3.2.1	2	Immediately			SWA				Southeastern Assn. of Fish and Wildlife Agencies could establish such a committee.
O-1 O-4	Establish/maintain national committee to coordinate between regions.	3.2.2	2	Immediately	4	SE	SWA				Expanded from Recovery Team Leaders Coordinating Committee.
O-1 M-3	Provide for information transfer to managers.	3.2.3	2	Continuous	4	HR	SWA, TVA, USFS, NPS, CE				
O-4	Support national coordination actions.	3.2.4	2	Continuous	4	SE	SWA, Private Conservation Groups				
O-4	Region 4 eagle coordinator.	3.2.5	2	Immediately	4	SE					

KEY TO IMPLEMENTATION SCHEDULE COLUMN 1

General Category (Column 1):

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

APPENDIX A: DETAILED STATE-BY-STATE HISTORICAL DATA ON NESTING OF BALD EAGLES IN THE SOUTHEAST

Detailed State-by-State Historical Data on Nesting of Bald Eagles in the Southeast.

Alabama. The historical occurrence of seven nests in Alabama has been documented. Nests have been reported from the Alabama Gulf Coast and from the Tennessee River. On the coast, three nests occurred in Baldwin County and one nest in Mobile County prior to 1962. Along the Tennessee River, eagles nested on Guntersville Reservoir, Marshall County (Imhof 1976). Farther downstream, a nest territory was reported on Wheeler Reservoir. On January 27, 1947, there were two nests in this location. One was in a large oak and was abandoned. The other was located in a tall pine about 200 yards from the abandoned nest. It was in use and contained two young. This successful nest was used through the 1948 and 1949 nesting seasons. It was abandoned after that probably due to human disturbance which resulted when its presence became known locally and it was visited by many sightseers (T. Atkeson, pers. comm.). Howell (1928) reported that eagles nested above Muscle Shoals (either in Lauderdale or Colbert counties). During the 1982-83 nesting season, nests were constructed in two breeding areas, but no eggs were laid (K.O. Guyse, pers. comm.). During the nesting season of 1987-1988, Alabama had no bald eagle breeding attempts (J. Meyers, pers. comm.).

Arkansas. Approximately 22 productive bald eagle breeding territories are believed to have occurred at various times in Arkansas. Until the early 1950's, bald eagle nests in Arkansas were scattered along the lower Mississippi and Arkansas River Valleys. In northern Arkansas, eagles nested on Big Lake (Wheeler 1924) and on Falls Lake adjacent to the Mississippi River, Mississippi County (A. F. Ganier and B. Coffey, unpubl. data). On Wapanocca National Wildlife Refuge, Crittenden County, a nest was constructed in 1979 and repaired in 1980; however, no eggs were laid (B. Grabill, pers. comm.). Three pairs were observed nesting on Horseshoe Lake, 25 miles southwest of Memphis in southern Crittenden County on March 9, 1930 (Ganier 1931, 1951). Eagles nested on Buffalo Creek, St. Francis County, in 1923 (Wheeler 1924). Two nests were reported on Council Lake, Lee County, adjacent to the Mississippi River in the 1930's (A. F. Ganier and B. Coffey, unpubl. data) and in Phillips County, a pair was reported nesting near Helena (Howell 1911). In 1957, a pair nested on Peckerwood Lake, Arkansas County, but were apparently unsuccessful as no eggs or young were seen (S. Barkley, pers. comm.). Nesting was reported at the junction of Bayou Meto and the Arkansas River, Jefferson County, in the mid 1950's (S. Barkley, pers. comm.).

The junction of the White, Arkansas, and Mississippi rivers appears to have been a high density nesting area in Arkansas with a total of nine bald eagle nests believed to have occurred near there (A. F. Ganier and B. Coffey, unpubl. data). One was located along the White River in southern Arkansas County. Two were located on the north side of the Arkansas River near its junction with the Mississippi in Desha County. (Another nest was close by on the east side of the Mississippi River, Concordia Lake, Bolivar County, Mississippi.) Four nests were reported

from Desha County, south of the Arkansas River, near Watson. One nest was located for many years on Big Island, Desha County, between the Arkansas and Mississippi Rivers (Wheeler 1924, and A. F. Ganier and B. Coffey, unpubl. data).

In extreme southeast Arkansas, two nests were placed on Walkers Bend, off the Mississippi River in Chicot County (A. F.Ganier and B. Coffey, unpubl. data, and Hunt 1921) and another was reported by Howell (1911) in the big swamps west of Wilmot, Ashely County.

Only one nesting attempt has been reported from western Arkansas. This nest was built near Bois D'Arc Lake, Hempstead County, in the winter of 1978-79, but no eggs were laid (S. Barkley, pers. comm.). From 1957 to 1977, no nesting activity was reported. Several unsuccessful nesting attempts were reported from 1978 to 1980. A single nest territory has produced young each year since 1981-1982 with the exception of the seasons of 1982-1983 and 1987-1988. There was a total of nine nesting attempts, all unsuccessful, in Arkansas during the winter of 1987-1988 (S. Barkley, pers. comm.).

Florida. Bald eagle nesting in Florida has been widely studied and published accounts are available from a variety of sources. A brief summary is presented here but the cited literature should be consulted for more details.

Charles Broley first noted a decline in eagle nesting in the late 1940's (Broley 1952). A further decline from 73 to 43 active nesting areas was reported for west central Florida by Broley (1958) between 1936 and 1957. Sprunt (1972) was able to locate only 35 pairs in 1964 for the same area. Howell (1937, 1941, 1949, 1954, 1958, 1962, 1968, 1973) reported a decline in nesting around Merritt Island from 24 to 4 nesting territories during the period from 1935 to 1971. Recent reviews of the status of nesting eagles in Florida are provided by Sprunt (1972), Sprunt et al. (1973), and Nesbitt et al. (1976). McEwan and Hirth (1979) provided additional information on productivity as well as nest site selection. An excellent summary was provided by Peterson and Robertson (1978) in Volume 2 of the Rare and Endangered Biota of Florida series, in which they characterized the populations at that time as less than 50 percent of historic numbers and still slowly decreasing. However, a state-wide survey conducted from 1973-1988 showed that the population during this period, for the most part, reproduced at a healthy rate. The 1988 production of 448 young from 399 occupied breeding areas was the highest of any year since the survey began (Nesbitt 1988).

Georgia. Burleigh (1958) reported eagles as once being common residents along the Georgia coast. Tompkins (1958) reported eggs collected from eight different islands in Chatham County during the early 1900's. Bonnycastle (1901) reported eagles congregating in great numbers in spring on the sand spits and tide flats of Denman's Island, and many remained to breed. He also reported seeing 125 eagles along 7 desolate miles of the coast. Erichsen (1919) reported eagle breeding on St. Catherines Island, and Pearson (1922) recorded nesting on the Cumberland Islands. Eagles

nesting in the Okefenokee were reported in 1913 (Wright and Harper 1913) and in 1941 (Hebard 1941). Teal (1959) reported four nests on Sapelo Island which although not used from 1955-57, fledged two young in 1958. Teal (1959) also cited a report of eagle nesting on Blackbeard Island by Wineland. Kale (1966) reported the Sapelo territory producing three young in 1959, was active but unproductive in 1960, and inactive from 1961-63. During 1962, four active breeding areas were recorded in Georgia with at least three of them successful (Sprunt and Cunningham 1962). Johnson et al. (1974) stated that formerly the bald eagle nested on most of the barrier islands and elsewhere along the coast, and recorded the last successful nesting for over a decade on St. Catherines Island during 1970. During the 1987 nesting season, there were seven active breeding areas in Georgia. Five of these were successful in producing a total of 9 young (K. Riddleberger, pers. comm.).

Kentucky. Mengel (1965) summarized eagle nesting in Kentucky as unlikely that more than 5-10 pairs nested as of the 1950's. Scattered isolated records come from Pindar (1923, 1925) and Monroe and Mengel (1941) with general comments in Barbour et al. (1973) and Funkhouser (1925). Peterson (1977) provides a summary of nesting in western Kentucky. During the 1987-1988 nesting season, Kentucky had three occupied breeding areas, however, no young were fledged. Only one of these areas has produced young in the recent past (J. MacGregor, pers. comm.).

Louisiana. In Louisiana, a total of at least 37 productive bald eagle nests have been documented. Bald eagle nests in Louisiana have occurred primarily along the Mississippi River Valley, the Gulf Coast, and Sabine River. One nest was located at Eagle Bend on the east side of the Mississippi River, Madison Parish. One of these birds was collected at the nest December 14, 1929, and a second bird was taken January 7, 1931 (A. F. Ganier and B. Coffey, unpubl. data). Another nest was located west of Tallulah at the northeast end of Judd Brake, the last nesting at this sight occurred in the spring of 1957. The same pair attempted to nest in 1958, but the nest, located in a tall bald cypress, was destroyed when the land was cleared for a soybean field (Spindler 1977). Farther south along the Mississippi River Valley, Stockard (1905) reported a nest in a cypress brake bordering a lakeshore in Catahoula Parish. He said the same nest was used season after season and was situated far up in the topmost branches of a high cypress tree. This brake was about 25 miles from the Mississippi River west of Natchez, Mississippi.

Eagles were reported breeding in West Feliciana Parish in 1933 and a nest was reported near Port Hudson, East Baton Rouge Parish, in March 1935 (Oberholser 1938). This nest was known to exist at least until 1945 (R. J. Newman, pers. comm.). A nest was located on Alligator Bayou near Spanish Lake south of Baton Rouge, Iberville Parish, until the late 1960's (R. Aycock, pers. comm.).

Coastal Louisiana bald eagle nesting records include one nest on the west side of the Pearl River in St. Tammany Parish that was active in 1979-80. Another nest, which is no longer active, was located on the shore of Lake Pontchartrain near Madisonville, Tangipahoa Parish (R. Aycock, pers.

comm.). A nest was observed on Jones Island, Tangipahoa Parish, in 1960-61 (W. Palmisano, pers. comm.). An abandoned nest was observed on the south side of Lake Maurepas, St. John the Baptist Parish, in March 1979. On March 10, 1939, T. R. Howell reported a nest near New Orleans, Orleans Parish, to contain 2 large young (letter on file in office of R. Aycock, U. S. Fish and Wildlife Service Area Office, Jackson, Mississippi). Other coastal nests which have been active in recent years include: two nests near the east shore of Lac Des Allemands in St. John the Baptist Parish and St. Charles Parish; one nest near the Moisant Airport, St. Charles Parish; one nest on the shore of Lake Cataouatche, St. Charles Parish; two nests near the Barataria Waterway, Jefferson Parish; one nest on Lake Verret, Assumption Parish; two nests on Avoca Lake, St. Mary Parish; four nests along the swamp/marsh interface, a nest on a cypress ridge, and a nest in dead timber (apparently killed by saltwater intrusion) in Terrebonne Parish (W. Dubuc, pers. comm.). In 1961-62, an eagle nest on Lake Hatch, Terrebonne Parish, was destroyed allegedly by trappers (R. Aycock, pers. comm.). During January 1895, eagles reportedly nested in an oak tree on a ridge near the mouth of Fresh Water Bayou, Vermilion Parish (McIlhenny, 1932). On February 17, 1917, one young was found in a nest on the E. A. McIlhenny Estate, Avery Island, Iberia Parish. Two eggs (one addled) were reported in a nest on February 2, 1919, a few hundred yards from the aforementioned location; and on the same day, 3 miles further into the swamp, a nest tree was cut down to obtain 2 young for a museum collection (Bailey 1919). One nest in a big cypress tree near the McIlhenny home was occupied for more than 50 years (McIlhenny 1932).

Three nesting territories are recorded from Cameron Parish, southwest Louisiana. One of these territories was in the vicinity of Lacassine National Wildlife Refuge from 1919-65. A nest was located 1/4 mile from the refuge headquarters on private land, and another was located on Blue Grove on a refuge impoundment. Production of young was recorded at both nests, but not during the same year. It appears that these two nests represented one territory (B. Brown, pers. comm.). Another bald eagle nesting territory was reported on Blue Island, Sabine National Wildlife Refuge, from 1941-52 (J. Walthers, pers. comm.). This was probably the same territory as that described below. "Two (bald eagle) nests were in rather isolated clumps of trees along Black Bayou in Cameron Parish, and one of them was scarcely thirty feet from the ground. The nest contained a newly hatched young and an addled egg on February 29, 1919" (Figgens 1923, and Bailey and Wright 1931). The third nest in the parish was observed in the 1950's on Tooney Marsh, Cameron Parish, near Orange, Texas (J. Walthers, pers. comm.). Upstream on the Sabine River, Vernon Parish, eaglets were collected from a nest during a logging operation and raised by a storeowner in Burr Ferry (R. Aycock, pers. comm.). Farther upstream on Toledo Bend Reservoir, Sabine Parish, an eagle's nest was located near Negreet in 1970. A nest was at Black Lake, Natchitoches Parish, from 1957-63. A new nest was built on Bayou D'Arbonne, D'Arbonne National Wildlife Refuge, Union Parish, in 1978-79. Birds attended the nest again in 1979-80; however, to date no young have been raised (D. Doshier, pers. comm). In 1987-1988, there were 36 occupied breeding areas in Louisiana. Twenty-three of these fledged a total of 41 young (W. Dubuc, pers. comm.).

Mississippi. Bald eagle nests in Mississippi were historically situated along the Mississippi River, along the coast, and in Oktibbeha County. In DeSoto County near Memphis, a nest was known near Mud Lake adjacent to the Mississippi River prior to 1924. Another nest was observed near Walls, DeSoto County, in the 1930's (B. Coffey, pers. comm.). Further south, a nest was reported next to the Mississippi River in southern Coahoma County (A. F. Ganier and B. Coffey, unpubl. data). Two nests were reported in Bolivar County; one was on Concordia Lake, and the other near the Mississippi River close to Benoit (A. F. Ganier and B. Coffey, unpubl. data). Lois Bays (pers. comm.) knew of two eagle nests in Bolivar County, Mississippi, and one just across the river in Arkansas in 1953. These may have been the same as nests reported by Ganier and Coffey in 1932. In Washington County, one nest was reported on Lake Washington (A. F. Ganier and B. Coffey, unpubl. data).

Six nests occurred in Issaquena County (A. F. Ganier and B. Coffey, unpubl. data). One of these was close to the Mississippi River north of Mayersville. Another nest was near the Mississippi River south of Magna Vista. Ganier (1932) visited an eagle nest on Cypress Lake, Issaquena County, on April 5, 1899. Two additional nests were located on small lakes south of Cypress Lake, and one nest was located on Halls Lake. Another nearby nest was located on the east side of the Mississippi River in Madison Parish, Louisiana (A. F. Ganier and B. Coffey, unpubl. data).

Bald eagles nested on Bluff Lake, Noxubee National Wildlife Refuge, Oktibbeha County, intermittently between 1945 and 1960. In 1947, one nest on the lake contained two young; a second nest was inactive. In 1953 and 1956, there were two nests on the lake. In subsequent years, a single nest was intermittently used; however, no reproduction was reported. Both nests were gone by 1973 (N. Anderson, pers. comm.).

Along the Mississippi Gulf Coast, bald eagle nests have been reported from Cat Island and Ship Island (J. Frazier, pers. comm., Burleigh 1944). In January 1974, a bald eagle nest was observed on a river near the coast in Harrison County. On February 21, 1975, one young was observed in this nest attended by two adults (Turcotte 1975). Adult eagles have been observed at this nest each year since 1975; however, there has been no successful reproduction. A new nest in the same general area was active in 1982-83, with at least one young fledged. In 1988, there were two occupied breeding sites, however, only one of these produced young.

North Carolina. Pearson et al. (1942) stated that the bald eagle "is not uncommon in the coastal region of North Carolina" and that "...the bald eagle probably breeds throughout the coastal country." Pearson et al. (1942) also cited nesting locations on Knott's Island, the mainland of Currituck County, Roanoke Island, Cape Hatteras, as well as in Onslow and Bladen Counties. Wiswall (1946) reported a nest on Wade's Point in Beaufort County in 1890. The North Carolina Heritage Inventory cited breeding areas at Roanoke Island Woods, Nags Head Woods, and Buxton Woods. Nests at these three areas on the North Carolina outer banks were reported to have become inactive prior to 1959. In 1962, only one breeding area was

reported as active by Sprunt and Cunningham (1962) but four were active in 1963 (Sprunt and Ligas 1963).

More recently, Benfield (Teulings 1971) reported an occupied breeding site at Mattamuskeet NWR during the 1970-71 nesting season. Hollingsworth (1974) reported successful nesting at Mattamuskeet Refuge in 1971-72, but only one adult was present during the 1972-73 season, and no activity was seen during 1973-74. Simpson (pers. comm.) reported two nestlings being hand-raised after they were found out of the nest. The young birds were released in Croatan National Forest. In 1988, there were three occupied breeding areas. One of these succeeded in producing 2 young (T. Henson, pers. comm.).

South Carolina. Sprunt and Chamberlain (1977) reported that the bald eagle in South Carolina was "a fairly common permanent resident and more frequent on the coastal plain." In a supplement to that volume, Burton reported the eagle as becoming scarce due to pesticides, shooting, and other causes. National surveys recorded six nests in 1962 (Sprunt and Cunningham 1962) and three in 1963 (Sprunt and Ligas 1963). An active nest was reported near Huger in 1964 (Carolina Bird Club 1964). Two young were fledged from a nest on the Cooper River in 1965 (Carolina Bird Club 1965) and also in 1966 (Chamberlain 1966). Eight active and many inactive nests were located by Beckett (1970) during the 1968-69 nesting season. In 1970, an additional nest produced two young on Hilton Head Island (Teulings 1970). However, by 1973 only two nests were reported for the state (Fink 1974).

Murphy and Coker (1978) reported that of 32 nesting areas active in the 1960's, only 8 remained active in 1977. From 1977 to 1979, 12 additional breeding areas were located, of which two appeared to be newly formed. From 1980 to 1983, 10 additional territories were located, of which 9 were newly formed breeding areas and only 1 was an established area located for the first time. A total of 59 breeding sites have been documented active in South Carolina over the past 30 years. Of these areas, 28 were occupied for at least 1 year between 1977-1983 (T. M. Murphy, unpubl. data). During the 1982-83 nesting season, 23 young fledged from 23 breeding sites. By 1988, there were 50 occupied breeding sites in the state, 41 of which succeeded in producing 68 fledged young (T. M. Murphy, pers. comm.).

Tennessee. Alsop (1979) summarized historical bald eagle nesting in Tennessee along the major river systems. Ganier (1931) found evidence of only five or six pairs breeding in 1930. Additional breeding records are provided by Ganier (1932, 1938a,b, 1951), Shaver (1931), and Spofford (1945) for scattered localities in the state. Hatcher and Miller (1982) summarized the records at Reelfoot Lake and Lake Isom NWR from Crews (1980). Sprunt and Cunningham (1962) and Sprunt and Ligas (1963) each reported five active but unsuccessful nests in Tennessee during the 1962 and 1963 nesting seasons. Hatcher and Miller (1982) reported that there was one successful nest in the state in 1961 or possibly 1962. During 1980 and 1981, eagle nests were started and abandoned in Tennessee. Two productive bald eagle nests were reported in Tennessee in 1984. One nest, located at Land Between the Lakes, was constructed in 1983 and produced one young in 1984. Another nest, located in the vicinity of Cross Creeks

National Wildlife Refuge, produced one young in 1983. Three young were hatched at this nest in 1984. By 1988, there were 9 occupied breeding areas, 8 of which fledged a total of 15 young (B. Hatcher, pers. comm.).

Texas. Oberholser (1974) reported bald eagles greatly reduced in number, especially as a breeder, since 1945. Oberholser (1974) stated that eagles are scarce and local on or near the central coast and rare and local in the southeastern part of Texas. There are 27 nesting records reported by Oberholser (1974). Eggs have been collected from Potter, Surry, McLennan, Bell, Arkansas, and Nueces counties.

Lacey (1912) reported the eagle as formerly not uncommon, and Simmons (1915) reported a nest near Galveston. Surveys by the Texas Parks and Wildlife Department (J. Smith, 1974, 1975) found seven breeding territories known to have been active during the 1974-75 nesting season. Surveys located 15 active breeding areas in 1982-83 (Thompson 1983). This includes nesting on inland reservoirs, which suggests recent colonization of this man-made aquatic habitat. By 1987-1988, twenty occupied breeding areas were known, 13 of which fledged a total of 20 young (D. Mabie, pers. comm.).

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APPENDIX B: TECHNIQUES AND TERMINOLOGY FOR SURVEYS OF NESTING BALD EAGLES

TECHNIQUES AND TERMINOLOGY FOR SURVEYS OF NESTING BALD EAGLES

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The purposes of this appendix are to describe how nesting surveys of bald eagles are conducted, define some of the terms that are used, and recommend standardized approaches to getting information needed to monitor recovery. Before the above items are addressed, however, some brief background information will be presented.

For long-lived birds with delayed reproductive maturity, such as the bald eagle, it is generally assumed that immatures (brown heads and tails) and subadults (individuals with changing, mottled heads and tails) do not breed, while adults do. However, in reality matters are not quite this simple. It is important to distinguish between the territorial and non-territorial segments of the total population present on the breeding range. The former consists of mated (paired) adults (rarely individuals still in immature or subadult plumage), associated with a breeding area (defined below) containing one or more nest structures, and defending or having exclusive use of some part of this area, usually the vicinity of the currently occupied nest (defined below). Occupation of a breeding area is prerequisite for reproduction. The non-territorial segment of the population consists largely of immature and subadult individuals, but is believed to include an unknown and variable proportion of fully adult eagles,

which have not succeeded in finding and holding a territory. These adult "floaters" are thought of as a reserve from which individuals are recruited into the territory-holding population. A young adult, upon reaching maturity has 3 basic options. It can:

1. enter the territorial population by filling a vacancy, that is, replacing an individual that died;
2. find an unattached mate and establish a new breeding area (if suitable unoccupied breeding habitat is available);
3. failing that, remain a part of the "floating" population until a mate and breeding habitat can be found.

As there are currently no practical ways to census the immature and "floating" adult segments of the breeding-season population, we must, for the time being, limit our efforts to the territorial segment of the bald eagle population.

SURVEYS OF NESTING BALD EAGLES

Surveys of nesting eagles are conducted in many ways and with variable levels of effort and competence on the part of observers. Some observations are conducted from the ground or water below the nest through variable lengths of time and from various distances. Some nest surveys are conducted from the air by flying low over the nest, usually with fixed-wing aircraft but occasionally via helicopter. Some persons climb up to the nest, either in conjunction with banding or simply to get better information on the use of the nest by the eagles, even in cases where there are no young present. Techniques are sometimes dictated by logistics, weather, and safety factors.

Both randomly sampled and systematic or non-random types of surveys have been employed to measure reproductive success of bald eagles. Unlike surveys to

estimate the density of nesting eagles, however, no significant differences have been found in productivity measurements depending on whether the nests are sampled at random or not. Thus, productivity surveys commonly do not employ (and do not need to employ) random sampling techniques.

Surveys of nesting eagles should be conducted only by qualified, experienced observers and pilots, if aerial surveys are used. Aerial surveys are the most accurate, efficient, and preferred method. Climbing to nests provides the most complete information, but should be conducted only after the young have reached a size at which they no longer require brooding and before they become old enough to fledge prematurely or "jump." Climbing should be undertaken only by experienced, qualified personnel under proper weather conditions. Climbing at the egg stage or before is permissible only if needed information cannot be obtained by any other means, and again only be qualified persons. Routine climbing to nests during the incubation period should be avoided, as there is great risk of abandonment imposed by such climbing. As a general rule, climbing or even close approaches to nests prior to hatching should be avoided.

Aerial surveys are not believed to distrub the birds although there have been isolated reports of adult eagles attacking the aircraft. Adult eagles generally respond to aircraft during the incubation period by staying on the nest (thus making it difficult or impossible to count eggs) and, during the nestling stage, by flying from the nest and circling or perching nearby until the aircraft has left. Nestlings vary in their response to the aircraft; some crouch or lay down on the nest but most simply stay as they are and watch the aircraft.

Depending on the intensity of the search and the experience and background of the searchers, based on their familiarity with the biology and subtle field sign of the eagles, one often can determine the recent presence of eagles even when the birds are not present during the brief period of the survey.

Nest surveys have been conducted at different times during the reproductive period. The generally accepted approach to nesting surveys among bald eagle researchers is to aerially check all known and reported nests once during the early part of the incubation period. They then conduct a second follow-up aerial survey during the latter half of the nestling period, when eaglets are large enough to be seen and counted from the air. Timing of surveys is important. Survey workers must be familiar with the phenology of the eagles' breeding cycle, that is, the timing of key events (egg laying, hatching, and first flights of the fledglings). In areas where ongoing research includes the banding of nestlings, the second aerial survey may be conducted earlier during the nestling stage, even though some young may be too small to be seen clearly and counted from the air, or may be covered by the brooding adult. Such timing of the second survey will determine which nests failed and which are still going. The final count of young approaching fledging age is then made by the banders.

Due to the variety of workers, techniques, and situations, there has been some disagreement over terminology, recommended techniques, and interpretation of the observations. Discussion among workers over the years has provided some resolution to these problems, and there is now more agreement on terminology.

TERMINOLOGY

Breeding area. This is the local area associated with one territorial pair of eagles and containing one or more nest structures. The term "breeding area" is more neutral, with fewer behavioral implications than the term "breeding territory" formerly used in this context. Under rare circumstances a breeding area occupied by a pair may lack a nest structure at the time of the survey; this can occur when a nest is destroyed by severe weather prior to the survey.

Alternate (supernumerary) nests. Bald eagles frequently re-use nest structures in subsequent years and often for periods of many years. Quite often eagles will build and use a new nest near a previous nest. Sometimes several nest structures will accumulate in such a manner in a particular area, although only one would be used for a nesting attempt during any given nesting season. There may be 1,2,3, and occasionally up to as many as 7 nest structures associated with a single pair of bald eagles. These groups of nests are generally identifiable by their closeness to each other and distance from the nearest nests of other pairs, but occasionally, such as in areas with high eagle nesting density, the distribution of nests is less clear and the groupings of nests are not as distinct. In such situations the number of pairs present and the "ownership" of individual nest structures will emerge from the pattern of simultaneous occupancy and use of nests over several years' time.

Active nest. The most generally agreed use for this term is for nests showing evidence of actual breeding by a pair of eagles, such as the presence of eggs, an adult in incubation position (although some birds show the behavior without eggs present), nestlings, or solid evidence of eggs or young having been present during that breeding season. The term has been used under such a variety of conditions by different workers, including situations without evidence of actual breeding, however, that it potentially is too ambiguous and should not be used further.

Occupied nest (or occupied breeding area). This term also has been used widely under a variety of contexts and involves a number of semantic and interpretation problems. Its use is both entrenched and accepted, however. Also, the term pertains most closely to the real item of interest — the number of breeding pairs of birds. Therefore, the term should continue to be used, although

with care and qualification.

Occupancy basically refers simply to the presence of one or more adult eagles within a breeding area during the breeding season. The biggest problem of determining occupancy revolves around the presence of single vs paird birds and, during surveys, whether one or two birds are seen. A pair of birds may exist within a given breeding area but frequently only one of the pair is seen during a survey. Different workers have handled (or ignored) the problem in different ways so that past data from different sources (including some used in this Plan) are not exactly comparable. An increasing concensus, however, has been to count only nests with evidence of actual pairs of eagles and not count nests occupied by single birds or where the status cannot be determined reasonably.

Based on the above agreement to count occupation by pairs and further based on results of an intensive study of techniques and timing of surveys in the Chippewa National Forest in north-central Minnesota, the Team recommends counting as occupied only those nests with evidence of an actual pair of birds in future surveys. (Observations of occupancy by unmated, single adults should continue to be recorded and reported for completeness of data and in case they are desired in later analyses but, for the present, they should not be tallied under "occupied nests.") Evidence for occupancy under this criterion includes the following: a) young were observed, b) eggs were laid (eggs or eggshell fragments observed), c) one adult observed in incubating ("sitting low") posture on the nest during the incubation period, d) two adults observed at an empty nest or within the breeding area, e) one adult and one eagle in immature or subadult plumage at or near a nest, especially if mating or reproductive behavior (display flights, copulation, nest repair, etc.) was observed, and f) an empty nest which shows clear evidence (sticks with fresh breaks on top, fresh lining material, green twigs, etc. added)

of having been repaired in the current season, or a brand new nest (fresh sticks from the base up). This conclusion rests on the assumption that nest-building behavior in the wild is elicited by the presence of a mate. Dropping and molted feathers alone usually are not sufficient evidence for a pair.

Productivity. This depends on the number of young raised each year within the nesting population. After young leave the nest they become much more difficult to observe and count, unless the area is studied intensively, than when they are still confined to the nest. Because of this and because the survival of birds raised to advanced nestling stages is quite high, the young are counted for productivity calculations in most studies just prior to the time of normal fledging. Historically this period has coincided with the banding period because the young are also at the best age for banding at that time.

The recommended measure of productivity for the breeding population is the average number of young per occupied nest, that is, the total number of young produced divided by the total number of occupied nests. Most workers also report the average brood size (total number of young divided by total number of successful nests). Brood size has shown relatively little variation, however, and by itself provides little insight into overall productivity.

While productivity based on total pairs (young/occupied nest) is the ideal measure, it is difficult to attain under some circumstances found outside of the Northern States Region. Where the two-survey technique can not be employed for logistical reasons, such as in Canada and Alaska, productivity is based on all breeding areas. This method, from a single survey during the nestling period, offers a crude estimate of productivity for areas with healthy bald eagle populations in which nearly all available breeding areas are occupied by pairs. Inasmuch as some breeding areas remain unoccupied by eagles, this method overestimates

population size and yields a minimum estimate of productivity.

BALD EAGLE NESTING SURVEYS FOR RECOVERY

Nesting surveys for monitoring population status and productivity for purposes of this plan should consist of 2 aerial surveys per year, one early in the nesting season to determine occupancy and one later to count the number of nestlings produced. Timing of these two surveys is important if not critical for reliable data, but may vary from locality to locality depending on local nesting phenology. Timing should be as follows:

1. Early survey. This should be during the average date of completed egg-laying and early incubation. In the Chippewa National Forest of north-central Minnesota, for example, that period is during mid-April.
2. Late survey. This survey should be conducted after the adults are not brooding consistently, the young are large and dark enough to be seen easily from an airplane, and most nestling deaths have occurred. It should be before the young normally begin fledging. The period is when most young are between about 5 and 9 weeks of age. For the Great Lakes States of Michigan, Wisconsin, and Minnesota, this period is generally during the month of June.

If funding is not available for both surveys, serious consideration will have to be given to which information is most important (number of occupied nests or productivity). Both are considerably important at present and both surveys should be maintained at all costs.

Although standardized data and reporting forms have not been constructed and adapted, they would facilitate collection, reporting, and comparisons of future surveys. Such forms are highly desirable and recommended as part of the

overall coordination and communication effort.

It is recommended that actual, raw, observations made during the surveys be stored, rather than interpreted conclusions made by the surveyors or compilers. Raw data, such as the number of birds present, their behavior and position relative to the nest, whether incubating or not, condition (state of repair) of the nest, date, time of day, etc., constitute a much more useful body of information, than do already interpreted records stating that the one or the other breeding area or nest is "occupied," "inactive," or whatever. The actual observations upon which such interpretations were based are much more informative and have the advantage that they enable other workers to compare them with their own and, if necessary, to reinterpret them in the light of the latest understanding of eagle breeding biology and behavior. The storage of raw, uninterpreted data will be especially important to resource agencies which experience a turnover of personnel.

APPENDIX C: CURRENT AND RECOMMENDED RECOVERY LEVELS OF EAGLE OCCURRENCE BY STATE

Current and Recommended Recovery Levels of
Eagle Occurrence by State

States	Number of occupied breeding areas 1981-1982	1987-1988	Occupied Breeding Areas Recovery Goal
Arkansas	1	9 (0[a])	10
Alabama	0	0 (NA)	10
Florida	340	399 (69)	400
Georgia[b]	3	7 (71)	20
Kentucky	0	3 (0)	5
Louisiana	18	36 (64)	40
Mississippi	0	2 (50)	10
North Carolina	0	3 (33)	10
South Carolina	21	50 (82)	40
Tennessee	0	9 (89)	15
Texas	13	20 (65)	40

a Percent of 1988 occupied breeding areas successful in raising at least one young.

b Georgia data is for 1986-1987.

APPENDIX D: BALD EAGLE MANAGEMENT GUIDELINES

HABITAT MANAGEMENT GUIDELINES FOR THE BALD EAGLE IN THE SOUTHEAST REGION

THIRD REVISION - JANUARY 1987

Introduction

These guidelines are published and issued by the U.S. Fish and Wildlife Service, Southeast Region, but were prepared in consultation with all the Southeastern State wildlife agencies and a number of bald eagle experts, with assistance from FWS solicitors. A number of Federal and State laws and/or regulations prohibit, cumulatively, such acts as harassing, disturbing, harming, molesting, pursuing, etc., bald eagles, or destroying their nests, (see Section IV); although advisory in nature, these guidelines represent a biological interpretation of what would constitute violations of one or more of such prohibited acts. Their purpose is to maintain and/or improve the environmental conditions that are required for the survival and well-being of bald eagles in the Southeastern United States, and are designated essentially for application in bald eagle/human activity (principally land development) conflicts. The emphasis is to avoid or minimize detrimental human-related impacts on bald eagles, particularly during the nesting season.

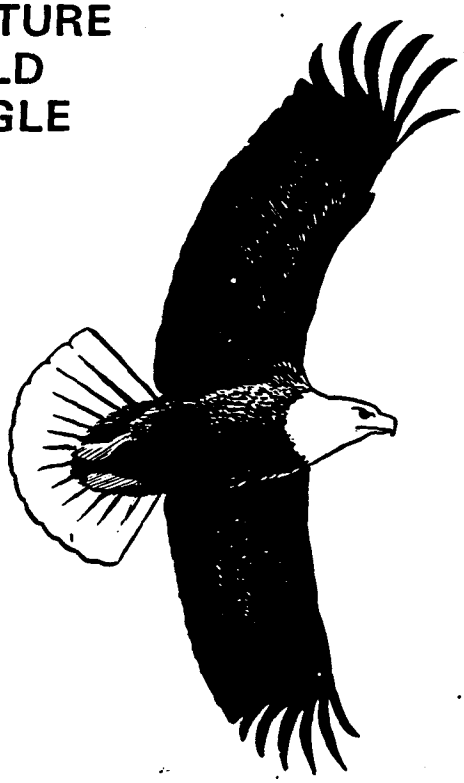
General

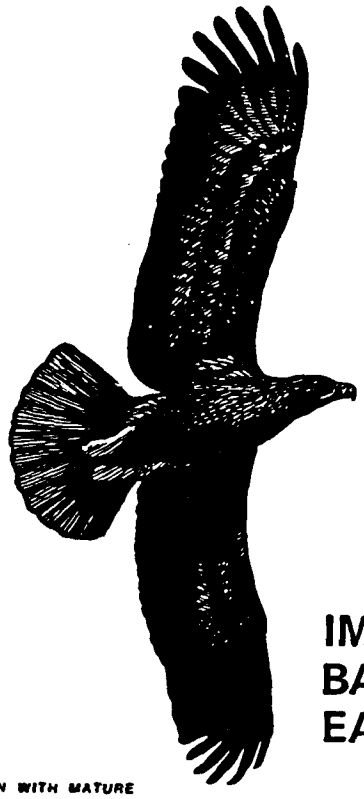
Individual bald eagle pairs exhibit considerable variation in response to human activity, depending in part upon the type, frequency, and duration of activity; extent of modification of the environment; time in the bird's reproductive cycle; and various other factors not well understood. Therefore, it cannot be predicted with absolute certainty the effects a given disturbance might have on a particular pair of bald eagles. Certain human activities are, however, known to disturb bald eagles more than others, and are addressed in the following sections as recommended restrictions. The guidelines are divided into sections on nesting, feeding, roosting, and legal considerations.

I. **NESTING:** In the Southeast, the bald eagle nesting period is usually from October 1 to May 15. However, in the northern portion of the range, nesting has occurred as late as August. Individual pairs return to their same territories year after year, and often territories are inherited by subsequent generations. Eagles are most vulnerable to disturbance early in the nesting period, i.e. during courtship, nest building, egg laying, incubation, and brooding (roughly the first 12 weeks of the nesting cycle). Disturbance during this critical period may lead to nest abandonment and/or chilled or overheated eggs or young. Human activity near a nest later in the nesting cycle may cause premature fledging, thereby lessening the chance of survival.

Loss of Nests or Nest Trees: Although bald eagle nests are legally protected, a nest in and of itself, from a biological perspective, is relatively inconsequential to a given pair of eagles (a pair can construct a nest in less than a week). It is the nest <u>site</u> that originally attracted the pair that is of critical importance. It is not uncommon for nests to be blown from trees by storms, after which the resident pairs typically renest on the same sites, often in the same trees. Therefore, in instances where nests, and even nest trees, are lost, these guidelines should continue to apply in their absence for a period extending through at least two complete breeding seasons subsequent to the loss.

MATURE BALD EAGLE





IMMATURE BALD EAGLE

TO AVOID CONFUSION WITH MATURE GOLDEN EAGLE REMEMBER:

- IMMATURE BALD EAGLES HAVE WHITE ON WING LININGS
- AND DO NOT HAVE FEATHERS EXTENDING TO TOES

"Abandoned" Nests: Bald eagles often use alternate nests in different years. Although all nests used by a given pair are situated in the same general vicinity, some nests go unused for several consecutive years and thereby may appear abandoned. Even a solitary nest can go unused for several years, often due to the death of one member of the resident pair, and then be reoccupied by either the original pair or one member of the original pair with a new mate. Even in instances where both members of a pair have died, the site would likely be taken over by another pair if no habitat degradation occurs. For these reasons, these guidelines should apply to apparently "abandoned" nests for a period extending at least through five consecutive breeding seasons of non-use.

Management Zones:

A. **Primary Zone:** This is the most critical area and must be maintained to promote acceptable conditions for eagles.

1. **Size:** Except under unusual circumstances, the primary zone should encompass an area extending from 750 to 1,500 feet outward from the nest tree. The precise radius distance between these two extremes would be dependent upon the proximal and spatial configuration of the critical elements (nest tree(s), feeding area, roost trees, etc.) within a particular nesting area, or other compelling factors.

2. **Recommended Restrictions:**

a. Close proximity of the following activities to bald eagle nests are likely to have detrimental impacts on eagle nesting and, therefore, should not occur within the primary management zone at any time:

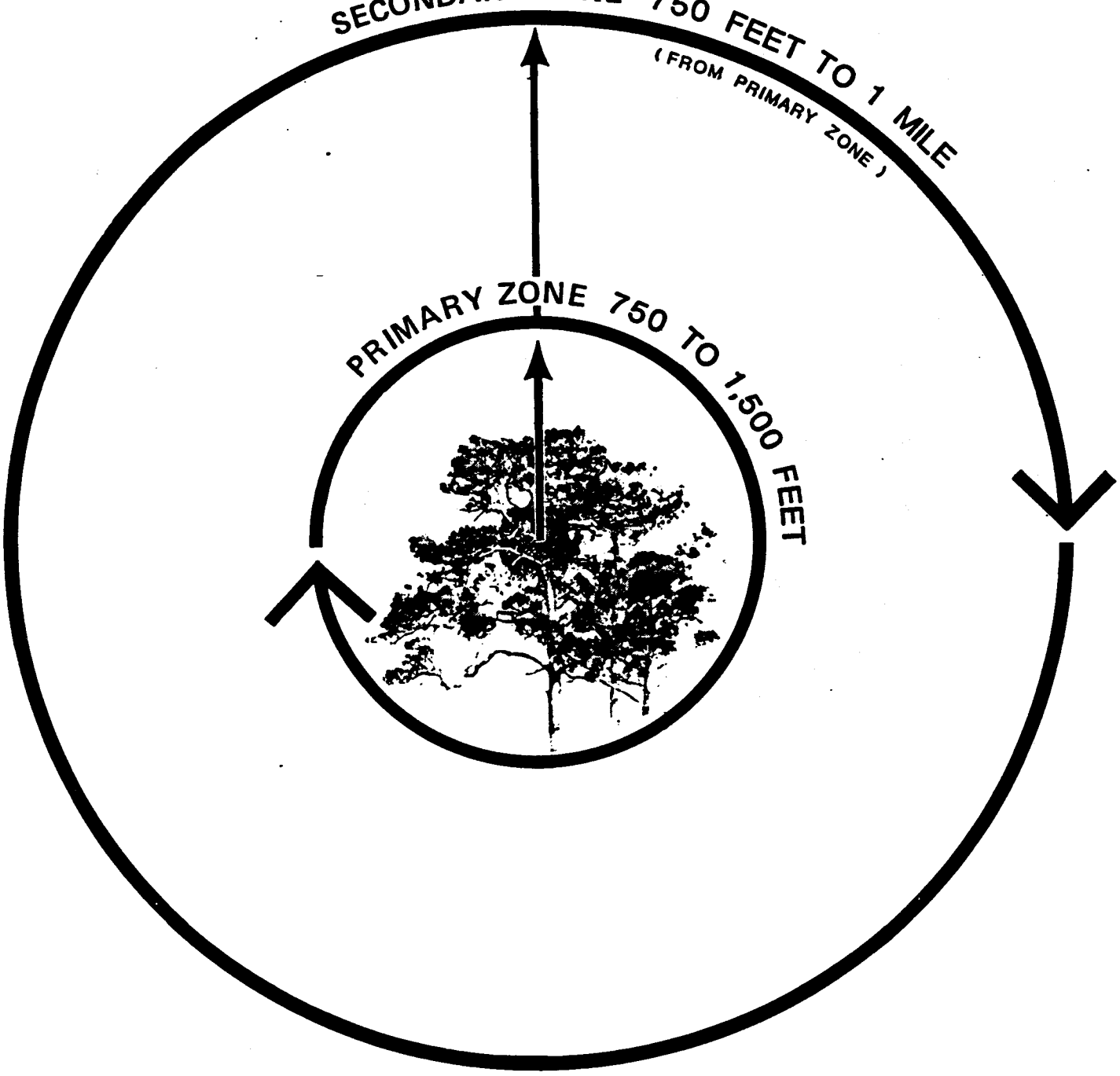
(1) Residential, commercial or industrial development, tree cutting, logging, construction and mining; and

(2) Use of chemicals toxic to wildlife.

b. The following activities would likely be detrimental while eagles are present and, therefore, should be restricted in the primary zone during the nesting period, but not necessarily during the non-nesting season:

(1) Unauthorized human entry; and

(2) Helicopter or fixed-wing aircraft operation within 500 feet vertical distance or 1,000 feet horizontal distance from a nest.


SECONDARY ZONE 750 FEET TO 1 MILE
(FROM PRIMARY ZONE)
PRIMARY ZONE 750 TO 1,500 FEET

B. **Secondary Zone:** Restrictions in this zone are needed to minimize disturbance that might compromise the integrity of the primary zone and to protect important areas outside the primary zone. The secondary zone should be arranged so as to be contiguous with feeding areas and provide a protected access between nests and the feeding area. In some cases that would involve extending a corridor from the primary zone to a particular feeding area, with that corridor requiring the same restrictions as the secondary zone.

1. **Size:** The secondary zone should encompass an area extending outward from the boundary of the primary zone, a distance of 750 feet to 1 mile. The precise distance will be dependent upon site-specific circumstances.

2. **Recommended Restrictions:**

a. Certain activities within the secondary zone are likely to be detrimental to bald eagles and in most cases should be restricted. These activities include, but are not necessarily limited, to:

(1) Development of new commercial and industrial sites;

(2) Construction of multi-story buildings and high density housing developments between the nest and the eagles' feeding area;

(3) Construction of new roads, trails, and canals which would tend to facilitate access to the nest; and

(4) Use of chemicals toxic to wildlife, such as herbicides or pesticides.

b. Other activities may take place in the secondary zone, but only during the non-nesting period. Even intermittent use or activities of short duration during nesting are likely to constitute disturbance. Examples are logging, land clearing, construction, seismographic activities employing explosives, mining, oil well drilling, and low-level aircraft operations. Minor activities such as hiking, bird watching, fishing, camping, picnicking, hunting, and recreational off-road vehicle use may be permitted in the secondary zone at any time.

II. **FEEDING:** These guidelines are designed to enhance the quality of bald eagle feeding areas and eliminate or minimize human disturbance.

A. The use of toxic chemicals in watersheds and rivers where bald eagles feed should be prohibited.

B. Alteration of natural shorelines where bald eagles feed should be prevented or limited. Degraded shorelines should be rehabilitated where possible.

C. Water quality in eagle feeding areas should be monitored and remedial steps taken when needed.

III. **ROOSTING:** These guidelines are designed to help preserve present roosting sites and provide future habitat.

A. Roosts within and adjacent to nesting territories

1. Within the primary management zone, no trees, living or dead, should be removed.

2. Within the secondary management zone, as many large trees as possible, living or dead, should be retained as roost and perch trees. Characteristically, these should be the larger trees in the stand. Trees with open crowns and stout lateral limbs are preferable.

B. Communal Roosts

1. There should be no significant logging, land clearing, or disruptive human activity within 1,500 feet of traditional roost sites.

2. Bald eagle roosting concentrations should be brought to the attention of the Fish and Wildlife Service or State wildlife agency so that a public or private agency can consider preservation of the roost by purchase, easement, or land exchange.

IV. **LEGAL CONSIDERATIONS:**

A. **Federal Statutes:**

1. The Bald Eagle Protection Act (16 U.S.C. 668-668d), and the regulations derived therefrom (50 CFR 22), state, in part, that no person ". . . shall take . . . any bald eagle . . . or any golden eagle, alive or dead, or any part, nest, or egg thereof . . .," with 'take' meaning ". . . to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb . . . ." Whoever violates any part of the BEPA may be fined from $5,000 to $10,000 or imprisoned from 1 to 2 years or both.

2. Section 9 of the Endangered Species Act of 1973 (16 U.S.C. 1531), as amended, makes it unlawful to 'take' any listed species with 'take' meaning to ". . . harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct . . . ."

For persons who violate the provisions of Section 9, the penalties can be civil or criminal with fines of from $5,000 to $20,000 and/or imprisonment from 6 months to 1 year. Section 7 of the ESA requires that all Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitat.

3. The Migratory Bird Treaty Act (16 U.S.C. 703-711) makes it unlawful ". . . to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, . . . offer for sale, sell, . . ., any migratory bird, any part, nest or eggs of any such bird . . . ." Violators may be fined from $500 to $2,000 and/or imprisoned from 6 months to 2 years.

B. State Statutes

1. State of Alabama:

Section 9-11-232 of Alabama's Fish, Game and Wildlife regulations curtails the possession, sale, and purchase of wild birds. "Any person, firm, association, or corporation who takes, catches, kills or has in possession at any time, living or dead, any protected wild bird not a game bird or who sells or offers for sale, buys, purchases or offers to buy or purchase any such bird or exchange same for anything of value or who shall sell or expose for sale or buy any part of the plumage, skin or body of any bird protected by the laws of this state or who shall take or willfully destroy the nests of any wild bird or who shall have such nests or eggs of such birds in his possession, except as otherwise provided by law, shall be guilty of a misdemeanor. . . ." Section 9-11-236, which prohibits the hunting of or posession of protected birds during closed season and carries a fine of up to $500, also protects eagles.

2. State of Arkansas:

Section 14.01 of the Official Codebook of Arkansas Game and Fish Commission Regulations states, "It shall be unlawful to take or attempt to take wild birds or bird eggs." A violation of this code carries a $100 to $500 fine.

3. State of Florida:

Rule 39-27.011 of the State of Florida Wildlife Code (Chapter 39, Florida Administrative Code) reads, "No person shall kill, attempt to kill, or wound any endangered or threatened species," and Rule 39-27.002(1) states, in part, "No person shall pursue, molest, harm, harass, capture or possess any endangered or threatened species or parts thereof or their nests or eggs . . . ." (The bald eagle is listed as a threatened species by the State of

State of Florida (cont'd):

Florida.) Violation of those regulations constitutes a second degree misdemeanor punishable by a $500 fine and/or up to 60 days in jail.

4. **State of Georgia:**

State law 27-3-22, referring to wildlife, states, in part, "It shall be unlawful for any person to hunt, trap, take, possess, sell, purchase, ship, or transport any hawk, eagle, owl, or any other bird or any part, nest, or egg thereof . . . ."

5. **State of Kentucky:**

Chapter 150, Section 330, of the Kentucky Fish and Wildlife Codes, revised in 1986, reads ". . . No person shall take, pursue, possess, purchase or sell or attempt to do so, any migratory birds, except as authorized by the migratory bird treaty act (40 stat. 755) as amended and regulations under it . . . ." Section 183 prohibits the importing, transporting, or possessing of endangered wildlife.

6. **State of Louisiana**

Chapter 9, Section 1901.C., which was amended in 1981, prohibits or carefully regulates ". . . the taking, possession, transportation, exportation from the state, processing, sale, or offer for sale or shipment within the state of . . . endangered species." (Endangered or threatened species are defined as those covered under the Federal Endangered Species Act, as concurred in by the Louisiana Wildlife and Fisheries Commission.) The bald eagle is recognized as an endangered species in Louisiana.

7. **State of Mississippi:**

Section 49-5-7 of the Mississippi Code of 1972 reads, "No wild bird other than a game bird shall be pursued, taken, wounded, killed, captured, possessed, or exported at any time, dead or alive. No part of the plumage, skin, or body of any bird . . . shall be sold or had in possession for sale in this state. No person shall molest, take or destroy the nests or eggs of any wild bird, or have such nests in his possession . . . ." Section 49-5-109 states, " . . . it shall be unlawful for any person to take, possess, transport, export, process, sell or offer for sale or ship, and for any common or contract carrier knowingly to transport or receive for shipment any species or subspecies of wildlife appearing on the following lists: (1) the list of wildlife indigenous to the state determined to be endangered within the State . . . ." (The bald eagle is listed as endangered in Mississippi.) Any person who violates these regulations will face a $1,000 fine and/or imprisonment for up to 1 year.

8. **State of North Carolina:**

In 1985 North Carolina law G. S. 113-294 was amended to include subsection(1) which refers specifically to eagles. It reads: ". . . any person who unlawfully takes, possesses, transports, sells or buys any bald eagle or golden eagle, alive or dead, or any part, nest or egg of a bald eagle or golden eagle is guilty of a misdemeanor. Unless a greater penalty is prescribed for the offense in question, any person convicted under this subsection is punishable by a fine of not more than $1,000, or imprisonment of not more than 1 year, or both."

9. **State of South Carolina:**

Regulation 123-160, derived from the Nongame and Endangered Species Conservation Act, and adopted in December 1976, protects eagles and other wildlife of the Orders Falconiformes and Strigiformes. "It shall be unlawful for any person to take, possess, transport, export, process, sell or offer for sale or ship, and for any contract carrier knowingly to transport or receive for shipment any such species or products or parts thereof except by permit for scientific, educational or falconry purposes issued by the South Carolina Wildlife and Marine Resources Department."

10. **State of Tennessee:**

Section 70-8-105(c) of the Tennessee Nongame and Endangered or Threatened Wildlife Conservation Act of 1974 states, " . . . it shall be unlawful for any person to take, possess, transport, export, process, sell or offer for sale or ship, and for any common or contract carrier knowingly to transport or receive for shipment any species or subspecies of wildlife appearing on any of the following lists: (1) The list of wildlife indigenous to the state determined to be endangered or threatened within the state pursuant to subsection (a); (2) The United States' List of Endangered Native Fish and Wildlife as it appears on April 5, 1974 (Part 17 of Title 50, Code of Federal Regulations, Appendix D); and (3) The United States' List of Endangered Foreign Fish and Wildlife (Part 17 of Title 50, Code of Federal Regulations, Apendix A) . . . . " A violation of this code constitutes a $25 to $1,000 fine and/or imprisonment for up to 1 year.

APPENDIX E: ESSENTIAL HABITAT RECOMMENDATIONS

ESSENTIAL HABITAT RECOMMENDATIONS

The term essential habitat is herein applied to those areas which receive bald eagle use and are considered to be of high significance to the maintenance and recovery of the species. The designated areas do not include all occupied eagle habitat, nor do they include all potentially significant habitat.

The purpose of this appendix is to alert planners to the locations of active bald eagle habitat of the highest significance so the protection of these areas may be considered early in project design. When a project is identified as occurring in essential habitat or affecting essential habitat, persons responsible for the project should contact the nearest Endangered Species Field Office, U.S. Fish and Wildlife Service. Planners should be aware that projects outside of the habitats identified below may also affect bald eagles, and therefore coordination on such projects with the Endangered Species Field Offices may be necessary to insure compliance with the Endangered Species Act.

The criteria used to identify essential habitat for nesting areas were not standardized from state to state. The Team felt this was not possible due to differences in habitat and differences in problems facing the bald eagle throughout the Southeast. The individuals who prepared the nesting habitat recommendation were simply asked to identify those areas within their state which are of the highest significance to bald eagle recovery. They were asked to do this in a manner which would (a) provide useful information to planners, (b) contribute to the protection of the eagles, and (c) avoid attracting unnecessary attention to the nest location.

Certain rivers, reservoirs, and lakes of the Southeast provide wintering habitat for non-nesting bald eagles. Wintering habitat as reported on the National Wildlife Federation's mid-winter eagle survey is also listed here. All wintering habitat which is used by five or more bald eagles on a routine basis during the wintering period should be considered as essential. Efforts to protect essential habitat for wintering bald eagles should emphasize maintenance of water quality, fish and waterfowl prey for the eagles, perch sites along shorelines, night roost sites, and an environment for the eagles in which they will not be harassed by human beings.

Note: No essential habitat recommendation has been included for Georgia as state personnel did not feel that this would contribute to conservation of the species.

Essential Nesting Habitat - Arkansas

Bald eagles have constructed nests at Bois D'Arc WMA, Bayou Meta WMA, Big Lake NWR, Wapponaca NWR and White River NWR. However, only one of these,

located on White River NWR, is known to produce young. Therefore, that refuge should be considered to contain essential nesting habitat.

Essential Nesting Habitat - Florida

Essential habitat for the Southern Bald Eagle in Florida is limited to areas of concentrated nesting that are looked upon as nuclear populations. The loss or substantial alteration of these population centers would seriously jeopardize the long term survival chances for the species in Florida.

VOLUSIA COUNTY (no nest, feeding habitat) Lake George from the Lake County line east of the eastern shore of the lake.

PUTNAM COUNTY contains 14 active eagle nests. Degree of threat - low within National Forest. Area along the St. Johns River north of Lake George east of Marion County line (Highway 19), west of east shore of St. Johns, south of Oklawaha River. Including Brighton Island and Salt Springs in the OCALA Forest.

T.12S R26E Section or portion of 9, 16, 17, 18, 19, 20, 21, 22, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35

T.13S R26E Section or portion of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, and Hernandez Grant south.

CHARLOTTE COUNTY Eight known active eagle nests. Degree of threat - high, from development. Placida Peninsula principally that area east of SR 771 south of Trout Creek bordering Charlotte Harbor.

Including T41S R21E section or portion of #-2/3 of 9, S-1/2 of 10, S-1/3 of 11, 14, 15, 16, E-1/3 of 17, E-2/3 of 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36.

T42S R21E section or portion of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 22, 23 and undesignated land south.

T.42S, R22E section or portion of 6 and undesignated land south.

T.42S, R20E section or portion of 12, 24

LEE COUNTY Seven known active nests. Degree of threat - high, from development Pine Island from Bakellin south to St. James.

R21E - T44S section or portion of 27, 35, 36, and 1.

R22E - T44S section or portion of 30, 29, 31, 32, 33, 6, 5, 4, 7, 8, 9, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36.

R22E - T45S section or portion of 1, 2, 3, 4, 9, 10, 11, 14, 15, 16, 21, 22, 23, 26, 27, 35, 36.

R22E - T46S sections or portions of 1, 2, 3.

LAKE COUNTY Seven active nests. Degree of threat - low, in National Forest west shore of Lake County (Volusia County Line) west of Forest Rd. 65 south of Forest Rd. 86. East of Highway 19 south and east to Forest Rd. 44 south to SR 42.

T.14S R26E sections or portions of 4, 5, 8, 19, 10, 11, 12, 13, 14, 15, 16, 17.

T.14S R27E sections or portions of 19, 37, 38, 40.

T.15S R27E sections or portions of 39, 35, 20, 21, 23, 24, 19, 37 F.M. Arredondo Grant.

T.15S R28E sections or portions of 38 and Domingo Fernandez Grant.

T16S R28E sections or portions of 37, 41, 40, 38, 35, 21, 22, 23, 26, 27, 28, 34, 35, 42 and Domingo Fernandez Grant;

T.17S R28E sections or portions of 11, 12, 2, 1.

T.17S R29E sections or portions of 37, 6, 7, 8, 18, 17, 35 and Domingo Fernandez tract.

OSCEOLA COUNTY Thirty active nests. degree of threat - moderate from development. Some of this area is State owned - most is in pasture. South from Kissimmee to Lake Kissimmee east from Polk County line west to the Florida Turnpike. This includes Lake Tohopekaliga, Lake Russel, Cypress Lake, Lake Hatchinaha, Lake Kissimmee, Lake Jackson, Lake Marion.

R29E T26S sections or portions of 13, 24, 25

R30E T26S sections or portions of 16-21, 27-34.

R30E T27S sections or portions of 3, 4, 5, 8, 9, 10, 15-23, 26-36.

R29E T27S sections or portions of 3, 4, 5, 7, 8, 9, 10, 11, 13-36.

R30E T28S sections or portions of 1, 2, 8-36.

R29E T28S sections or portions of 1 and 12.

R30E T29S sections or portions of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 23, 24.

R31E T30S sections or portions of 1-17, 21-28, 33-36.

R30E T30S sections or portions of 13, 24.

R31E T30S sections or portions of 1-4, 8 & 7, 10-15, 17-20, 23-26, 35, 36.

R32E T30 sections or portions of 1-36.

R33E T30S sections or portions of 5, 6, 7, 8, 9, 16, 17, 18, 19, 20, 21, 22, 27-34.

R32E T29S sections or portions of 4-10, 14-36.

R33E T29S sections or portions of 30 and 31.

R32E T28S sections or portions of 31 and 32.

R31E T28S sections or portions of 5, 6, 7, 8, 9, 15-23, 25-36.

POLK COUNTY Six active nests. Degree of threat - moderate from development and pollution. Some of the area is State owned (Lake Kissimmee State Park). Includes Lake Hatchincha and northwest shore of Lake Kissimeee.

T.28S R29E sections or portions of 1-5, 8-16, 22-26.

T.29S R29E sections or portions of 13, 24, 25, 26, 35, 36.

T.29S R30E sections or portions of 18, 19, 20, 29, 30, 31.

Essential Nesting Habitat - Louisiana

The wetlands of the coast, the Mississippi River, and Toledo Bend Reservoir provide habitat for most of Louisiana's nesting population. These areas are considered to be the most likely site of future expansion of the Louisiana nesting population. If the remaining Louisiana population is to expand to the point of recovery, it is imperative that these wetlands be maintained in a state capable of sustaining an eagle population regardless of whether they are currently occupied. It should be recognized that many areas in Louisiana other than those listed here are essential to the recovery of the species, but that these areas cannot be identified in a practical manner until they have been occupied by eagles.

The essential habitat identified below has been limited to isolated nesting territories which have shown nesting activity within the past five years and core areas of nesting habitat. The recommendation for isolated territories includes the nest, the surrounding territory and a minimal amount of feeding habitat. All such areas include a minimum of a one mile radius around the nest with the exception that heavily industrialized/urbanized lands were excluded from these habitats. Core areas incorporate the same features as those for isolated territories but do so for a group of territories. All or part of the listed sections are considered as essential habitat and therefore it is recommended that

persons planning development within these sections contact the U.S. Fish and Wildlife Service to discuss their project.

It is anticipated that eagles will utilize many flight corridors and feeding and loafing areas not identified as essential habitat. Agencies working in the vicinity of this essential habitat should be aware that activities outside of these areas may have direct impact on the species (e.g. destruction of feeding habitat) and upon the essential habitat.

NEST#	NEST NAME	QUAD NAMES(S)	DESCRIPTION
9B	Lake Verret	Grassy Lake Napoleonville SW	T14S,R13E,Sec.22, 23,27,N1/2 26
19	Shell Gibson	Bayou Cocodrie Gibson	T17S,R15E,Sec.30, 31,32, 33,34
21B	Hanson Canal	Humphreys	T17S,R16E,Sec.S1/2 53, S1/2 54,S1/2 55, 82,E1/2 83,E1/2 89, 90,91
25	Jesuit Bend	Lafitte Phoenix	T15S,R24E,Sec.19 and T16S R24E, Sec.2,3,4,5,6,7,8, (South and West of canal and ridge/swamp interface)
26	Bayou Pigeon	Centerville NW Centerville NE	T13S,R11E,Sec.7,18, 19,20,S1/2 7,S1/2 8,and T13S,R12E Sec.S1/2 12,13
29	Lake Fausse Point	Charenton	T12S,R9E,Sec.16, 17,18,19,20,21,28, 29,30(west of Atchafalaya Basin levee),and T12S, R8E,Sec.13,24
31	Bayou L'ours (Cut off)	Cutoff Golden Meadow	Lat.293129, Long.901757 Lat.293121, Long.901554 Lat.292925, Long.901554 Lat.292925, Long. 901757
32	Raceland	Bayou Boeuf	North and west of US Hwy 90 and East of LA Hwy 307

34	Tickfaw River	Manchac	Lat.302134, Long.902854 Lat.302134, Long.902650 Lat.301938, Long.902650 Lat.302039, Long.902854 follows coast of Lake Maurepas
35	Maurepas (Reserve Canal East)	Mount Airy NE	T10S,R7E,Sec.16,17,18,19, 20, 21,28,29,30
37	Garden City Field	Franklin Centerville Ellerslie North Bend	T15S,R9E,Sec.10,11,12,13, 14, 15,22,23, 24
40	Willow Tree	Bourg, Larose	Lat.293235, Long.903019, Lat.293237, Long.902819 Lat.293058, Long.902819 Lat.293058, Long.903019
41	Simeneaux Pond	Des Allemands	T14S,R20E,Sec.25,S1/2 24, N1/2 36, 35 (N of Burchell Canal, E of Paradis Canal) 26(E of Paradis Canal), SE1/4 23
45	North Lake Theriot	Lake Theriot	Lat.905118, Long.292913 Lat.905000, Long.292918 Lat.904917, Long.292847 Lat.905047, Long.292753 Lat.905148, Long.292827
5	Bayou Black	Bayou Cocodrie	T17S,R15E,Sec.5,6,7,8,9, 10, 11,12,13,14,15,36,37, 38,39
6A	Lake Cataouatche	Lake Catouatchie W	Lat.295048, Long.901657, Lat.295048, Long,901859, Lat.295231, Long.901859, Lat.295231, Long.901657
20A	Prospect (Houma)	Houma	T17S,R18E,Sec.23, 24,25,26,32
23A	Moisant (New Orleans)	LaBranche, Luling	T12S,R9E,Sec.17,20, 40,47,south 1/2 of 39

28	Amelia	Amelia	T16S,R13E,Sec.10,11,14,15, 42
33	Coteau Road	Houma	T17S,R17E,Sec.13, 14,15, 16, 17,18,19, 20,21,22,23, 25,26, 27
42	Kings Point	Chamblee	T9N,R2W,Sec.2,3,4, 8,42
44	Sugar Ridge	Patterson	T16S,R11E,Sec.south western 1/2 of the following sections 46,47,48,49,all of sections 50,51,11,12 and northern 1/2 of 13 and 14
2,3A	North Lafitte, South Lafitte	Lafitte	Lat.293620, Long.900503, Lat.293622, Long.900726, Lat.293905, Long.900725, Lat.293904, Long.900531
11C	Theriot	Lafitte	Lat.292403, Long.904323, Lat.292407, Long.904520, Lat.292551, Long.904522, Lat.292551, Long.904316
13	White Kitchen	Rigolets	Lat. 301320, Long.893941, Lat. 391319, Long.894142, Lat. 301504, Long.894143, Lat. 301504, Long.893941

Mauvais Bois Ridge Core

10C	Lake Penchant	Lake Penchant	The following includes habitat for 10C and 30A.
30A	West Mauvais Bois	Lake Theriot	Lat.292442, Long.905739, Lat.292702, Long.905226, Lat.292504, Long.905226, Lat.292315, Long.905632

Paradis Core

12A	Paradis	Hahnville	The following includes habitat for 12A and 16A. T13S,R19E,Sec.16,15,14,21, 22,23,24,25,26,27,28,33, 34,35,36 and T13S,R20E, Sec.77,112,114,113
16A	Lac Des Allemands	Lac Des Allemands	

Morgan City Core

1A	Bay Wallace	Morgan City	The following includes habitat for nests 1A, 7C, 15B 18C 24, 38, and 43. T16S,R12E,Sec.24,25,36. T16S,R13E,Sec.19,20,28,29 30,33,43,45,47,37,38. T16S,R14E,Sec.34,35,36, 37,79,80. T17S,R13E,Sec. 1,2,3,4,10,11,12,13,14,15, 23,24,25,26. T17,R14E, Sec.2,3,4,5,6,7,8,9,10, 11,14,15,16,17,18,19,20, 29,30.
7C	North Bayou Chene	Amelia	
15B	Gibson	Gibson	
18C	Kent Bayou	Morgan City SW	
24	Turtle Bayou	Morgan City SE	
38	Alligator Bayou	Bayou Cocodrie	
43	Avoca Lake		

Essential Nesting Habitat - Mississippi

Area - Vicksburg Nest
General Location - Range 2E, Township 17N, Sections 3,4,5,8,9,10
Significance - 1 active nest territory
Degree of Threat - high from agricultural development

Area - Biloxi Nest
General Location - Biloxi River, Harrison County
Significance - 1 active nest territory
Degree of Threat - high from residential and industrial development
Size - 4,315.6 acres

Special Considerations - Size and shape of area adjusted to include more of the limited feeding habitat.

Boundaries of Biloxi nest essential habitat

	Latitude	Longitude		Latitude	Longitude		Latitude	Longitude
(1)	302513	885918	(2)	302514	890005	(3)	302602	890119
(4)	302729	890119	(5)	302759	890101	(6)	302759	885945
(7)	302725	885919	(8)	302725	885811	(9)	302634	885811
(10)	302634	885831	(12)	302614	885918			

Essential Nesting Habitat - North Carolina

1. Hyde County Nest

   General Location - Gull Rock Game Land, and adjacent area within the following boundaries: South of US 264, East of Quarter Canal, West of Outfall Canal, and North of Pamlico Sound.
   Significance - 1 nest, active since 1985
   Degree of Threat - Low from logging and clearing of adjacent lands.

2. Washington County Nest
   General Location - Canaby Creek in area bounded by Albemarle Sound, Cashie River, NC 45, SR 1300, and SR 1323
   Significance - 1 nest, active since 1986
   Degree of Threat - Low from water pollution from nearby paper mill and potential forest management by landowner.

3. Beaufort County Nest
   General Location - South side of Pamlico River in area bounded by Durham Creek, SR 1936, SR 1946, the Texas Gulf phosphate mine open pit, and the Pamlico River.
   Significance - 1 nest, found in 1988.
   Degree of threat - High from adjacent phosphate mine and processing plant.

Essential Nesting Habitat - South Carolina

Georgetown Area Essential Eagle Habitat

Highway 17 on the west, state road 23 and Winyah Bay on the north, Atlantic Ocean on the east and the South Santee River on the south plus the adjacent properties of Harrietta, Wedge, and Fairfield plantations and the Santee Coastal Reserve. Approximately 100 square miles or 64,000 acres.

Cooper River Area Essential Eagle Habitat

An area 1.5 miles from either shore of the West Branch of the Cooper River from the Seaboard Coastline Railroad Crossing to the fork of the East and West branches of the Cooper River. An area 1.5 miles on either side of the East Branch of the Cooper River from the fork to Quinby Creek. Approximately 21 square miles or 13,400 acres.

Edisto/Combahee Area Essential Eagle Habitat

An area bounded on the east by the Edisto River and on the north by Highway 17, on the south by the Intracoastal Waterway and on the South by the Combahee River plus the land area within 1.5 miles of the Beaufort County shore of the Combahee River and an area 1.5 miles on

either shore of the Combahee River 6 miles upriver from the Highway 17 bridge. Approximately 163 square miles or 100,000 acres.

Essential Nesting Habitat - Tennessee

These recommendations include a minimum of a one-mile radius around active nests.

Site Name - Lake Isom Refuge
County - Lake
Lake - Lake Isom
Coordinates - 36 20, 89 25
Location and Comments - SE Tiptonville in cypress tree

Site Name - Reelfoot WMA
County - Lake
Lake - Reelfoot
Coordinates - 36 25, 89 25
Location and Comments - NE Tiptonville, in cypress 0.03 miles from water

Site Name - Reelfoot Refuge
County - Obion
Lake - Reelfoot
Coordinates - 36 30, 89 20
Location and Comments - NE Tiptonville; 1 egg didn't hatch in 1987

Site Name - Land-Between-the Lakes
County - Stewart
Lake - Kentucky
Coordinates - 36 35, 87 60
Location and Comments - NE Hwy 79 bridge in red oak 2.3 miles from water

Site Name - Big Sandy Bay
County - Benton
Lake - Kentucky
Coordinates - 36 25, 88 00
Location and Comments - Pair of eagles observed regularly in 1987-88 but no nest

Site Name - Duck River Bottoms
County - Humphreys
Lake - Kentucky
Coordinates - 36 55, 87 60
Location and Comments - Near mouth of Duck R. 2 nests abandoned in 1985; one pair observed in area in 1987 & 1988; no nests

Site Name - Tennessee National Wildlife Refuge
County - Benton
Lake - Kentucky
Coordinates - 35 55, 87 55
Location and Comments - SE Benton County; dead oad 0.06 miles of water

Site Name - Westvaco/Dover
County - Stewart
Lake - Barkley
Coordinates - 36 25, 87 45
Location and Comments - SE Dover; scarlet oak 1.1 mile of water

Site Name - Averitt/Indian Mound
County - Stewart
Lake - Barkley
Coordinates - 36 30, 87 40
Location and Comments - E of Dover, shagbark hickory 1.3 miles of water

Site Name - Normandy
County - Coffee
Lake - Normandy
Coordinates - 35 30, 86 10
Location and Comments - W of Manchester, TN; decid. tree 0.1 miles of water

Site Name - Cordell Hull
County - Jackson
Lake - Cordell Hull
Coordinates - 36 15, 85 45
Location and Comments - N Granville, TN; Tulip popular 0.5 miles from water

Essential Nesting Habitat - Texas

Nest - 019-1a
General Location - Red River drainage, Bowie County, Texas, S.E. corner at 33 35 - 94 30.
Significance - Found in 1987. No young produced. Probably nest site shift from nest that fell in 1982 in Red River County.
Degree of Threat - None

Nest - 093-1c
General Location - Gibbon's Creek Reservoir, Grimes County, Texas. S.E. corner at 30 35 - 96 00.
Significance - First found in 1984. Two nest site shifts. Fledged 6 young in past 5 years.
Degree of Threat - Low, recreational activity.

Nest - 146-1a
General Location - Trinity River drainage, Liberty County, Texas. S.E. corner at 30 10 - 94 45.
Significance - Found in 1986. Active for 3 years. Fledged 5 young in 3 years.
Degree of Threat - Low, recreational activity.

Nest - 202-1a
General Location - Toledo Bend Reservoir, Sabine County, Texas. S.E. corner at 31 15 - 93 40.
Significance - First found in 1988. Fledged 2 young.
Degree of Threat - Low, recreational activity.

Nest - 029-2a
General Location - Guadalupe River drainage, Calhoun County, Texas. S.E. corner at 28 30 - 96 50.
Significance - Active for past 8 years. Fledged 10 young in 8 years.
Degree of Threat - Low, possible boat traffic.

Nest - 045-1d
General Location - Colorado River drainage, Colorado County, Texas. S.e. corner at 29 30 - 96 20.
Significance - Active territory past 7 years. Three nest sight shifts have occurred. Fledged 13 young in 7 years.
Degree of Threat - Low, recreational disturbance.

Nest - 079-1b
General Location - Brazos River Drainage, Ft. Bend County, Texas. S.E. corner at 29 25 - 95 35.
Significance - Active nest site territory for past 8 years. Two nest site shifts have occurred. Fledged 10 young in 8 years.
Degree of Threat - Possible urban development.

Nest - 088-2b
General Location - San Antonio River drainage, Goliad County, Texas. S.E. Corner at 28 35 - 97 10.
Significance - Active nest site territory for past 8 years but not any young produced. Probably alternate nest site to 088-5a.
Degree of Threat - None.

Nest - 088-4a
General Location - San Antonio River drainage, Goliad County, Texas. S.E. corner at 28 35 - 97 10.
Significance - Active for the past 7 years. Fledged 8 young in 7 years.
Degree of Threat - Low, if any.

Nest - 088-5a
General Location - Coleta Creek Reservoir, Goliad County, Texas. S.E. corner at 28 40 - 97 10.
Significance - Found in 1988. Probably a nest site shift from the San Antonio River. Fledged 1 young in 1988.
Degree of Threat - Low, boat traffic.

Nest - 158-1b
General Location - Cedar Lake Creek, Matagorda County, Texas. s.e. corner at 28 50 - 95 35.
Significance - Active for past 8 years. Fledged 7 young in 8 years. There has been one nest site shift.
Degree of Threat - Low, recreational activity.

Nest - 158-2a
General Location - Colorado River drainage, Matagorda County, Texas. S.E. corner at 29 05 - 96 00.
Significance - Active nest site territory for past 8 years. Fledged 3 young in 8 years.
Degree of Threat - Low, if any.

Nest - 235-1a
General Location - Guadalupe River drainage, Victoria County, Texas. S.E. corner at 28 30 - 96 55.
Significance - Active for past 8 years. Fledged 13 young in 8 years.
Degree of Threat - Low, some petroleum development in vicinity.

Nest - 235-2b
General Location - Guadalupe River drainage, Victoria County, Texas. S.E. corner at 28 35 - 96 55.
Significance - Active for past 8 years. One nest site shift due to nest falling out. Fledged 9 young in 8 years.
Degree of Threat - Low, some petroleum development in vicinity.

Nest - 235-3a
General Location - Guadalupe River drainage, Victoria County, Texas. S.E. corner at 28 40 - 97 00.
Significance - Active for past 7 years. Fledged 9 young in 7 years.
Degree of Threat - Low, if any.

Nest - 011-1b
General Location - Colorado River drainage, Bastrop County, Texas. S.E. corner at 30 10 - 97 20.
Significance - Active for past 5 years. Fledged 5 young in 5 years. There has been one nest site shift.
Degree of Threat - Low, recreational activity.

Nest - 020-1b
General Location - Brazos River drainage, Brazoria County, Texas. S.E. corner at 29 10 - 95 30.
Significance - Active for past 8 years. Fledged 7 young in 8 years.
Degree of Threat - Low, if any; possible nearby boat traffic.

Nest - 020-3e
General Location - Brazos River drainage, Brazoria County, Texas. S.E. corner at 29 05 - 95 35.
Significance - Active nesting territory for past 8 years. Nest site shift in 1988. Nest site location has changed 5 times since 1981. Some nest site shifts are due to urban development. Fledged 9 young in 8 years.
Degree of Threat - Low, some cattle operation.

Nest - 020-5d
General Location - Brazos River drainage, Brazoria County, Texas. S.E. corner at 29 10 - 95 35.
Significance - Nest site territory active for past 8 years. four nest site shifts have occurred due to nest fall outs. Fledged 7 young in 8 years.
Degree of Threat - Low from cattle operation and some recreational activity.

Nest - 020-6c
General Location - San Bernard River drainage, Brazoria county, Texas. S.E. corner at 29 05 - 95 40.
Significance - Active for past 8 years. Fledged 5 young in 8 years.
Degree of Threat - Possible urban development.

Listed below is a summary of three years of data from the National Wildlife Federation's midwinter bald eagle survey in each state of the Southeast. The Team recommends that all wintering habitat which is used by five or more eagles on a routine basis during the wintering period be considered as essential habitat.

Wintering Habitat - Alabama

County	Location	Drainage	1986	1987	1988
Lauderdale, Colber	Pickwick Lake	Tennessee River	38	36	76
Marshall	Guntersville Reservoir	Tennessee River	11	23	13
Tuscaloosa, Jefferson, Washington	Holt Lake, Bankhead Lock and Dam, Bankhead Lake	Black Warrior River	-	-	22

Wintering Habitat - Arkansas

County	Location	Drainage	1986	1987	1988
Arkansas, Monroe, Philips	White River NWR	White River	70	61	35
Arkansas	Arkansas Post National Memorial	Bayou on northwest boundary of park	2	3	3
Baxter	Norfolk Reservoir	North Fork of White River	18	12	9
Benton, Carroll	Beaver Reservoir	White River	23	67	31
Clark	Degray Reservoir	Caddo River	19	16	33
Garland, Montgomery	Lake Ouachita	Ouachita River	27	47	40
Hempstead, Little River	Millwood Reservoir	Saline and Little Red Rivers	102	67	42
Pope, Logan	Lake Dardanelle and Pool 9	Arkansas River	41	77	174
Baxter	Bull Shoals Lake	White River Drainage	-	65	50

Polk	Irons Fork Reservoir	Irons Fork River	-	-	8

Wintering Habitat - Georgia

County	Location	Drainage	1986	1987	1988
Seminole	Seminole Lake	Chattahoochee River	2	1	-
Quitman	Lake Eufaula	Chattahoochee River	-	1	6

Wintering Habitat - Kentucky

County	Location	Drainage	1986	1987	1988
Ballard	Ballard Wildlife Management Area	Ohio River	31	19	49
Clinton, Cumberland	Dale Hollow Reservoir	Wolf River	16	26	27
Lyon, Trigg	Land Between The Lakes (Lake Barkley)	Cumberland River	10	22	10
Lyon, Marshall, Calloway, Trigg	Land Between The Lakes (Kentucky Lake)	Tennessee River	-	45	24

Wintering Habitat - Louisiana

County	Location	Drainage	1986	1987	1988
Cameron	Lacassine NWR	Mermentau Basin, Bayou Lacassine	0	0	0
Lasalle	Catahoula NWR	Duck Lake Impoundment	0	1	0
Morehouse	Bonita	Rice Fields near Bonne Idee	4	8	-
Union	D'Arbonne NWR, Lower D'Arbonne NWR, Upper Quachita NWR	Bayou D'Arbonne, Upper Ouachita River	-	1	-

Morehouse	Bostrop	Quachita River, Bayou Bartholomeu, Beouf	-	-	4

Wintering Habitat - Mississippi

County	Location	Drainage	1986	1987	1988
Grenada	Grenada Lake	Yalobusha Basin	17	9	8
Madison, Rankin	Ross Barnett Reservoir	Pearl River	2	4	1
Noxubee, Winston	Noxubee NWR	Bluff and Loakfoma Lakes	2	3	1
Tate	Arkabutla Lake	Coldwater River Drainage	3	5	1
Warren	Eagle Lake, Halpino Lake	Mississippi River	3	-	3
Washington	Glen Allen	Lake Washington	2	-	-
Washington	Yazoo NWR	Swan and Deer Lakes, Steele Bayou	0	3	-
Yalobusha, Panola	Enid Lake	Yocona River	10	10	19
Panola	Cypress Point, Pats Bluff, Sardis Reservoir	Little Tallahatchie River	-	-	2

Wintering Habitat - North Carolina

County	Location	Drainage	1986	1987	1988
Mecklenburg, Gast	-	Catawba River	-	0	0
Chatham, Orange	Jordan Lake	Cape Fear River	-	7	1
Hyde	Mattamuskeet NWR	Lake Mattamuskeet	-	3	2

Montgomery, Stanly, Anson, Richmond	-	PeeDee River	-	8	2
Wikes, Yadkin, Davidson, Davie, Surry	-	Yadkin River	-	5	2

Wintering Habitat - South Carolina

County	Location	Drainage	1986	1987	1988
Statewide	-	-	120	150	150

Wintering Habitat - Tennessee

County	Location	Drainage	1986	1987	1988
Benton	Big Sandy, Kentucky Lake	Tennessee River	11	18	-
	Busseltown, Kentucky Lake	Tennessee River	3	3	-
DeKalb	Center Hill Reservoir	Cumberland River	1	2	-
Cheatham	Cheatham Reservoir	Cumberland River	2	2	2
Grainger	Cherokee Reservoir	Holston River	1	1	1
Hamilton	Chickamauga Reservoir	Tennessee River	7	11	11
Claiborne, Grainger, Union	-	Clinch River	1	-	-
Clay	Cordell Hull	Cumberland River	2	4	3
	Cross Creek NWR	Cumberland River	1	4	3
Clay, Pickett	Dale Hollow Reservoir	Cumberland River	45	32	45
Humphreys	Duck River, Kentucky Lake	Tennessee River	36	42	-

Marion	Guntersville Reservoir	Tennessee River	1	-	-
Henry, Stewart	Land Between The Lakes, Kentucky Lake	Tennessee River	11	-	18
Marion	Nickajack Reservoir	Tennessee River	6	0	3
Coffee	Normandy Lake	Upper Duck River	1	-	-
Campbell, Union	Norris Reservoir	Clinch River	4	2	9
Obion, Lake	Reelfoot (vicinity)	Mississippi River	103	165	40
Monroe	Tellico Reservoir	Tellico River	1	-	-
Meigs, Rhea, Roane	Watts Bar Reservoir	Tennessee River	12	28	31
Franklin	Woods Reservoir	Elk River	3	4	-
Cannon	-	-	1	-	-
Cumberland	-	-	1	-	-
Dyer	-	Mississippi River	2	-	-
Hardin	Kentucky Lake	Tennessee River	10	-	-
Lauderdale	Chickasaw Lake	Mississippi River	1	-	-
Lauderdale	Moss Island	Mississippi River	1	-	-
Lauderdale	Open Lake	Mississippi River	8	1	2
Lauderdale	Chisholm Lake	Mississippi River	-	1	-
Jefferson	Douglas Lake	French Broad River	-	1	3
Knox, Blount, Loudon	Lake Loudon	Tennessee River	-	1	1
Hardin	Pickwick Lake	Tennessee River	-	11	3
Hardin	Pickwick Lake tailwater	Tennessee River	-	3	2
Cannon	Woodbury	Cumberland River	-	0	0

Henry, Stewart	Kentucky Lake	Tennessee River	-	-	65

Wintering Habitat - Texas

County	Location	Drainage	1986	1987	1988
Grayson	Lake Texoma	Red River	-	0	3
Shelby, St. Augustine, Sabine	Toledo Bend	Sabine River	-	2	12
Bowie	Wright Patman Reservoir	Sulphur River	-	6	-
Burnet, Llano	Lake Buchanan	Colorado River Drainage	-	17	35
Colorado	Attwater Prairie Chicken NWR	Colorado River	-	1	1
Freestone	Lake Fairfield	Trinity River	-	12	11
Harris	Warren Lake	Rock Hollow Creek	-	0	4
Hunt	Lake Tawakoni	Sabine River	-	6	9
Montgomery	Lake Conroe	Westfork of San Jacinto	-	0	-
Potter	Lake Meredith	Canadian River	-	12	19
Randall	Buffalo Lake NWR	Tierra Blanca Creek	-	4	1
San Jacinto	Lake Livingston	Trinity River	-	2	0
Wood, Rains	Lake Fork	Lake Fork Creek	-	11	31
Marion	Lake O'The Pines	Cypress Creek	-	-	17

APPENDIX F: HANDLING AND DISPOSITION OF EAGLES FOUND DEAD IN THE WILD

HANDLING AND DISPOSITION OF EAGLES FOUND DEAD IN THE WILD

Accidents, disease, age, severe weather and vandalism take their toll of young and adult bald eagles. Because of their conspicuous size, eagle carcasses are more likely to be encountered in the wild than those of other bird species. Many are found and reported each year.

By knowing the cause of death of representative members of populations, it may be possible to take management steps to reduce excessive mortality. Accordingly, since the early 1960's, the U.S. Fish and Wildlife Service has studied eagle remains to determine cause of death and to monitor exposure of eagles to pollutants. Carcasses are sent first to the U.S. Fish and Wildlife Service's National Fish and Wildlife Health Laboratory in Madison, Wisconsin, where necropsies are performed by specialists in wildlife pathology. Selected tissues from each bird then are sent by NFWHL to the Patuxent Wildlife Research Center in Laurel, Maryland. At Patuxent chemical analyses are made to determine the presence and amounts of many pollutants believed to be hazardous to eagle health. A combined necropsy and analytical report is sent from Patuxent to the submitter with copies to agencies involved in eagle management. Periodically, data on several eagles are combined to determine if there are trends in mortality cases, and summary reports are published.

Procedures For Handling Dead Eagles. While the study of eagle carcasses by U.S. Fish and Wildlife Service specialists is important in eagle management, that importance must be tempered with circumspection where the public is concerned. The possession of a bald eagle, or any part thereof, is illegal. Only those persons authorized by permit, primarily eagle researchers, may possess eagles temporarily under stated conditions and for stated reasons. Any person not so authorized who finds a dead or moribund eagle should leave the carcass, where found, if feasible, and report the exact location to the nearest U.S. Fish and Wildlife Service Special Agent or State Conservation Officer. If these individuals are unavailable or unknown, the report should be made to the nearest office of the U.S. Fish and Wildlife Service or State Game and Fish Agency. One reason for not moving the carcass, aside from legal constraints, is that the eagle itself might have resulted from an illegal act. The site should be examined first by trained investigators.

If the carcass appears fresh, based on known time of death, odor, or some other judgemental criteria, it should be tagged, placed in a heavy plastic bag, and refrigerated as soon as possible. Fresh specimens are best for necropsy. If the carcass has deteriorated, or if it must be stored for several days, it should be frozen and kept frozen from then on. The tag should contain all pertinent information such as date found, exact location, habitat type, name and address of person finding the carcass, name and address of shipper, and other information that might contribute to a determination of cause of death.

The National Fish and Wildlife Health Laboratory should be called as soon as possible. Laboratory staff will advise the caller on procedures to follow in packaging and shipping the carcass to Madison. The address and phone number is:

National Wildlife Health Laboratory
6006 Schroeder Road
Madison, Wisconsin 53711
608/264-5422 FTS-364-5422

Disposition of eagle carcasses. Collecting bald eagles for scientific study is not possible due to their special protected status. As noted above, bald eagles found dead or moribund in the wild are shipped to the U.S. Fish and Wildlife Service's National Wildlife Health Laboratory in Madison to determine cause of death. This procedure affords an opportunity to obtain additional valuable eagle data.

We recommend a data form be developed that would become part of the case history of every bald eagle found dead in the U.S. The same form could be adapted for birds found dead in Canada. The form (or format), to be developed later, should incorporate detailed field observations and laboratory measurements. Among the included data would be standard measurements, banding or marking information (including numbers, and FWS necropsy and analytical findings. Where feasible, the format should permit computerized key entering.

Color photographs (prints and negatives) should be included with the form wherever possible. Photographs should include: side of head, outstretched wings and tail spread sufficiently to display any molt and new feather growth, and dorsal and ventral views of the body.

All data should be centralized. They should be made available on request although publication restrictions may be placed on data from birds that are part of ongoing research projects.

The possession of bald eagle carcasses or parts, even temporarily, is strictly regulated. Persons wishing to make measurements on carcasses prior to their transfer to U.S. Fish and Wildlife Service auspices should be certain that

they have legal authority to do so.

Carcasses should be disposed of as follows:

1. Deposited as a study skin or mount in a recognized collection. This is particularly important if the bird was banded as a nestling and, hence, is of known age and geographic origin, and if the plumage is in good condition.
2. Providing feathers to Indians for bona fide religious purposes provided the bird first has been photographed with plumage intact.

Carcasses should not:

1. Be destroyed unless badly decomposed.
2. Be stored indefinitely in a freewer following the disposition of court cases.
3. Be deposited as study skin or mount in locations or situations where they would be inaccessible to researchers.

APPENDIX G: EMERGENCY CARE OF INJURED AND DISEASED BALD EAGLES

EMERGENCY CARE OF INJURED AND DISEASED BALD EAGLES

By Patrick T. Redig
University of Minnesota Raptor Rehabilitation Center

Successful treatment of an injured or sick eagle can be greatly enhanced by careful handling and the immediate administration of basic emergency care prior to shipping to a clinical facility. Almost any eagle that can be approached closely is either diseased or injured. The problem may range from minor sprains or bruises to severe fractures or debilitating illness, but approximately 80% of all afflicted eagles have been victims of traumatic injury. Often the nature of an injury cannot be determined without the aid of radiographic equipment. Emergency procedures are as follows:

1. If authorized to handle eagles, transport the eagle from the field to a quiet, warm place. If not authorized to do so, contact the nearest U.S. Fish and Wildlife Service Agent or a law enforcement officer. Ambient temperatures of 60-70 degrees F are very beneficial to injured and diseased birds. A cardboard box or burlap sack should be used to transport the eagle.
2. Contact appropriate medical personnel at the University of Minnesota facility. The following phone numbers may be used.

Dr. Patrick Redig 612/373-0816 Office
612/376-5642 Laboratory
612/484-3489 Home

Dr. Gary Duke 612/373-0821 Office
612/484-4323 Home

When calling have ready as much history as is available on the bird and the results of the physical examination. Such information is needed so that proper advice on subsequent handling can be given. A brief summary of some short-term procedures is given under points 3, 4, and 5. These, however, should not be used in lieu of direct communication with the Rehabilitation Center.

3. If the nature of the problem is not readily apparent, go to point 4. If there is an obvious injury, follow the ensuing procedures: a) Where broken wings or legs are noted, search for protruding ends of bones; this is most easily accomplished with the eagle restrained on its back. Wounds surrounding broken bones should be flushed with sterile saline (salt solution, 0.85%) or sterile water (boil water for 20 min.). b) After flushing, pack the wound with an antibiotic ointment (e.g., Furacin[1]) and cover it with a non-adhering pad (Micropore[2]). Though it is preferable for exposed bone to be reinserted under the skin, attempts to position the ends are usually futile and may actually lead to excessive soft tissue damage. Fractures of the wings may be immobilized temporarily at this point by folding the wings and securing them to the body with masking tape. The uninjured wing should be left free to assist the bird in maintaining its balance. Fractured legs should be wrapped snugly with a clinging, self-adhesive gauze (e.g., Kling-gauze[3]). Eight to ten layers should be applied, taking care not to wrap so tightly as to impair circulation. The gauze should be covered with adhesive tape. Periodically check the toes to see that they are warm and not swollen, which would indicate insufficient circulation.

4. Dehydration followed by starvation are the most severe threats to injured

birds, not the wounds or broken bones that initially incapacitated the bird. Oral fluids should be administered at the rate of 6 tablespoons per pound (eagles weigh between 8 and 12 pounds) at four to six hour intervals. A convenient fluid is Gatorade(R) which provides glucose and electrolytes as well as water. If Gatorade(R) is not available, a boiled cola (such as Pepsi or Coca-cola) works well. Administer the fluid with a syringe, poultry baster, small rubber tube, etc., but be careful to avoid getting fluids down the trachea (windpipe).

5. During the insect season (May through October) the eagle should be carefully inspected for the evidence of maggot infestation of wounds. The wrist joints, elbow joints, base of tail and hock joints in the legs are the most common sites. Maggots should be removed by gentle washing of the entire affected area with a screw worm repellent (e.g., Cutter's Screw Worm Bomb).

6. If an eagle must be held a few days prior to shipment, a daily feeding of 8-10 ounces of fresh raw meat will be necessary. Poultry, raw beef, or a fresh road kill is an appropriate diet. Avoid hamburger (suitable for 1-2 meals) and processed meats. Unfledged eagles should be fed two times daily with parts of the whole bodies of mammals or birds.

7. Injured eagles should be treated with a broad-spectrum antibiotic to prevent or reduce infections associated with open wounds. Seek the assistance of a veterinarian in obtaining such drugs and determining the dosage. The following orally administered agents may be safely used:

Ampicillin or Amoxicillin	25 mg/lb,2 times per day
Chloramphenicol	15-20 mg/lb, 4 times per day
Terramycin (Oxytetracycline)	30 mg/lb, 4 times per day.

Commercial air freight has proven to be a rapid and dependable means of

transporting injured eagles to a treatment facility. Direct non-stop flights are preferred. Flights that involve change of aircraft and especially change of carrier can be troublesome and the latter are much more expensive. As of July, 1980, the cost of shipping an eagle anywhere in the U.S. by direct flight was $36.75. Plastic dog carriers large enough for a 40 lb. dog are satisfactory containers. Alternatively, a wooden box constructed of 1/2" plywood that is 24" long, 18" high, and 13" wide with air holes low on the sides is satisfactory. Such a container is reusable and meets postal regulations so it can be returned easily by mail.

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[1]Furacin Dressing, Norwich-Eaton Pharmaceuticals, Norwich, New York 13815

[2]Micropore Pads, 3M Company, St. Paul, Minnesota 55101

[3]Johnson & Johnson Products, Inc., New Brunswick, New Jersey 08903

APPENDIX H: BALD EAGLE TRANSLOCATION POLICY

Revised Bald Eagle Translocation Guidelines

Background

In 1982, the Service approved the first Bald Eagle Translocation Policy. Since the generation of this policy, hundreds of bald eagles have been released to the wild in numerous release projects employing a variety of differing strategies, with varying degrees of success. The data gathered as a result of these efforts have proven informative and useful in the preparation of the Service's Revised Bald Eagle Translocation Guidelines.

The previous decline of bald eagle populations in the United States has been reversed. Throughout most of its range, the bald eagle is increasing. The Fish and Wildlife Service (Service), as well as the public, has shown a great deal of interest and support for the return of bald eagles. In response to this support, many Federal, State, and private agencies have given top priority to bald eagles in their non-game and endangered species programs and budget their resources accordingly. Since 1974, various Federal, State, and private agencies have been using translocation techniques to augment or reestablish bald eagle populations within the species' historic range. Restoration projects involve the movement of eggs, eaglets, or free flying birds from a wild population of relative abundance or a captive population (including captive-bred, rehabilitated and confiscated birds) to an area with no or comparatively low numbers of breeding birds. Hacking (a modified version of the falconer's technique for training raptors for release into the wild), fostering, and egg/clutch manipulation are techniques typically utilized in restoration efforts.

Bald eagle translocation activities have resulted in the increase in the number of nesting pairs of eagles in several States. Recognizing that translocation is a legitimate management tool, and further recognizing the Service's statutory responsibilities for protecting and recovering bald eagles, it is incumbent upon the Service to promulgate guidelines which outline major responsibilities and priorities, provide the framework and appropriate interface for the orderly execution of translocation projects nationally, and prescribe maximum resource protection.

This document establishes basic national guidelines and criteria while allowing individual Regions the flexibility to review, approve or disapprove, and coordinate translocation activities consistent with the intent of the Endangered Species Act, the Bald and Golden Eagle Protection Act, and the Migratory Bird Treaty Act.

General Fish and Wildlife Service Policy

The complex and intricate interdependencies of living organisms dictate that conservation efforts be focused on the community and ecosystem level. The purpose of the Endangered Species Act is "...to provide a means whereby the ecosystems (emphasis added) upon which endangered species and threatened species depend may be conserved,..." It is the policy of the Service to focus attention on habitat improvement and management in its efforts to restore bald eagle populations. Whenever there is evidence of natural

pioneering, or that wild birds are present in small or depressed (including declining) populations, their protection, management, and enhancement through means other than translocation should receive highest priority. However, the Service believes, as a general rule, that it may be appropriate to translocate bald eagles into suitable but unoccupied (or nearly so) habitat far removed from successfully reproducing breeding populations when expansion or natural pioneering into that habitat is not anticipated in the foreseeable future.

When translocation is selected as a management tool, all such actions, regardless of technique used, will be conducted in accordance with the following Service guidelines and any guidelines or policies of the affected State(s).

Translocation Guideline Procedures

1. Preliminary Planning Process

The party initiating the translocation project request (recipient area) must provide a project description to the Regional Directors serving both the recipient and donor areas.

This document should include (but not be limited to):

A. A statement of long range goals and objectives to be achieved including:

1. A description of how the project relates to the appropriate Bald Eagle Recovery Plan(s) and reference to the specific citation in the plan calling for translocation.

2. The number of breeding pairs of eagles to be established.

3. A breakdown of the number of donor eagles requested per year, and an assessment of the ability of the donor population to contribute birds without any long term adverse effect.

4. Suggested sources for obtaining the required number of nestlings or eggs.

5. The estimated duration of the translocation project.

B. An assessment of the recipient area.

1. An evaluation of past, present, and future ownership and management of the area.

2. An evaluation of historical records and current data regarding previous and present use of the area by nesting bald eagles.

3. An analysis of the suitability of the release site to support nesting eagles including maintenance of water quality and maximum base flows, and the effects of other fish management activities on the prey base.

4. An evaluation of the availability and suitability of nest and perch sites and other key habitat features.

5. A determination of the probable effects of disturbance by the public, including proximity of translocation sites to urban areas, industry, recreational areas, and future development in the area.

6. An analysis of limiting factors which contributed to the initial decline, i.e., environmental contaminant levels, habitat destruction, and indiscriminate shooting.

7. A review of local public sentiment toward restoration in the recipient area.

8. An evaluation of the proximity of the area to other areas with successfully breeding bald eagles to determine the possibility of natural recruitment through pioneering.

C. Funding and personnel requirements including:

1. Funding source(s).

2. Annual and total project costs.

3. Identification of key personnel involved in the translocation project, their affiliation, and qualifications for attaining the goals and objectives of the program.

2. Coordination Responsibilities

The Regional Director, Region 3, is designated as the Service's National Coordinator for bald eagle translocation activities. Translocation project descriptions and justifications that receive final Regional approval will be transmitted to the Regional Director, Region 3, for reference and informational purposes. Each Regional Director must inform the Region 3 Regional Director of both the availability of donor eagles in their Region and the number of eagles required annually for an approved project. The Regional Director, Region 3, will work with the other Regional Directors and their staff, striving for the most effective placement (from a national standpoint) of the limited eagles available for translocation, while endeavoring to meet at least those project requirements for each Region that fall into the priority A category (see paragraph 3. Translocation Project Priority).

The Regional Director, Region 3, will be responsible for all coordination activities between the various recipient Regions, Region 7, and the Commissioner, Alaska Department of Fish and Game, with regard to securing Alaskan eagles for release in the coterminous United States. The Regional Director, Region 3, will determine the most appropriate distribution of wild eaglets available from donor States in that Region, and will provide other guidance as necessary relative to the distribution of eagles from other donor Regions and the Canadian Provinces. These determinations will be largely based on the assessment documents provided by the recipient projects. Cooperative agreements/contracts negotiated between any Canadian Province and a particular State or Region prior to the approval date of these revised guidelines will be honored throughout the duration of the project, and reviewed independently from the priority system contained herein.

In attempting to interface these guidelines with the needs of each translocation project, priority should be given to well established, ongoing projects that have previously received Regional approval and that appear to have a high probability of success. For those projects specifying particular donor areas for acquiring eagles, the Regional Director and the affected agencies in the donor area should be part of the decision-making process for approving translocation projects.

The Regional Directors will have the authority to review, evaluate, approve or disapprove, and coordinate translocation activities. Once Regional approval has been granted for a translocation project, it will be the responsibility of the Regional Director serving the recipient area to make the necessary arrangements with the affected Federal, State, Provincial, or private agency for the acquisition of eagles. The Regional Director may choose to delegate this responsibility to the agency conducting the translocation project. For translocation projects where the donor and recipient areas are located in separate Regions, close coordination must be maintained among donor and recipient Regions and Region 3 throughout the duration of the project. The agency initiating the translocation project must file an annual report with the appropriate Regional Director(s) serving the donor and recipient sites, detailing the procedures used and the results of the translocation effort.

All translocation projects must comply with Section 7 of the Endangered Species Act, as well as Federal and State permit (including the Endangered Species Act, Bald Eagle Act, and Migratory Bird Treaty Act permits as appropriate) requirements. These guidelines and the following priority system do not supersede State authority as manifested in their existing bald eagle management programs or approved Cooperative Agreements under Section 6 of the Endangered Species Act.

3. Translocation Project Priority

The Service identifies the priority for distributing eagles for translocation as follows:

A. To maintain or enhance relict populations (defined as a known historic population of at least one breeding pair that has attempted to breed or occupied a breeding area in at least 1 of the last 5 years).

B. To reestablish extirpated populations.

C. To enhance established populations (defined as a population of breeding pairs greater than 25 percent of the known or suspected historical level) that are not otherwise increasing their numbers.

4. Donor Sources

The priorities for sources of eagles for translocation are:

A. Captive breeding; including zoos and private breeding programs.

B. Incidentally obtained nestlings or eggs, such as confiscations, nest blow-downs, or healthy rehabilitation cases.

C. Limited use of wild-produced nestlings or eggs from the nearest available healthy and productive population.

D. Limited use of wild-produced nestlings or eggs from distant populations.

When nestlings or eggs are obtained for release into the wild from these sources, efforts should be made to match the donor birds lineage (including population origin) with that of the recipient area.

The Service does not encourage the development of new captive breeding facilities specifically for bald eagle propagation purposes. When incidentally obtained nestlings or eggs do become available, every effort must be made to use these in an appropriate reintroduction program before taking eagles from the wild.

Release of birds that have become imprinted upon humans shall be prohibited as it is likely these birds would be incapable of breeding and would have a diminished capability of surviving in the wild. Under no circumstances should birds from either captive or wild sources that are infected with an avian disease, or are suspected of having been exposed to disease, be released in translocation projects. The agency conducting the translocation activity is responsible for the health of the birds. There are numerous wildlife disease authorities including the Service's National Wildlife Health Center in Madison, Wisconsin, that may be contacted for instructions regarding test procedures for donor bald eagles.

The decision regarding the number of nestlings or eggs that may be removed safely from wild nests for translocation purposes should be

made by the Regional Director and the State or Canadian Provincial wildlife agency serving the donor area, in consultation with the different information and advisory sources available. The Service advocates taking eagles only from a wild population that is at least maintaining a stable population over the last 5 years, i.e., the number of breeding pairs and the productivity figures are relatively constant or increasing, with no serious problems/threats existing with regard to nesting success. Both the short - and long-term trends of a donor population should be considered.

The Service believes that 5 percent of the previous year's productivity (successfully fledged young), or 5 percent of the mean annual productivity over the past 5 years, whichever is lower, may be taken without causing serious impact to healthy donor populations. These figures are somewhat arbitrary and appear to be conservative based on bald eagle population modeling conducted by Dr. James Grier, North Dakota State University (Northern States Bald Eagle Recovery Plan, 1983). An understanding of the percent survivorship to breeding age in a population will prove most useful in determining the number of eagles that may be safely removed for translocation projects. Individual donor States and Provinces may exercise their option to reduce or increase the percentage of nestlings or eggs taken.

Attempts should be made to remove nestlings from as many different nests as possible, in an effort to reduce the possibility of in-breeding in the recipient area. No birds should be taken from newly established nests, unless the nest is doomed to failure (imminent destruction or known death of the adults).

The removal of eagle eggs for translocation purposes is generally discouraged due to the threat of breakage during handling and transporting, as well as the difficulties encountered in artificially maintaining critical incubation temperatures. Egg/clutch manipulation may, however, be appropriate particularly under circumstances where the donor nest has a history of failure due to the deposition of habitually thin-shelled eggs. Once the thin-shelled eggs have been removed, adults may be induced to remain attentive to the nest by the insertion of "dummy" eggs (ceramic eggs, goose eggs, etc.). The thin-shelled eagle eggs are then hatched under controlled conditions and these eaglets or other eaglets of appropriate age subsequently returned (or fostered) to the nest for rearing by the wild adults. Close observation of the nest must be undertaken to ensure nest site tenacity by the adults during egg incubation, and that successful acceptance of the chicks occurs when fostered or returned to the nest.

In Florida, recent experiments have demonstrated that a high percentage of eagle pairs will "recycle" or lay a replacement clutch of eggs during the same breeding season when the entire clutch is removed. The eggs that are removed may then be artificially incubated, hatched, and the chicks raised to an appropriate age for introduction (hacking or fostering) to the wild, with little or no net loss in productivity to

the donor nests. Before consideration of this approach in other areas, it must be demonstrated that the egg-laying season is of appropriate duration to allow for recycling, and the clutch should be removed early enough during the egg-laying season to ensure that the eagles have an opportunity to recycle at a time when other adult eagles are still laying eggs. Because it is uncertain how adult eagles will respond to the removal of eggs in successive years, it is recommended that eggs not be removed from the same donor nests for a period of more than three consecutive years.

5. Techniques for Translocation

As there are circumstances unique to each translocation project, the Service finds it imprudent to outline specific translocation procedures. Eagles should be translocated only in conjunction with properly organized programs, which include subsequent monitoring and evaluation. Efforts such as observation at the donor and hack/nest site, color-marking, radio-telemetry, banding, or other means of identifying and following individual birds subsequent to fledging, should be taken (as appropriate) to monitor the immediate and long-term outcome of translocations. All marking and radio-telemetry schemes must be approved by the Service's Bird Banding Laboratory in Laurel, Maryland.

A concerted effort must be made to monitor those nests from which nestlings or eggs are taken to determine what effects (if any) the nesting disturbance and removal of young or eggs may have on the fledging success of any remaining young, as well as the behavior and productivity of the parents in subsequent years. In translocation projects involving the removal of eggs to induce donor pairs to recycle, it is important to conduct follow-up studies (whenever recycling is attempted for different latitudes) to ascertain whether recycling is occurring in the donor population. If the agency providing eagles from the wild for translocation projects is unable to conduct follow-up studies, the recipient agency should assume the responsibility to ensure that these studies are performed. The results of this monitoring will affect future decisions regarding the removal of eggs or eagles for subsequent translocation projects.

The party initiating the translocation project must work cooperatively with the Regional Directors serving the donor and recipient areas, the affected State or Provincial Wildlife agency, and recognized authorities in the development of the most practical and efficient techniques for successful reintroduction of bald eagles.

Conclusion

The Service will continue to fulfill its commitment to review and revise this translocation policy as new information becomes available. The Regional Directors will assume the major responsibility for ensuring compliance with and adherence to the guidelines established herein, including the initial review, approval, and coordination of translocation activities. The Region 3 Regional Director will work together with the other Regional Directors and their staffs to ensure that the guidelines and priorities reflected in this policy are implemented successfully on a national basis, and are consistent with the ultimate goal of recovery of the bald eagle.

Approved: _____

Flowchart To Help Determine The Validity of Bald Eagle Translocation Proposals

Does the project relate to recovery objectives (see 1.A of Guidelines)?

No — Drop

Yes — Is there adequate funding?

No — Drop

Yes — Is the assessment of the area positive (see 1.B of Guidelines)?

No — Is it realistic to try to correct problems causing negative assessment?

No — Drop

Yes — Correct

Yes — Are bald eagles present?

No — Drop

Yes — Is population likely to increase through natural recruitment?

No — Hack

Yes — Do not hack

Decreasing — Hack

Stable — Does it need to increase

Yes — Hack

No — Do not hack

Increasing — Do not hack

APPENDIX I: "RESTORING THE BALD EAGLE"
(Reprinted from the American Scientist)

Restoring the Bald Eagle

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Despite Benjamin Franklin's persistent lobbying on behalf of the wild turkey, our founding fathers chose the bald eagle (*Haliaeetus leucocephalus*) as our national symbol. A common resident throughout much of North America in the eighteenth century, the bald eagle was viewed as a symbol of strength, courage, beauty, and freedom. Ironically, populations have plummeted over the past two centuries, so that today the bald eagle also symbolizes the effects of environmental contamination, habitat loss, human persecution of wildlife, and the impending free-fall of biological diversity throughout the world (Lewin 1986). Since the banning of DDT in 1972, populations have shown encouraging signs of recovery (Grier 1982); nevertheless, today over 90% of the remaining nesting pairs are confined to relict populations centered in Florida, the Chesapeake Bay area, Maine, the Great Lakes, and the Pacific Northwest (Green 1985).

Ancient falconry techniques, animal husbandry, and modern ecological theory are aiding the recovery of the bald eagle

Over the last 15 years, nationwide conservation efforts have been focused on restoring the bald eagle to portions of its former range. For the most part, these efforts have involved the reintroduction of birds into the few remaining fragments of suitable habitat. Often these habitat islands are imbedded in a landscape highly modified by man's activities, where, without direct intervention, there would be little likelihood of natural recolonization.

The foundation of most projects to reintroduce birds of prey is the ancient falconry technique known as hacking (Sherrod et al. 1981). The term comes from the *hack*, the board on which the hawk's meat was laid and to which the hawk returned. Hacking, formerly used with great success for restoring populations of the peregrine falcon (*Falco peregrinus*), has more recently been applied to bald eagles (Cade and Temple 1977; Nye, in press). Centuries ago, falconers discovered that most birds of prey are philopatric—that is, they form an attachment to the place where they are raised and tend to return to that location when they are ready to breed. The irony of this philopatric tendency is that it makes wild birds unlikely to recolonize vacant habitats. For example, although over 2,500 bald eagles migrate from the northern United States and Canada to winter in southeastern states, few, if any, stay to breed in what appears to be suitable and vacant habitat. Thus despite a large yearly influx of birds, there currently are only about 120 active nests of bald eagles in the southeastern United States outside of the state of Florida (Bagley 1987). Current populations of the southern bald eagle are estimated to be about one-third of their historic size (Fig. 2). Young bald eagles released into suitable but unoccupied habitat will tend to return to that habitat to nest when they reach adulthood at four to six years of age. Thus, hacking has proved to be an effective tool of wildlife management, because it establishes birds in the scattered islands of remaining suitable habitat, and it overcomes the population inertia that results from philopatry.

The goals for the restoration of the species are determined by the US Fish and Wildlife Service and outlined in a document entitled the Recovery Plan (Murphy et al. 1984). This plan has established a goal of 90 new nests in the Southeast, increasing the regional nesting population to approximately 40% of its estimated historic level. At that point the population would no longer be viewed as in danger of extinction, and consideration would be given to changing its status from endangered to threatened. Although most of the 14 eagle hacking projects under way in the United States are in their early stages, the results have been encouraging, and to date, at least seven new nesting territories have been established by hacked birds (Nye, in press).

Finding a suitable source of birds for reintroduction is an obstacle for all hacking projects. This problem is particularly acute in the case of the southern bald eagle. While hacking projects in the northern United States have used chicks removed from healthy populations in Canada and Alaska, southern bald eagles are considered by many to be a distinct subspecies (King 1981). They show several unique adaptations to their environment, all of which are believed to have some genetic basis.

Figure 1. A program to restore the southern bald eagle (*Haliaeetus leucocephalus*) to its historic range attempts to reestablish the eagles in an area by placing fledglings that have been hatched in captivity into artificial nests. The eagles will return to these nests to be fed until about 6 months of age, when they can hunt for themselves entirely. The eagle shown here on the Mississippi River is a juvenile about a year old. The restoration program relies on the fact that when eagles reach adulthood and are ready to breed—at 4 to 6 years of age—they return to the area where they were raised. (Photograph by Frank Oberle.)

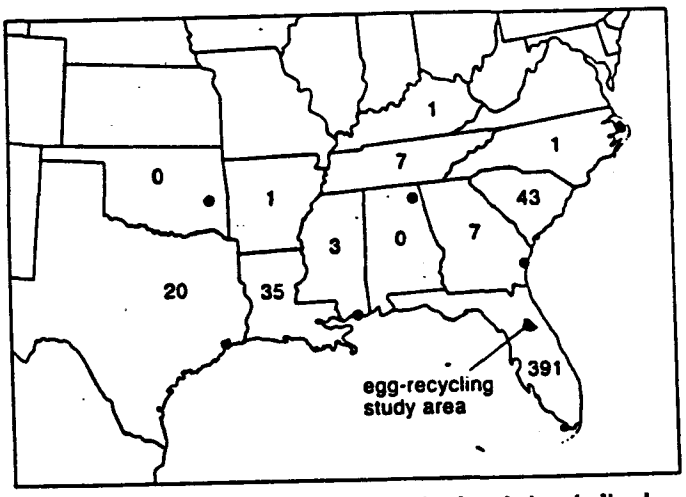

Figure 2. The population of the southern bald eagle has declined from an estimated 1,500 breeding pairs, historically distributed from eastern Texas to the Carolinas, to about 500 pairs today. Over 80% of the remaining birds are concentrated in central and southern Florida. The restoration program seeks to reestablish breeding birds across the Southeast through a combination of egg-recycling, captive propagation, and hacking at strategic sites (*red dots*) in five states.

Southern birds are smaller (presumably an adaptation to the warmer climate), less migratory as adults, and, in contrast to their northern counterparts, winter breeders. Our work, a large cooperative project involving the Sutton Avian Research Center, the states of Florida, Georgia, Alabama, Mississippi, Oklahoma, and North Carolina, the University of Florida, the US Fish and Wildlife Service, and the National Park Service, is an effort to develop a restoration program that takes into account the unique characteristics of southern bald eagles. The first and most important stage of this project was an attempt to determine whether we could use the relict Florida population, which contains over 80% of the birds remaining in the Southeast, as a renewable source of eagles by employing a technique called egg recycling.

Egg recycling

The technique of egg recycling relies on a female bird's ability to lay a replacement clutch of eggs—to recycle. This ability, presumably an adaptation to the loss of eggs to predators, storms, and other hazards, had been demonstrated in related species, such as ospreys (*Pandion haliaetus*) and falcons, but not in wild bald eagles (Kennedy 1977; Morrison and Walton 1980). However, if Florida bald eagles could be induced to recycle, and if they could do it without a significant reduction in their breeding success, our plan was to use that surplus production as a source of birds for hacking projects throughout the Southeast.

We set out to examine this question in 1985 with four objectives: to determine whether recycling occurs in southern bald eagles; to determine how egg removal affected subsequent nesting success and productivity; to determine how the timing of clutch removal influenced recycling; and to determine whether there were any differences in behavior or survival between late-fledging eagles from donor nests and fledglings from undisturbed control nests.

Donor and control nests were located in two areas of north-central Florida (in Alachua and Marion counties, and in the Ocala National Forest) where there are large numbers of nesting bald eagles (Fig. 2). Aerial surveys during the breeding seasons from 1985 to 1987 were initiated prior to egg-laying (in October and November) and repeated approximately every week until nearly all eggs hatched (mid-March). From mid-March until the eaglets fledged, surveys were conducted approximately every two weeks to monitor chronology and productivity at all nests.

A substantial amount of time and persuasion was required to locate accessible nests for egg collecting and to obtain permission from landowners to visit the nests. A total of 42 suitable donor nests were eventually located, and 87 eggs were removed over three breeding seasons. One egg-collecting trip was made in 1985, and two in 1986 and 1987. Eggs were removed from the nests by climbers and quickly dispatched to the Sutton Center in Oklahoma (Fig. 3).

We found that the rates at which eggs were recycled were high, ranging from 70.6% in 1987 to 100% in 1985, and averaging 78.6% (Table 1). Although none of the adult birds we studied was marked or banded, we are confident about our estimates of recycling, which were based on the chronology of egg laying, on the proximity of alternate nests, and on the history of eagle nesting in the area. Of the 33 birds that recycled over the three years, 21 did so in their original nests, and 12 recycled in nearby alternate nests.

The age of an egg at the time of collection was estimated by subtracting the 35-day incubation period from the hatching date (Bent 1937). During the three years of the study, the ages of the eggs when collected varied widely, averaging 15.9, 16.2, and 15.8 days old, respectively. Although our sample sizes are small, it does appear that the probability of recycling decreases as the nesting season progresses—recycling did not occur readily at nests from which eggs were taken late in the egg-laying period (mid-January).

Recycling intervals (the number

Table 1. Recycling data for nests of the southern bald eagle

Year	Nest type	n	n recycled	% recycled	Mean recycling interval (days)	% nests fledging young	Fledglings per active nest
1985	Donor	9	9	100.0	32.4	77.8	1.22
	Control	31	—	—	—	71.0	1.19
1986	Donor	16	12	75.0	31.0	56.2	1.00
	Control	47	—	—	—	66.0	0.98
1987	Donor	17	12	70.6	26.2	70.6	1.24
	Control	54	—	—	—	68.5	1.17
1985-7	Donor	42	33	78.6	29.9	66.7	1.14
	Control	132	—	—	—	68.2	1.11

of days between the removal of eggs and subsequent laying of replacement eggs) averaged nearly 30 days, ranging from 20 days to 57 days. Overall, there was no relationship between the age of the clutch when removed and the recycling interval.

The ultimate impact of removing eggs was judged by comparing the productivity of donor and control (i.e., unmanipulated) nests. We found no significant differences between these two groups in the percentage of nests fledging young or in the number of young fledged per active nest. We believe that if precautions are taken to collect eggs early in the season, Florida bald eagles will recycle readily and produce young at normal rates.

Captive propagation

Preparations for the captive propagation phase of the project began at the Sutton Avian Research Center a full year before any eggs were collected. A chick-raising laboratory with facilities for the production, preparation, and storage of food was built. Specialized equipment, such as cannisters for holding eggs in the field, portable field incubators, and a motor home to be used as a field laboratory also had to be built and tested. Redundancy, backup, and monitoring capabilities were incorporated into each phase of the project to ensure against the inevitable problems caused by bad weather, power outages, equipment malfunction, and human error.

Once eggs are removed from a nest, they are put into a protective cannister, lowered to the ground, and placed in a portable field incubator. This incubator, powered by a portable generator, is fitted inside with netting to cradle the eggs and protect them from vibration and shock. It is designed to maintain internal temperatures within 0.25°C in the face of ambient temperatures that range between freezing and 27°C. The eggs are then taken to the motor-home field laboratory and placed in a larger incubator that also has been specially cushioned against road vibration and equipped with backup power and temperature alarms. About two days are required to obtain the approximately twenty eggs normally taken during a collecting trip. During that period, and the nonstop 33-hour ride back to the Sutton Center, the eggs are monitored carefully and turned by hand every three hours around the clock.

At the Sutton Center, the eggs are placed under Cochin sitting hens. These hens, which are kept "broody" by exposure to long photoperiods, make excellent surrogate parents, and their attention greatly increases hatching success. Prior to hatching, at about 35 days of age, the eggs are transferred back to an incubator to minimize the possibility of transmitting diseases to the newly hatched chicks.

After hatching, chicks are brooded on thermostatically controlled hot water bottles until they are capable of thermoregulation, at about 3½ weeks of age. For the first several weeks chicks are fed with a latex eagle-head puppet to ensure the proper stimulus for imprinting (Fig. 4). By three weeks they are able to feed themselves from trays of ground food left in their individual artificial nests, and by six weeks they are capable of tearing up whole food on their own. As soon as the chicks' vision begins to sharpen, at about one week, all feeding is done from

Figure 3. Climbers who collect eggs wear surgical gloves and masks to protect the eggs from contamination. The overhanging nest edge can make access to nests precarious, but most clutches are removed in less than fifteen minutes. (Photograph by M. A. Jenkins.)

Figure 4. A latex bald eagle puppet is used to feed a three-week-old eaglet. Birds are observed through one-way mirrors and are kept isolated from human contact to prevent imprinting. (Photograph courtesy of the Oklahoma Department of Wildlife.)

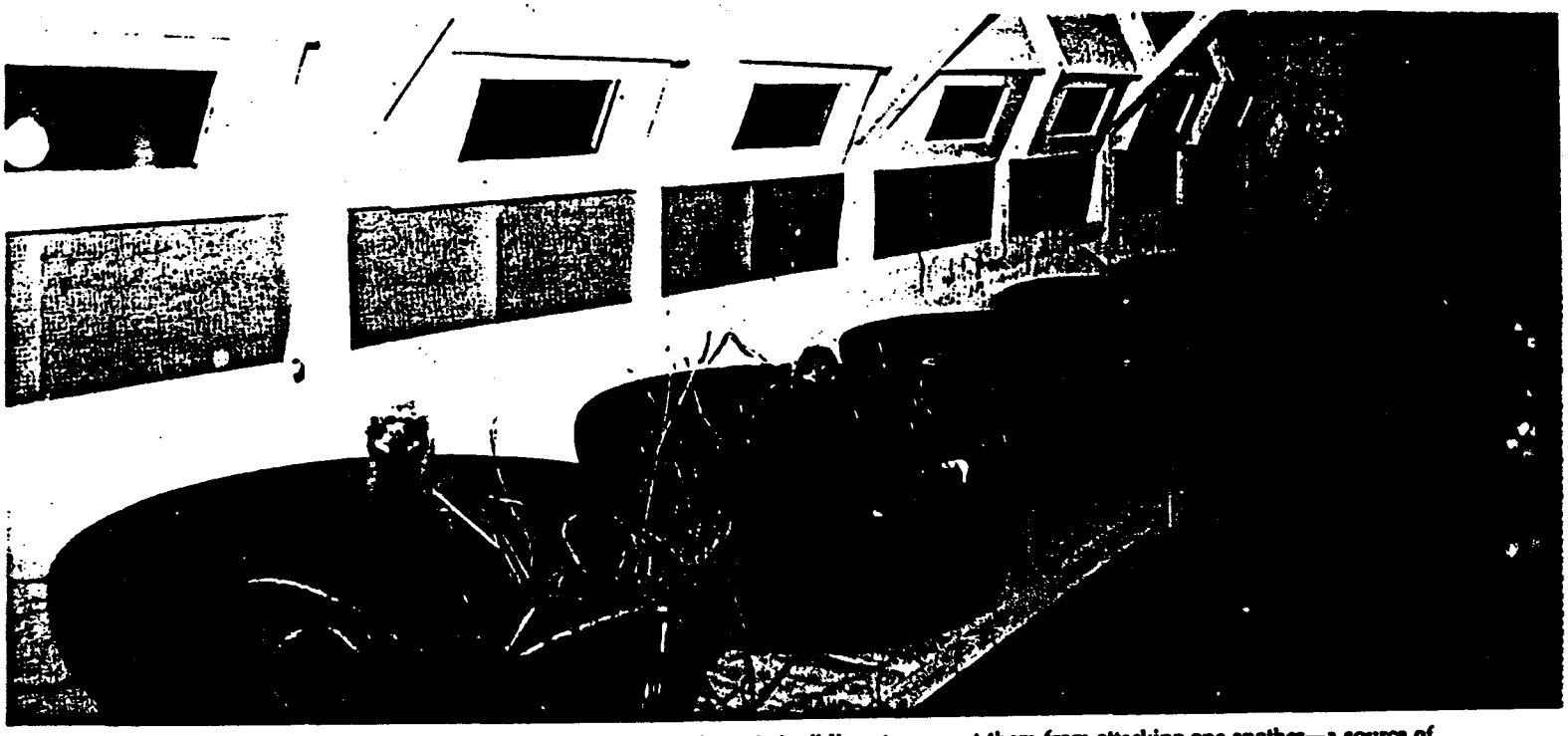

Figure 5. These four-week-old eagle chicks are kept separated from their siblings to prevent them from attacking one another—a source of mortality in wild chicks. (Photograph by G. McKee.)

behind one-way mirror dividers. This is one of the precautions taken to minimize the chicks' awareness of their human caretakers, so that the birds do not imprint on their foster parents and lose the instincts necessary for survival in the wild.

The staple of the young eagles' diet consists of Coturnix quail, raised year-round at the center. Eagle chicks, which weigh about 85 g when they hatch, weigh 3.5 to 5 kg some eight weeks later and consume the equivalent of 800 quail (125 kg) in that interval. Only about half that number are fed to each bird, however, with the balance of their diet made up of venison, rabbits, chickens, rats, and a supplement of multiple vitamins.

Sibling aggression, a common behavior in birds of prey, must be controlled in birds reared in captivity. During the first month of development, although chicks must be kept within sight of their nest mates to permit proper imprinting, they must also be kept physically separated to prevent them from attacking and killing each other (Fig. 5). This aggressive behavior—called the "Cain and Abel" conflict (Stinson 1979)—appears to be an adaptation to eliminate competition in the nest during periods of food shortage, and it persists until chicks are about a month old. Until that time, the mere presence of a dominant sibling close by may inhibit a subordinate chick's feeding and development. In the wild this behavior often means that fewer chicks survive to fledging than actually hatch. By preventing sibling chicks from killing each other in the laboratory, and by providing optimum conditions for hatching, nutrition, and development, we have achieved productivities up to 60% greater than are normally attained by wild birds (Tables 1 and 2).

Table 2. Captive rearing and hacking of southern bald eagles

	Annual breeding season			*Total*	
	84–85	*85–86*	*86–87*	*84–86*	*84–87**
Eggs collected	18	34	35	52	87
Viable eggs**	17	33	32	50	82
% Eggs collected that are viable	94.4	97.1	91.4	96.2	94.3
Chicks hatched	17	30	24	47	71
% Viable eggs that hatched	100.0	90.9	75.0	94.0	86.6
Chicks reared to hacking age	13	28	20	41	61
% Hatched chicks reared to hacking age	76.5	93.3	83.3	87.2	85.9
Chicks that were hacked successfully	12	28	19	40	59
% Hatched chicks that were hacked	70.6	93.3	79.2	85.1	83.1
% Viable eggs resulting in hacked birds	70.5	84.4	59.4	80.0	72.0
% Collected eggs resulting in hacked birds	66.7	82.4	54.3	76.9	67.8

* 1987 was an atypical breeding season in Florida because of unusually warm, wet weather during the incubation period. These conditions apparently fostered the growth of bacteria in the birds' nests and the infection of many developing embryos (Sherrod et al., in press). The result was an abnormally low hatching success in eggs reared both in the wild and in captivity. Therefore, the 84–86 statistics are probably more typical of the results that can be obtained under average conditions.

** Viable eggs are fertile eggs that showed some sign of development.

At six weeks of age, the chicks, now nearly fully grown, are moved from the temperature-controlled laboratory to a "hardening yard," where they are acclimated to ambient temperatures. After about two weeks of acclimation, their sex is determined, they are banded, and they are then flown to the hack sites.

Hacking

There currently are four hack sites in the program, and a fifth, in North Carolina, will be added in 1988 (Fig. 2). The criteria for selecting a site are illustrated by the Horn Island hack site located 15 km off the Mississippi coast. Historic data indicate that the bald eagle was once a fairly common breeder on the barrier islands and adjacent coastal areas (Burleigh 1945). The species was extirpated by the early 1950s, and today only a single coastal nest can be found along the northern Gulf Coast. The Horn Island site will serve the important function of reconnecting the relict populations in Louisiana and Florida. This strategy, a basic tenet of conservation biology, will promote genetic exchange between the subpopulations and reduce the probability of local population extinctions (Wilcove et al. 1986). Additional evidence of the area's suitability for eagles is provided by the abundance of ospreys, an ecologically similar species. And finally, protected public lands, such as Gulf Islands National Seashore and nearby Bon Secour National Wildlife Refuge, ensure the long-term preservation of those habitats. These characteristics (evidence of historic nesting, high-quality protected habitat, and the potential for reconnection of relict populations) are shared by all the release sites.

The hack tower consists of a platform about 9 m high, with cages, artificial nests, and an adjacent room from which the birds can be observed and fed (Fig. 6). Here, as in the earlier stages of the program, great care is taken to ensure that the birds have no direct contact with people. The birds are nearly full grown when they are placed in the hacking tower, and they require about one kilogram of fresh whole fish, rabbits, or other meat a day.

Before release, each bird is fitted with a lightweight radio transmitter that allows us to monitor the birds for about six months. The device is attached with a backpack-style harness made of tubular Teflon ribbon and falls off within a year. Regular observations are stepped up when the birds reach ten weeks of age in order to pinpoint the best time for release. Nestlings become noticeably more restless just prior to fledging, and it is important that they not develop an aversion to the hack tower by being confined too long. If released properly, young eagles usually return to the tower to feed within 72 hours and continue to do so for up to three months as they sharpen their hunting and flying skills. This gradual transition to independence is probably crucial to their survival, especially in light of recent evidence that most fledglings embark on a long nonstop northward migration when they are about six months old. Hacked birds are not expected to establish breeding territories until they are four to six years old. Nevertheless, we already have two records (one in Oklahoma and the other in Alabama) of hacked birds returning to their release sites a year or more after release.

Figure 6. Hacking towers, this one on Horn Island, Mississippi, are placed in isolated patches of vacant habitat in an effort to reconnect the relict populations remaining in the Southeast. Cages containing artificial nests surround a central observation room from which the birds, unaware of their human caretakers, can be fed and observed. (Photograph by T. Simons.)

Management strategy

Once the viability of a restoration program based on egg recycling was demonstrated, the next step was the development of a management strategy that addressed the objectives of the recovery plan. This was not a simple matter, in large part because of a lack of good demographic data. The current state of our knowledge about bald eagles illustrates that wildlife management today is an imprecise science at best. Although they are one of the most conspicuous and intensively studied of all North American birds, and in spite of the fact that they have received special attention as our national symbol and as an endangered species, we still know very little about the population biology of bald eagles. The characteristics of a population are determined by both fecundity and survival. At present, almost all that we know about bald eagles comes from studies conducted during the breeding season. As a result, we have a fair understanding of fecundity in these birds, but we can only make rough estimates of juvenile and adult survival rates, and can only guess at the percentage of adult birds that attempt to breed each year (Newton 1979).

One approach to these shortcomings has been the use of stochastic population models to determine the

most sensitive aspects of a species' life history. These models, which incorporate random fluctuations in life-history parameters, have been used recently to understand better the population dynamics of several endangered birds, including California condors (*Gymnogyps californianus*) (Mertz 1971); bald eagles (Grier 1980a, b); and dark-rumped petrels (*Pterodroma phaeopygia*) (Simons 1984). The patterns are similar for each of these long-lived, low-productivity ("k-selected") birds (MacArthur and Wilson 1967). Modeling has shown that populations of these and many other endangered species are extremely sensitive to changes in adult survival rates (Grier 1980b); their populations are less sensitive to changes in juvenile survival and are rather tolerant of variations in reproductive success. In addition, a low intrinsic rate of population increase subjects small populations of these species to high probabilities of extinction (Fig. 7). When applied to the conservation of bald eagles, these models indicate that even under optimum conditions, population recovery will require several decades; that founder populations established by hacking should be fairly large (at least 30 birds) to minimize the chances that random events will send a population to extinction; and that future conservation efforts must be based on a better understanding of survival rates, because unless adult survival rates are high (above 85%), efforts that focus on fecundity, such as hacking, may be futile.

Our plans for future work have been shaped by the results of this modeling, by the work on egg-recycling, captive propagation, and hacking, by the recovery plan objectives, and by the need for better information on survival rates.

The egg-recycling results indicate that the Florida eagle population can withstand a harvest of 100 eggs per year. About 20% of the eggs we collect in Florida will produce breeding adult birds. This estimate is derived from modeling, captive-propagation results, and the success of hacking efforts to date (Nye, in press). Population modeling predicts that for a given number of birds, hacking all of the birds in one year will, on the average, yield the same results as hacking smaller numbers of birds over many years. Other factors suggest that the optimal way to hack birds would be as one large group. First, the economics of hacking strongly favor larger releases. Second, it is reasonable to assume that birds released into vacant habitats as part of a single large cohort will be more likely to find a mate when they reach breeding age, than birds in small cohorts. On the other hand, caution argues that putting all of one's eagle eggs in one basket may be risky, given the uncontrollable effects on survival of weather and food supplies.

Our plan for the management phase of this project is an attempt to strike a balance between these biological and economic factors. It will run for at least five years and involve release sites in a minimum of five states (eventually with several sites per state). Each year, beginning in 1989, the sites in the target state will release a large cohort of up to 75 birds, while the remaining birds will be distributed among the sites in the other states. This effort should realize the recovery-plan goal of 50 to 60 new nests in the five target states, about two-thirds of the regional objective. Assuming the results are favorable, the program will then be shifted to the remaining southeastern states and will continue for another three to five years.

The expanded restoration program has been coupled with new field studies intended to broaden our understanding of the biology of bald eagles. This work

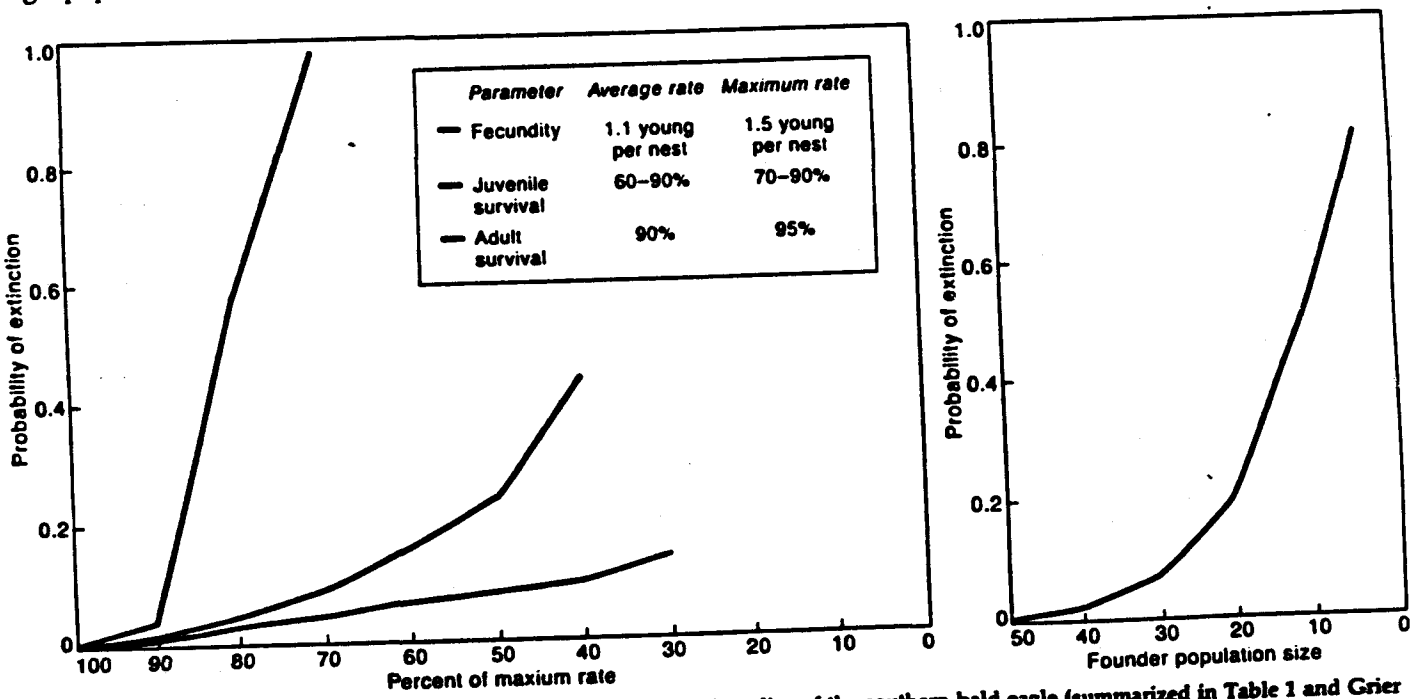

Figure 7. Mathematical modeling, based on data derived from the field studies of the southern bald eagle (summarized in Table 1 and Grier 1980b), shows that the probability of established populations becoming extinct increases as the rates of fecundity, of annual survival among juvenile birds (1–4 years old), and especially of annual survival among adult birds (5 years and older) decrease (*left*). The simulations depict each parameter as a percentage of the maximum rate, assuming the average rate for the other two parameters, and assuming a founder population of 50 birds. (See Grier 1980a, b and Simons 1984 for details of the model.) The modeling also shows that small populations of eagles have a high probability of becoming extinct (*right*), because of a low rate of fecundity combined with random fluctuations in the annual rates of fecundity and survival; this simulation assumes rates of fecundity and survival that fluctuate around average values.

includes the close monitoring of donor nests in Florida and the initiation of a long-term population study aimed at determining the dispersal patterns and survival rates of wild birds. Radio telemetry will be a valuable tool for much of this work.

Recent advances in the technology of batteries, miniaturization, and solar cells have made radio-telemetry studies of eagles both feasible and affordable (Kenward 1980). Miniature battery-powered transmitters weighing less than 30 g and capable of air-to-air ranges of up to 100 km are now available at a reasonable cost, as are slightly heavier solar-assisted transmitters with life spans of several years or more. Studies begun as part of this program have documented the dispersal and survival patterns of hacked eagles in Oklahoma and of fledglings from donor and control nests in Florida. Ten Florida chicks were radio-tagged in 1987 and tracked for several months. Preliminary data indicate that the age at which nestlings disperse does not differ between control (128 days) and donor (131 days) nests. Several Florida fledglings were located again after migrations to the Chesapeake Bay area, and Oklahoma birds also have been located after migrating to northern Wisconsin and Minnesota. In one instance, a combination of ground and aerial tracking was used to follow a bird flying from the Oklahoma hack site on a continuous 11-day migration to southern Canada in 1987. Surprisingly, the bird did not feed or follow rivers or other natural features during migration. Instead, it flew due north each day—even over downtown Omaha—only varying from that course as a result of the strong westerly winds it encountered en route. The bird was located again in early August on a lake in northern Wisconsin, and a second bird from the Oklahoma hack site was found on a lake in northern Minnesota about the same time. The Minnesota bird was resighted on the Fourche La Fave River in western Arkansas in mid-February, less than 100 km from the Oklahoma hack site. Sadly the bird was shot, and died on 28 February 1988. Unfortunately, shooting is still a major form of unnatural mortality in bald eagles and other large birds of prey.

The development of lightweight satellite telemetry transmitters holds the greatest promise for understanding the population biology of eagles. Employed for almost a decade on a variety of larger animals, including caribou, sea turtles, whales, and grizzly bears, the transmitters work with a Doppler positioning system carried aboard the National Oceanic and Atmospheric Administration's TIROS-N satellites. Researchers from the Applied Physics Laboratory at Johns Hopkins University were the first to refine the technology to the point where it could be applied to large free-flying birds (Strikwerda et al. 1985, 1986). They attached a prototype transmitter weighing 170 g to a young male bald eagle in July 1984 and tracked the bird for almost eight months over a distance of 4,554 km. The results, an unprecedented record of movement patterns and habitat selection in a free-flying eagle, provided a glimpse of the technology's potential. The weight of satellite transmitters will have to be reduced by about 50% before they become practical for large-scale applications, but such a reduction is thought to be feasible, and commercially produced transmitters are expected to become available within the next two years (Tomkiewicz and Beaty 1987). When they are, and we begin to understand the movement patterns and survival rates of bald eagles, we will for the first time be able to make the best possible use of the limited resources available for the conservation of this and other wide-ranging wildlife species.

Conservation programs targeted at species like the bald eagle can be extremely effective mechanisms for preserving biological diversity. The acquisition and preservation of breeding and wintering habitats for a particular species promote the conservation of untold other species that piggyback on this process. In addition to these direct benefits, there are many others that are less tangible. In some ways, this project is as symbolic as the birds it is attempting to conserve. Bald eagles are not on the verge of extinction, and when viewed in the context of global conservation needs and of other critically endangered species, the attention may seem misplaced. In fact, it is precisely the symbolic nature of widespread species like the bald eagle—with their ability to capture the imagination of the public—that makes them such worthwhile conservation investments. As symbols of wilderness and of the freedom wilderness represents, bald eagles have the unique capacity to inspire people and to foster a sympathetic attitude toward the needs of other threatened species and toward related environmental issues such as habitat destruction and water quality. Clearly, without that sympathy and the political will it engenders, the needs of more obscure species will go unmet. It may be trickle-down conservation, but in light of the ever-increasing pressure on global resources, it may prove to be one of the more fruitful conservation strategies available in the years ahead.

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