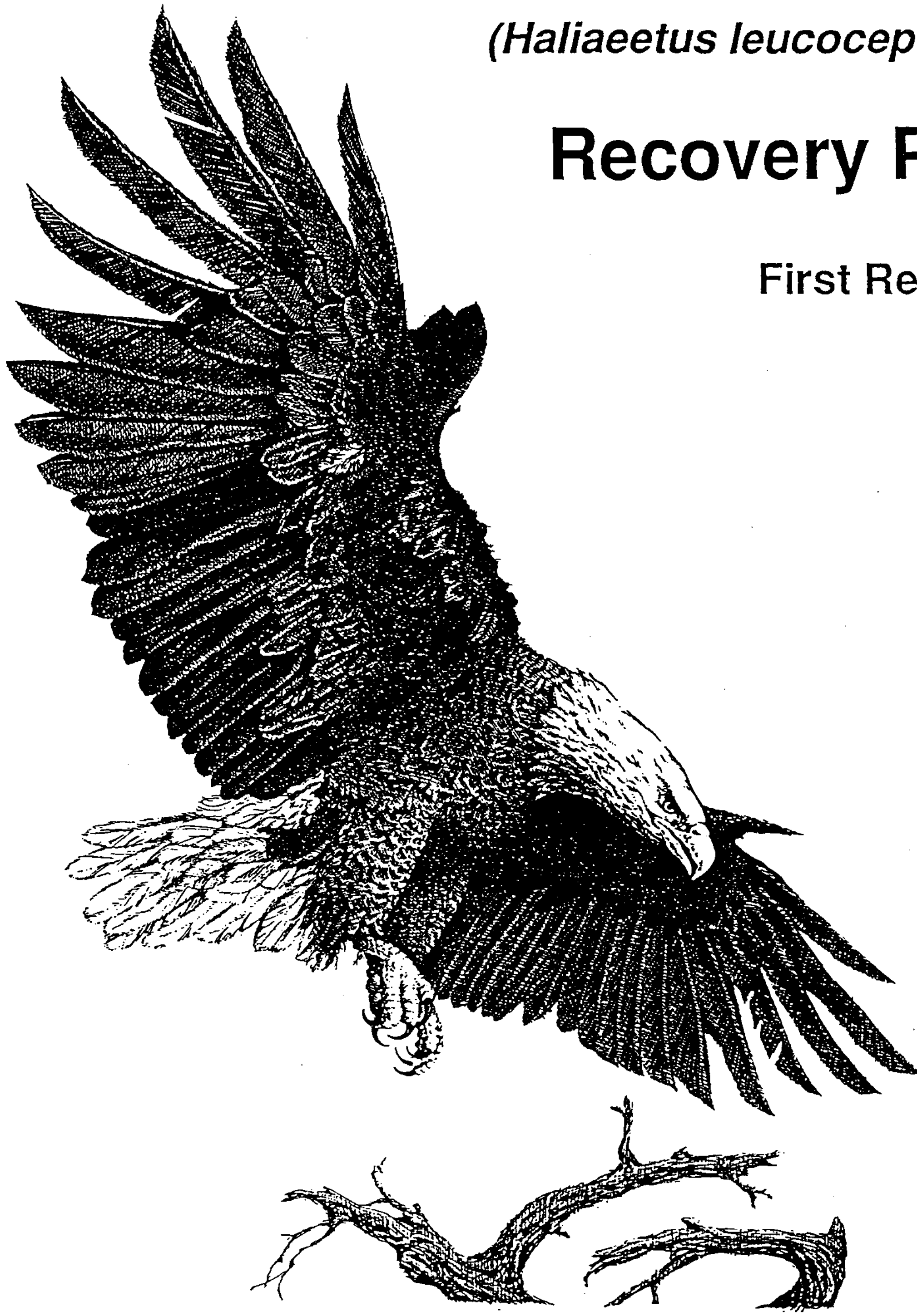
Chesapeake Bay Region Bald Eagle

(Haliaeetus leucocephalus)

Recovery Plan

First Revision



Eagle illustration courtesy of Dick Bernard

U.S. Fish and Wildlife Service • Region Five • Newton Corner, Massachusetts

CHESAPEAKE BAY REGION BALD EAGLE

REVISED RECOVERY PLAN

(Original Approved: May, 1982)

Prepared by:

Chesapeake Bay Region Bald Eagle Recovery Team

and

Region Five
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Dedicated to the memory of Jackson M. Abbott,
the grandfather of bald eagle research and management
in the Chesapeake Bay Region

* * *

The following plan is the first revision of the Chesapeake Bay Region Bald Eagle Recovery Plan. It is intended to be a companion document to the original plan, which has guided bald eagle recovery efforts in the Chesapeake Bay/Delaware Bay region since 1982. This revised plan describes accomplishments to date as well as continuing needs to assure full recovery of the Chesapeake Bay Region bald eagle population.

Recovery plans delineate reasonable actions believed to be required to recover and/or protect listed species. Objectives will be attained and funds will be made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities.

This recovery plan does not necessarily represent the views, official positions, or approval of any individuals or agencies involved in plan formulation, other than the U.S. Fish and Wildlife Service. The plan is subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

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Additional copies of the plan can be purchased from:

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Fees vary according to number of pages.

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At the time this revised plan was originally prepared, Don Perkuchin was a member of the Chesapeake Bay Region Bald Eagle Recovery Team. Although Don has since moved out of the region to become refuge manager at the Okefenokee National Wildlife Refuge, his past work on the plan and in behalf of bald eagles on the Chesapeake Bay is gratefully acknowledged.

The latter stages of plan production and updating were coordinated by Mary Parkin of Region 5 of the U.S. Fish and Wildlife Service. Comments received during review of the draft plan by the recovery team, cooperating agencies, and the public proved to be very useful in consolidating the final plan.

This revision borrows heavily from David Buehler's estimable dissertation on bald eagle distribution and abundance in the northern Chesapeake Bay area, as well as Timothy Mersmann's comprehensive thesis on bald eagle foraging ecology in the region.

EXECUTIVE SUMMARY
CHESAPEAKE BAY REGION BALD EAGLE REVISED RECOVERY PLAN

Current Status: This bald eagle population is listed as endangered. The region currently supports 230 breeding pairs which show a productivity level of 1.43, meeting the population target for reclassification to threatened status. However, available habitat is continuing to decline, affecting the ultimate carrying capacity of CBR habitat.

Habitat Requirements and Limiting Factors: The CBR bald eagle occupies shoreline habitat of the Chesapeake and Delaware Bays and their tributaries. The eagle requires large blocks of undisturbed mature forested habitat in proximity to aquatic foraging areas. The principal threat to its continued recovery is habitat loss due to shoreline development and other land use changes. The CBR eagle is also threatened by acute toxity caused by continued use of certain contaminants, shooting, accidents, and natural environmental events.

Recovery Objective: Delisting.

Recovery Criteria:

(1) To downlist by sustaining a population level of 175-250 breeding pairs with a productivity level of 1.1 young per active nest, concurrent with showing sustained progress in habitat protection measures.

(2) To delist by sustaining a nesting population of 300-400 pairs with an average productivity of 1.1 young per active nest over 5 years, and by achieving permanent protection of sufficient habitat to support this nesting population along with enough roosting and foraging habitat to support population levels commensurate with increases throughout the Atlantic recovery regions.

Actions Needed:

1. Protect existing nesting, foraging, and roosting habitat.
2. Protect potential habitat sufficient to support recovery levels.
3. Monitor nest sites, concentration sites, and roost areas.
4. Investigate factors affecting breeding and nonbreeding eagle survival, and reduce mortality from shooting, environmental contamination, and other causes.
5. Characterize habitat and develop predictive models to assess impacts on the CBR eagle population.
6. Develop habitat management plans.
7. Continue public education activities.

Total Cost of Recovery: Including costs of achieving permanent habitat protection, the total cost of recovery is estimated to be between $50 and $100 million.

Date of Recovery: The upper population goal for delisting (400 nesting pairs) should be met by 1998. Given land costs, it is not possible to predict when or if the habitat protection portion of the recovery goal can be met.

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PART I: INTRODUCTION

The following plan delineates a course of action to achieve recovery of that bald eagle (Haliaeetus leucocephalus) population breeding in the Chesapeake Bay Region (CBR), including the Delaware Bay area. It also includes actions to protect nonbreeding eagles, both resident and migrant, in the region. The plan describes continuing threats to the well-being of this endangered species and outlines strategies to ensure the lasting presence of a secure, self-sustaining CBR bald eagle population.

The bald eagle was first designated a Federally endangered species in 1967, with the listing of the Southern bald eagle. The bald eagle was listed as an endangered or threatened species throughout the United States on February 2, 1978; at that time, the Chesapeake Bay bald eagle population was determined to be endangered (43 FR 6233). The major limiting factor for the CBR population was identified as lowered productivity resulting from the pesticide DDT and other contaminants, exacerbated by shooting, disturbance, and habitat destruction.

Bald eagle populations began to recover throughout their range after the 1972 Environmental Protection Agency ban of DDT. The CBR bald eagle population has increased from 80 nesting pairs in 1970 to over 230 pairs in 1990. This comeback is attributed primarily to reduction in the use of environmental contaminants.

Although the possibility of recontamination remains a concern in the CBR (particularly in the Delaware Bay area), loss of suitable nesting, roosting, and foraging habitat has become the most significant threat to this bald eagle population. As eagle populations continue to expand, the amount of suitable habitat required to support them also will increase. However, human populations also are expanding, resulting in increased habitat destruction and disturbance to eagles. Thus, human-eagle interactions will play an increasingly important role in defining ultimate eagle population levels (Buehler 1990).

This revised plan recognizes both the improving status of the CBR bald eagle population and the growing threat of shoreline development and associated disturbance in the CBR recovery region. If habitat losses continue, it is possible to foresee a time when bald eagle numbers in the CBR will stabilize, then decline, despite present trends upward. The primary purpose of this revised recovery plan is to prevent such a reversal.

BACKGROUND

Location

The Chesapeake Bay/Delaware Bay recovery region encompasses Virginia east of the Blue Ridge Mountains, the entire states of Delaware and Maryland, the eastern half of Pennsylvania, the "pan handle" of West Virginia, and the southern two-thirds of New Jersey (Figure 1). The West Virginia, Pennsylvania, and New Jersey areas were added to the recovery region in 1984.

The Chesapeake Bay is a shallow, brackish inland sea, 8,384 km^2 in size, with an entrance to the Atlantic Ocean 20.2 km wide. Forty-eight rivers, with over 100 tributaries and myriad creeks, drain into the bay through numerous marshes and swamps. The total length of the Chesapeake Bay shoreline,

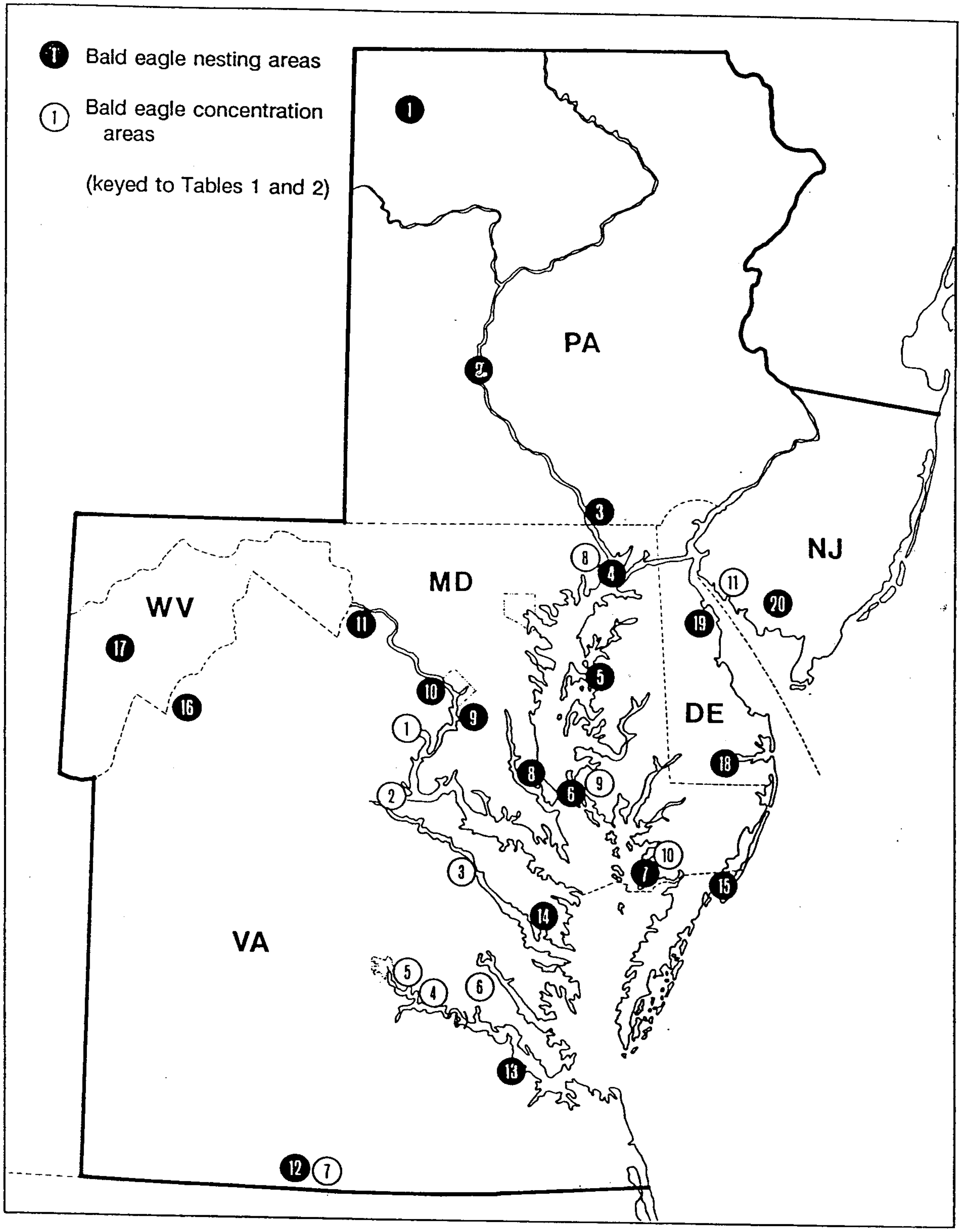

Figure 1. Chesapeake Bay Region Bald Eagle Habitat

including tributaries, is 13,033 km. This rich estuary may comprise the most important bald eagle habitat in eastern North America (Buehler 1990).

The Delaware Bay, another major estuary along the Atlantic seaboard, is geographically situated between Long Island to the north and Chesapeake Bay to the south. The basin resembles a flattened funnel 75.2 km in length and having a maximum width of 43.6 km. Extensive intertidal flats occur along the New Jersey shore, with the deepest areas along the Delaware side.

Distribution and Abundance

The Chesapeake Bay/Delaware Bay region provides habitat for a current level of over 230 pairs of breeding bald eagles, along with wintering and summering habitat for hundreds of nonbreeding resident eagles (immatures and nonbreeding adults) and migratory eagles which come to the mid-Atlantic region from the Northeast in winter and from the Southeast in summer (Buehler 1990). Abundance in the CBR varies in an annual cycle as evidenced by Buehler's observations of winter peaks, spring lows, larger summer peaks, and fall lows on the northern Chesapeake Bay.

Current Nesting Distribution. While breeding birds make up only a portion of the eagle population using the Chesapeake Bay/Delaware Bay region, this breeding component is the entity on which recovery population targets are based. As of 1989-90, nesting bald eagles have been observed in the areas listed in Table 1 (see also Figure 1).

Table 1. Bald eagle nesting distribution in the CBR as of 1989-90.

MAP KEY	AREA DESCRIPTION	NESTING OCCURRENCES
1	North central Pennsylvania	The northernmost active bald eagle nest in the Chesapeake Bay region is located on Pine Creek in Tioga County.
2	Middle stretch of the Susquehanna River, Pennsylvania	A nest is located 10 miles north of Harrisburg in Dauphin County.
3	Lower Susquehanna River, Maryland and Pennsylvania	Four nests are currently located along the lower Susquehanna River: one nest on the west side of the river in Harford County, Maryland; two nests in southern Pennsylvania, on the Lancaster-York County line; and one nest on Octorara Creek east of the Susquehanna on the Lancaster-Chester County line.
4	Northern end of the Chesapeake Bay, Maryland	Twenty pairs of bald eagles currently nest in this area, which includes Baltimore, Harford, Cecil, and Kent Counties, Maryland.
5	Middle Eastern Shore, Maryland	Consisting of Caroline, Queen Anne's, and Talbot Counties, this area has 13 nesting pairs.
6	Dorchester County, Maryland	This area, on Maryland's eastern shore, has the greatest density of nesting eagles in the state, with 21 pairs in 1989.
7	Lower Eastern Shore, Maryland	Some significant increases are beginning to occur on the lower eastern shore. Three pairs nested here in 1986, and nine pairs nested in 1989.
8	Western Shore, Maryland	Anne Arundel, Calvert, and St. Mary's Counties had a total of 13 nesting pairs in 1989. Charles County had 17 nesting pairs in 1989.
9	Prince Georges County, Maryland	There are three active nests in this area.
10	Potomac River between Harper's Ferry and Mt. Vernon, Virginia	In 1986 a nest was built just above Great Falls on an island on the Potomac River; the site has remained occupied since then. Mason Neck also supports one active nest.
11	Loudon County, Virginia	One active nest is located in this area.
12	Kerr Reservoir in central Virginia	A single pair of bald eagles has occupied a nest at this location since 1985. However, a number of large reservoirs are present in the region, with suitable nesting habitat around them; it appears that these impoundments have the potential to support a number of breeding pairs of eagles.
13	James River, Virginia	There are 16 nesting pairs in this watershed.

Table 1. Continued

MAP KEY	AREA DESCRIPTION	NESTING OCCURRENCES
14	York-Rappahannock-Lower Potomac Rivers, Virginia	Most of the state's nesting population of bald eagles is found along these rivers; over 75% of the bald eagles nesting in Virginia use these drainages.
15	Virginia Eastern Shore Peninsula	One nest in Accomack County has been active for 10 years or more, and a second active nest appeared in the county in 1987. There are currently two active nests in Northampton County.
16	Bath County, Virginia	An active eagle nest is located on the Bath County pumped-storage reservoir.
17	West Virginia	An eagle nest was located in the state for the first time in 1981, and a second in 1987.
18	Northern Delaware	The only nest in this area for many years was at Bombay Hook NWR; in 1990 another pair nested in this part of the state.
19	Southern Delaware	There are four active nests in the southern part of the state.
20	Southern New Jersey	New Jersey had only one active nest for many years (in Cumberland County); however, as a result of an ambitious hacking program, the number of eagles using the New Jersey shore of Delaware Bay has increased substantially in recent years. There are currently four active nests in the state.

Current Roosting/Concentration Sites. Bald eagles are not distributed uniformly around the CBR; rather, they tend to concentrate in certain areas having particularly favorable characteristics. Concentration points include night roosts, daytime loafing areas, and foraging areas. There are currently 11 sites within the CBR where bald eagles concentrate in considerable numbers. Seven of these are populated chiefly in the winter, two in summer, and two year-round. Seven of the 11 sites are in Virginia (where the ratio of adults to immatures was about 50/50 during the 1980s). Three other concentrations are found in Maryland, and one is found in New Jersey. CBR concentration areas are listed in Table 2 and shown in Figure 1.

Table 2. **Roosting/concentration sites in the CBR as of 1989-90.**

MAP KEY	LOCALITY	ROOSTING/CONCENTRATION SITES
1	Mason Neck, Fairfax County, Virginia	Twelve to thirty eagles are found here from November to March. The refuge also supports a summer roost.
2	Potomac River shore, Virginia	Since at least 1974, 60-100 eagles have spent the summer months in a five-mile stretch of mixed woodlands along the Potomac River shore at Caledon State Park and adjacent Cedar Grove Farm, King George's County.
3	Rappahannock River shore, Virginia	Over 45 eagles concentrate and roost in winter along two stretches of the Rappahannock River. Twenty to thirty-five eagles have been found along a segment from Port Royal to Horsehead Point. Eleven eagles winter along a two-mile stretch in Richmond County. Ninety-seven eagles were observed in this area during the winter of 1990.
4	James River at Flowerdew Hundred, Virginia	Since at least the late 1970s, 60-150 eagles have been observed during the summers along a five-mile stretch of upper James River shoreline. Most of these birds are thought to be transients, with a total summer population of up to 1,000 birds moving through the area.
5	James River at Presquile NWR, Virginia	Approximately 30 eagles concentrate along a stretch of the James River between Turkey Island, Curles Neck, and Jones Neck during the winter.
6	Chickahominy River, Virginia	Up to 15 birds have been observed wintering on the Chickahominy river between Johnson Creek and Wilcox Neck.
7	Kerr Reservoir, Virginia	Up to 10 eagles winter on Kerr Reservoir.
8	Aberdeen Proving Grounds, Maryland	Mid-winter surveys between 1979 and 1989 have shown an average bald eagle count of 56, with a range of 9-182, at the U.S. Army's Aberdeen Proving Grounds in Harford County. Many birds also use this roost in the summer.
9	Rehobeth, Somerset County, Maryland	Twenty eagles were reported in 1988 in an area near Rehobeth, Somerset County where eagles concentrate near chicken farms in the winter. (It should be noted that having bald eagles concentrated in areas where domestic poultry is located increases the potential of disease and transmission from poultry to eagles.)
10	Blackwater NWR, Maryland	Winter surveys since 1979 at the Blackwater NWR in southern Dorchester County have shown an average count of 35 birds with a range of 16-82.
11	Southern New Jersey	The past two years have seen a dramatic increase in eagle use in New Jersey along the Delaware Bay coast, and several sizeable wintering roosts are now reported in this area. Twenty-two birds were found at one roost near Dividing Creek in 1989-1990, and 5-10 birds use the Maurice River each winter.

Movement Patterns. Movements of CBR breeding eagles are limited to areas near their nest sites; in general, Chesapeake breeding birds are resident on their territories year-round. Although Buehler (1990) observed one or more adults within three km of their nests in the northern Chesapeake Bay more often during the breeding season (January-June) than the nonbreeding season, he attributed this to greater visibility during the breeding season for territorial defense, courtship, and activity at the nest rather than eagles being absent from the area during the nonbreeding season.

Nonbreeding eagles avoid nest sites with similar frequency during breeding and nonbreeding seasons. Buehler reported that on the northern Chesapeake Bay nonbreeding eagles rarely get within 1000 m of an active nest, and most of the nonbreeding eagles he located were more than 500 m from nest sites, regardless of season.

In general, nonbreeders, because of their lack of attachment to breeding sites, move when suitability of local areas declines. However, it appears that little time is spent completely off the Chesapeake Bay by local nonbreeding eagles. Buehler observed that about 10% of nonbreeder use was south of the bay in winter 1986-87, with even less in winter 1987-88. Nonbreeder use was minimal north of the Chesapeake Bay; Delaware Bay received some use by Chesapeake nonbreeders.

Nevertheless, historical observations indicate that some immature bald eagles from the CBR dispersed widely, ranging as far as Ohio, Massachusetts, and North Carolina (Cooke 1941, Stewart and Robbins 1958). More recent banding returns from first-year fledglings indicate some nomadic movements of Chesapeake Bay immature eagles; one immature eagle was recovered in Ontario, another in northern Pennsylvania, one in Alabama, and two in South Carolina. Numerous other observations as well as band recoveries are summarized in Cline (1986). Data on post-fledging movements of immatures from a Delaware Bay nest are provided by Niles and Clark (1988).

Bald eagles from areas in northeastern Canada and the United States migrate southward into and through the CBR in fall and winter (Stewart and Robbins 1958, Fraser et al. unpubl. data). Northern eagles arrive on the northern Chesapeake Bay from late November to mid-January; departure is more synchronous, ranging from early March to mid-April. Northern eagles wintering on the northern bay generally displace Chesapeake nonbreeders, causing these birds to move to the lower bay (Buehler 1990).

During the spring and summer months there is an influx of bald eagles from the southeastern United States into the Chesapeake Bay region. Buehler (1990) observed their arrival on the northern Chesapeake Bay between mid-April and mid-July; departure ranged from mid-June to mid-October.

Ecological Characteristics and Requirements

Within the CBR, it appears that eagle occurrence is determined by a complex interaction of factors. In general, breeding eagles are limited to areas that: (1) have suitable nest trees, (2) are less than 1.5 km from open water, (3) are relatively isolated from human activity and development (Andrew and Mosher 1982), and (4) have an adequate prey base (Buehler 1990). Nonbreeding and migrant eagles in the region are apparently limited to areas with (1) adequate food, (2) suitable roost and diurnal perch habitat, (3) a low level of human activity and development, and, possibly, (4) a lack of harassment from breeding birds (Buehler 1990). More specific information for both breeding and nonbreeding eagles is provided below.

Nesting. Within the CBR, nesting territories commonly encompass an area of about 2.59 km^2 (1 mi^2) in which one pair of eagles builds one or more nests (Abbott 1978). Most nest sites are found in large wooded areas overlooking marshes or water bodies. Nests are also located in isolated trees within marshes, on farmland, or in logged-over areas where scattered seed trees remain (Andrew and Mosher 1982). While nest sites usually are remote from intensive human activity, some CBR bald eagles have built nests close to railroad tracks, highways, airfield runways, and residences (Abbott 1978, MD Department of Natural Resources unpubl. data). Most eagle nests are less than 1.6 km from feeding areas, although some nests are up to 3.2 km from the birds' primary food source.

Density of nesting territories varies according to the quality of nesting and feeding habitat and the degree of human disturbance. Active nest sites (i.e., those in which an adult eagle has been observed in an incubating posture or eggs or young have been observed) have been documented as close as 1.2 km from each other, primarily in large, undisturbed forested tracts or large wetland ecosystems. Eight km seems to be the usual minimum linear distance between active nests along river or bay shorelines in the CBR (Abbott 1978).

The normal time for nest construction or repair in the CBR is from December through January (Abbott 1978). Eggs usually are laid between mid-January and mid-March; the majority are laid during the month of February (Jones unpubl. data, Tyrrell 1936, Bent 1937, Stewart and Robbins 1958, Abbott 1978).

Eggs typically hatch in March, and the young fledge by the end of June or in early July. Bald eagles in the CBR usually lay one to three eggs, although there are several records of four-egg clutches (Jones unpubl. data, Tyrrell 1936, Schmid 1966-67, Cline 1986), and two clutches of five eggs in 1938 and 1940 (egg data card of E.J. Court of Washington, D.C.).

In the CBR, bald eagles use a variety of tree species for nest sites. Pines, principally loblolly and to a lesser extent Virginia pine, are used most frequently. Deciduous species used include oaks, tulip poplars, beech, and hickory (Clark and Lincer 1977, Abbott 1978, Dittrick and Clark 1978, Andrew and Mosher 1982, Cline 1986).

There are few documented occurrences in the CBR of bald eagles nesting on artificial structures. Two nests were situated on wooden observation towers in the 1950s (Abbott 1978). Also, a man-made stick nest was built in an 80-foot pine on the New Jersey shore of the Delaware Bay (Niles and Clark 1988). The stick nest was approximately 1.2 m diameter and 1.2 m deep, and was constructed of sticks ranging in diameter from 2 to 6 cm. It was built within 92 m of an active nest in a dead tree, and was used by the pair the first season after construction.

A bald eagle's nest in a tree is usually 15 m or more above the ground in the uppermost triple limb crotch (Abbott 1978), with top branches often forming a protective canopy over the nest. A typical nest is a large structure formed of a base of sticks up to 2.5 cm in diameter and 0.9 m long (Abbott 1978). It is lined with fine grasses, and green pine needles or leaf sprays are often placed in the nest cup before eggs are laid (Abbott 1978). A new nest is about 0.61 m deep and 1.5 m across; materials are added to the nest each year so that an

8-10 year old nest which has been used annually may be 1.8 to 2.4 m deep and equally as wide (Abbott 1978).

Feeding. In the CBR, the bald eagle is found feeding most often along river, lake, and bay shorelines, or perched in the trees bordering them; and in extensive freshwater marshes on hillocks, muskrat houses, bare sand or mud bars, and isolated trees.

The bald eagle's foraging strategy; its broad use of birds, mammals, and fish; and its role as predator, scavenger, and pirate are well documented (see Mersmann 1989). Bald eagles are foraging opportunists capable of exploiting a variety of food sources, and bald eagle use of food resources in the CBR tends to reflect food abundance. Mersmann (1989) documented large seasonal and geographical variation in abundance of major bald eagle foods (fish and waterfowl) on the northern Chesapeake Bay.

Eagles feed almost exclusively on live and dead fish when fish are abundant. Although dead fish are taken when available, bald eagles are capable of capturing live fish. Bald eagles typically snatch fish from the water's surface; shallow water is thus an important component of live fish availability to eagles. Eagles select large prominent trees (both pines and hardwoods, alive or dead) for use as fishing perches. They also show preference for fishing perches in trees atop high shoreline bluffs (Wallin and Byrd 1984).

In Mersmann's study, the four fish species most frequently eaten by eagles were the same four species most commonly netted: menhaden, large gizzard shad, white perch, and catfish. Bald eagles often fed on dead or moribund gizzard shad during winter; catfish were taken spring through fall, primarily in rivers and predominantly as carrion. Menhaden were taken primarily in spring and summer in a variety of habitats, and perch were used primarily during the spring spawning season (Mersmann 1989).

Eagles readily shift their diet to exploit abundant waterfowl and mammal carrion in winter when fish numbers are low. On the northern Chesapeake, eagles shifted between these two diets primarily in the transition months of October and March. Although they have been observed to prey on live waterfowl (Bent 1937, Imler and Kalmbach 1955), wintering eagles most frequently feed on waterfowl carcasses, which are common near waterfowl concentrations and associated hunting areas. Deer carrion also are frequently eaten during winter months (Mersmann 1989). Duck and muskrat are common remains at eagle nests on the Chesapeake Bay (Smith 1936, Cline and Clark 1981). Although reptiles and amphibians are not frequently recorded in bald eagle food habits studies, remains of several turtle species are commonly found at Chesapeake Bay eagle nests (Cline and Clark 1981).

Roosting. The following discussion is based on Buehler (1990). Availability of roost sites with suitable thermal and vegetational characteristics may be an important determinant of bald eagle distribution and abundance, and may also affect eagle ability to use otherwise suitable foraging areas. Buehler reported that eagle roosting habits on the northern Chesapeake Bay are distinctive insofar as eagles use only deciduous trees for roosting, and roost close to foraging areas. Northern Chesapeake Bay eagles exhibit similar roost behavior to eagles elsewhere in that eagles select winter roost trees and sites that are relatively protected compared to those used in summer.

Buehler observed that almost all communal roosts are used consistently and in the same seasons (primarily winter) each year. Eagles roost alone most often in summer, and summer roosts are more dispersed across the bay than winter sites. Solitary roosting is least common in fall.

CBR eagles select roost sites in relatively large forested blocks but adjacent to large open corridors (these corridors may be important for providing access to roost sites, given the eagle's limited flight agility). They select large, super-canopy trees (primarily beeches, oaks, and yellow poplars) that are open and accessible for roosting. Roost sites generally are located away from houses and roads, and usually are on public land (for instance, on military reserves and state parks which have protected mature coastal forests and limited human development).

Roost sites are, on average, within six km of all types of aquatic habitat. Eagles focus on the bays as their primary unit of foraging habitat, supplemented by other more limited aquatic areas. Some roosts are associated with ponds in apparent response to alternative foraging opportunities (waterfowl and fish). Most of these aquatic habitats could be considered potential eagle foraging areas for most of the year.

Population Trends

The Chesapeake Bay historically was thought to support one of the densest breeding populations of bald eagles outside Alaska, with up to one nest per mile of shoreline (Buehler 1990, citing F.C. Kirkwood in Tyrrell 1936), due to abundant prey and extensive shallow-water foraging habitat. Estimates of pre-European Chesapeake Bay eagle populations range from about 3,250 to over 4,000 breeding pairs.

Eagles declined as deforestation and human disturbance, including widespread shooting, began during European settlement of the bay. By the 1930s, the Chesapeake Bay area had an estimated population of 600-800 pairs (Tyrrell 1936). Tyrrell surveyed approximately 1/4 of the Chesapeake Bay region in 1936 and saw 39 active nests of known outcome within the area he covered that year. The results of the Tyrrell survey are shown in Table 3, along with data from subsequent surveys.

By 1962 the population had declined to 150 pairs. An aerial bald eagle nest survey conducted by J.M. Abbott and F. Scott that year showed a productivity rate (0.2 young per active nest of known outcome) that was only one-eighth the level of productivity found in 1936. It also showed a high abandonment rate: 25 of 37 nests of known outcome in 1962 were abandoned (unknown causes) compared with only one out of the 39 nests of known outcome in 1936.

The reasons for this decline in the bald eagle population in the Chesapeake Bay region are well documented. The use of persistent organochlorine pesticides in the region and elsewhere resulted in direct mortality and, more critically, depressed productivity. The expansion of industry and development and increased construction of shoreline vacation homes disturbed or displaced nesting bald eagles from traditional territories. Shooting contributed to further decline in a population already under severe constraints.

By 1970, census observers estimated the nesting population of bald eagles in the Chesapeake Bay region at 80-90 pairs. However, the productivity rate of 0.40 young per active nest was a minor improvement over the 1962 rate.

Table 3. Bald eagle nest success and productivity in the CBR -- 1936-1990, selected years

	Active Nests	Successful Nests	Young	% Nest Success (Successful/Active)	Productivity: Young/Active	Young/Successful
1936	39	31	63	79%	1.61	2.03
1962	37	5	7	14%	0.19	1.40
1970	55	17	22	31%	0.40	1.29
1980	85	49	72	58%	0.85	1.47
1986	138	101	192	73%	1.39	1.90
1987	166	-	235	-	1.42	-
1988	186	-	260	-	1.40	-
1989	198	-	217	-	1.10	-
1990	235	-	328	-	1.43	-

NOTES:

1. Nest success and productivity figures are based on nests of known outcome only.
2. Included in the totals for 1985-1990 are figures for New Jersey and West Virginia.
3. At least 15 nest sites or territories, located in Maryland and Virginia, are known to have been active for 60 years or more (Tyrrell 1936, Abbott pers. comm.).
4. 1990 figures for active nests include a count of 104 nests in Virginia, although 5 of these nests were not relocated due to heavy foliage. Productivity (young/active nest) is calculated based on 99 nests in Virginia.
5. All data are from bald eagle research programs in the states involved.

Beginning in the mid-1970s, a significant improvement in the CBR population was observed. Between 1977 and 1983, productivity in the Chesapeake Bay region population was at or above 0.7 young per active breeding pair, the rate generally thought to be necessary to maintain a stable bald eagle population (Sprunt et al. 1973). Since 1984, productivity in the CBR has reached and often exceeded the recovery target of 1.1 young per active nest, and this rate appears to be stable. Figures for recent years indicate an increase in both the number of active nests and in productivity rates. This is evidenced by an increase in multiple chick nests; one nest in 1986 contained four eaglets, 16 nests each contained three eaglets, 56 nests each contained two eaglets, while 28 nests each contained only one eaglet (Cline 1986).

CBR productivity figures since 1984 include the New Jersey, Pennsylvania, and West Virginia areas that were added to the recovery region that year.

Twenty-two nests were active in New Jersey during 1959-1963 (Holstrom 1984); however, only one active nest remained in the 1970s, which was seldom productive. The bald eagle population has grown in recent years, and, as of 1990, there are three productive and three unproductive bald eagle nests in New Jersey.

That portion of Pennsylvania in the Chesapeake Bay region had one active nest during 1987-88, which produced one eaglet each year. The number of active nests increased to five in 1989, with three young. Although the number of active nests decreased to four during the 1990 season, these nests fledged five young.

The first bald eagle nest in West Virginia was discovered in 1981; it remained active until 1987, and the female adult at this site was found dead in 1988. This nest became productive again in 1990. A second nest was discovered in 1987; while no young were produced that year, one eaglet was produced at the site in 1988. While neither nest fledged young in 1989, in 1990 the two nests produced a total of five young.

All three populations using the Chesapeake Bay/Delaware Bay region (resident, northern and southern migrants) are increasing (Wood <u>et al</u>. 1990, Nickerson 1989), although the the Delaware Bay (Delaware and New Jersey) population has not exhibited the magnitude of success of the Chesapeake Bay population. The Delaware Bay bald eagle population remains small, with limited resilience in terms of recovering from significant losses.

THREATS

As early as 1955, Imler and Kalmbach noted that bald eagles throughout the United States were steadily declining because of human activities that either directly affected the birds or modified their habitat and destroyed their nests. Since the late 1970s, habitat loss associated with shoreline development and use has replaced organochlorines as the most critical threat facing the CBR bald eagle population. Shooting, continued use of certain contaminants, natural environmental events, and accidents also contribute to continuing pressures on CBR bald eagles.

Habitat Loss and Human Disturbance

<u>Shoreline Development and Use</u>. In the Chesapeake Bay/Delaware Bay region, shoreline habitat has come under increasing development pressure since the 1970s, when the Chesapeake eagle population was at its all-time low. Shoreline use trends around the region are described below.

The Institute for Wildlife Research, National Wildlife Federation, recently completed a cursory review of the extent of development occurring in the vicinity of bald eagle nests in the Virginia portion of the CBR. Their records indicate that development has occurred within at least 74% of the total available potential habitat blocks examined. Further, development has occurred in 55% of the shoreline areas along the Potomac, Rappahannock, James, and York Rivers and the Chesapeake Bay. Although this analysis is incomplete, the data indicate that eagle nesting habitat and foraging areas are being degraded to a significant extent in these areas.

Developed land in Maryland increased by 16.5% from 1970 to 1980, and developed land is projected to increase by 59% from 1980 to the year 2020 (Breeden _et al_. 1988). Reese (1977) found that land development for waterfront living had consumed nearly all the available shoreline in Talbot County, Maryland.

Buehler (1990) found that of the 1,442 km^2 of nonaquatic habitat in the northern Chesapeake Bay area, 400 km^2 (27.7%) is classified on USGS land use maps as developed, and of the 2,500 km of shoreline, 75.6% has developments within 500 m of the shoreline; the density of shoreline development differs by geographic area, ranging from 3.58 to 10.6 sites per shoreline km. This shoreline may be largely lost as eagle habitat.

Similar concern over shoreline development and the consequent loss of eagle habitat has been reported for Delaware (Gelvin-Innvaer pers. comm.) and New Jersey (Sprunt 1963). Holstrom (1984) found that the rate of loss of suitable habitat for bald eagle nesting in New Jersey increased substantially in the 1980s. Currently, the greatest share of wetland development applications in New Jersey are received from counties with bald eagle nesting areas (Niles pers. comm.).

This trend appears to hold over much of the shoreline of the Chesapeake/Delaware Bays and their tributaries as bald eagle habitat continues to be destroyed for housing, shopping malls, highways, parks, airports, and public utilities. Concern about the potential for continued habitat loss due to development is heightened by the fact that most bald eagle habitat in the eastern United States is on private land: in the Chesapeake Bay area, only 15.5% of nests occur on public land (Cline 1986), and in other areas along the Atlantic coast, well below 30% of nests occur on public lands (Buehler 1990). If steps are not taken to protect eagle habitat from destruction on private lands, eagles could someday be confined largely to islands of publicly-owned habitat, which may not support full recovery levels.

Human activity associated with shoreline development is also on the rise. Boating, fishing, and shoreline recreational activities (evidenced by marina development) in the Chesapeake Bay have increased dramatically in recent years (MD Department of Natural Resources and VA Department of Game and Inland Fisheries unpubl. data). Around the Delaware Bay, eagle disturbance is a serious problem both on the ground and from recreational boat traffic (DE Department of Natural Resources unpubl. data). Waterfront recreation activities associated with wetland development may be the biggest threat to bald eagles in New Jersey (Niles pers. comm.).

Eagles avoid large portions of shoreline because of development and human activity. Buehler (1990) found that while 27.7% of the northern bay is developed, only 4.9% of radio-tagged eagle locations occurred in human-developed habitat blocks. Furthermore, most of these eagle locations occurred on Aberdeen Proving Grounds, where habitat was designated as developed because of military operations despite low human use and very few physical structures present (only 0.9% occurred in nonmilitary developed areas).

There has been considerable study of eagle sensitivity to human activity. Several studies have shown that eagles select nest sites away from developed areas, and other studies have noted eagle sensitivity to human activity at foraging areas (Buehler 1990). Eagles on the northern Chesapeake Bay (and elsewhere, e.g., Colorado, Washington, Oklahoma) show human avoidance behavior in roost site selection. Buehler observed significant eagle avoidance of shoreline which had developments within 500 m, in all seasons but fall. Eagles appear to be more tolerant of developed shoreline in fall than in other seasons, suggesting that other factors, such as food supply, may affect eagle tolerance to human disturbance. Other potential effects of development, such as vegetational habitat alteration and prey base disruption, need to be studied to isolate the most detrimental effects of human development on eagles.

While human activity appears to be the most important factor causing eagle avoidance of developed shoreline, eagles on the Chesapeake also avoid developed shoreline in winter, when human activity is largely absent, suggesting that eagles also must be sensitive to the development structure regardless of whether human activity is present. Eagles appear to avoid shoreline segments with human activity (pedestrians and boats) within 500 m, primarily in summer when human activity is greatest (Buehler 1990). Shoreline in the northern Chesapeake with human activity but not development also appears to be unsuitable for eagle use, at least while the human activity is present. Human activity occurs in seasonal, weekly, and daily cycles, with corresponding effects on eagles.

The reason eagles avoid areas being used by people is still in question. People may either directly flush eagles from developed shoreline, driving away eagle use of these areas, or eagles may simply avoid shoreline which has people or developments present.

The presence of boat landings appears to be a better predictor of the level of human disturbance than the presence of houses and other buildings per se. The presence of a house does not necessarily preclude utilization of the area by eagles, particularly if the house is set back from the shore somewhat and is associated with dense mature shoreline forest. The presence of a boat landing apparently serves to focus human activity, and hence disturbance, on the shoreline itself; once disturbed, eagles do not return to the shore for a considerable period of time. This is important because the installation of piers and boat ramps requires a Federal permit, and potential impact on endangered species is an important consideration when permit requests are reviewed (Wallin and Byrd 1984).

Interest in a proposal to build a public boat ramp on the James River in an area heavily used by bald eagles during summer months persists, although the Corps of Engineers recently denied a permit for this proposal. The Fish and Wildlife Service believes that the disturbance associated with such a development would disrupt a major concentration of birds.

Logging and Land Clearing. Alteration of eagle habitat can also occur through logging practices and land clearing for agriculture. The threats posed by logging include (1) nest disturbance, which is more critical as incubation progresses or if no alternate trees are available; (2) overall loss of forest age classes that are suitable for bald eagle nesting, which becomes more significant as available habitat is filled; and (3) silvicultural practices which produce seed trees that are less acceptable as bald eagle nest sites.

Destruction of eagle nesting sites by logging has been reported for many years by numerous observers (Broley 1947, 1950; Barnes 1951; Howell 1962; Snow 1973), and detrimental effects of logging on nesting have been documented specifically for the CBR (Scarupa 1971, Abbott 1974).

Snow (1973) reported that timber activities in a nesting area are especially critical when eagles are at their nest sites. Although a pair may remain in their territory after loss of the nest tree, destruction of nest trees can mean the end of the reproductive cycle for a given pair of eagles if suitable alternate trees are not available (Marshall and Nickerson 1976). The impact of logging on bald eagle nesting can be reduced by establishing buffer zones around nest trees and mitigated by using the seed tree timber harvest technique of reforestation, which will help to preserve nest trees.

Due to the loss of much of the undisturbed nesting habitat in the CBR, many bald eagles have been observed nesting in areas formerly logged by clear-cutting techniques (Clark and Lincer 1977, Pramstaller and Clark 1979). These birds usually nest in the seed trees which have been left, often within one or two years after cutting. The emerging second growth forest is very dense and tends to discourage human traffic, providing some protection for the birds.

Land clearing in the CBR, particularly for agriculture on the Delmarva Peninsula, has reduced availability and suitability of nesting sites. Such changes in land use patterns in the region could pose a significant long-term threat to bald eagle nesting habitat.

<u>Shooting</u>. Shooting has historically been a major cause of direct mortality of bald eagles (Jones 1933, Tyrrell 1936, Imler and Kalmbach 1955, Howell 1962, Sprunt 1963, Sprunt and

Ligas 1963, Coon et al. 1970, Mulhern et al. 1970, Belisle et al. 1972, Snow 1973, Cromartie et al. 1975, Prouty et al. 1977, Kaiser et al. 1980, Reichel et al. 1984). Nationwide, however, the percentage of eagles submitted for necropsy that have died of shooting has steadily declined over the years, from 59% for 1960-65 to 19% for 1978-81.

The incidence of eagles being shot is high in the Chesapeake Bay region. Fourteen of 49 bald eagles from the CBR that were submitted to the U.S. Fish and Wildlife Service for necropsy from 1963 to March 1987 had been shot. The majority of these were shot during the months of October through February (National Wildlife Health Research Center [NWHR] unpubl. data). Four of 23 live bald eagles from the CBR that were submitted to the Patuxent Wildlife Research Center (PWRC) during 1967-84 had been shot, and at least five additional birds possibly had been shot. Six of these nine were submitted during October through February. The NWRH has noted, however, that submission of dead bald eagles has not been uniform and comprehensive either in the CBR or across the United States; therefore, the relative significance of mortality factors cannot be fully analyzed.

Other Activities. Fishing activities pose particular problems for eagles and other fish-eating birds. Nestling ospreys were found entangled in monofilament fishing line in the CBR (Byrd pers. comm., Wiemeyer et al. 1987). In addition, Wiemeyer (pers. comm.) stated that in one instance a bald eagle succumbed after being severely entangled in the hooks of a fishing lure.

Well-intentioned management efforts could also have indirect effects on CBR bald eagles. Ongoing efforts to improve water quality and restore abundant and diverse fish stocks in the Chesapeake Bay could affect the fish portion of the eagle's food base. Increasing stocks of predatory fish, such as striped bass, may deplete populations of fish frequently eaten by eagles at the present time, but also may increase the availability of a variety of fish species.

Reduction of waterfowl hunting seasons and bag limits due to declining waterfowl populations may affect the eagle food base through reduction in the number of waterfowl carcasses. Although these actions are designed to increase waterfowl populations in the long run, immediate impacts on eagle food abundance are possible, particularly in mild winters when natural mortality of birds, mammals, and fish is low. It is not known what level of decreased waterfowl populations and hunting pressure might affect eagles; however, even with decreased seasons and bag limits in 1987-88, uneaten waterfowl carcasses were common in late February, indicating a food surplus at that time (Mersmann 1989).

Environmental Contaminants

Organochlorine pesticides, primarily DDT (especially its metabolite DDE) and dieldrin, were a significant reason for the past decline of the CBR bald eagle population, causing major reductions in reproductive success and direct mortality of eagles during the 1950s and 1960s. Although DDE concentrations have decreased markedly, other contaminants continue to have a negative impact on the population.

The historical effects of DDT and current threats from other environmental contaminants on bald eagles are discussed below.

Organochlorines. Abbott (1957) first reported that the Chesapeake Bay bald eagle population appeared to be declining.

Broley (1957, 1958) hypothesized that the cause of the population decline and reproductive failure in Florida at that time might be DDT contamination of the environment. The extremely low rate of production by the Chesapeake Bay population in 1962 (see Table 3) provided additional support to this hypothesis, as did a decline in reproduction for the New Jersey bald eagle population observed in the late 1950s (McLaughlin 1964).

Appendix A summarizes residue levels found in eggs and tissues of bald eagles collected in the Mid-Atlantic region between 1962 and 1985. Findings are discussed below.

Residues in eggs: The residue levels of several organochlorines found in CBR bald eagle eggs that failed to hatch for the years 1973-79 were among the highest for any bald eagle population in the United States (Wiemeyer et al. 1984). DDE, shown to cause eggshell thinning in several species of birds in experimental studies (Heath et al. 1969, Wiemeyer and Porter 1970, Longcore et al. 1971, McLane and Hall 1972, Lincer 1975, Mendenhall et al. 1983), occurred at especially high levels. Wiemeyer et al. (1984) found that DDE in bald eagle eggs was much more closely associated with eggshell thickness and production of young than other toxicants.

A DDE concentration of 1.3 ppm in eggs was associated with a production level of 1 young per active breeding pair, whereas a concentration of 3.5 ppm was associated with a mean production of 0.7 young per pair. When DDE levels reached 15 ppm, production of young was reduced to 0.25 young per active breeding area. The geometric mean DDE concentration for Maryland and Virginia bald eagle eggs collected in 1973-79 was 9.6 ppm. Concentrations of

DDE declined to 4.7 ppm for the years 1980-85 (Wiemeyer unpubl. data).

The mean PCB concentration for these years declined from 27 to 15 ppm, whereas the mean dieldrin concentration declined from 1.0 to 0.3 ppm. Concentrations of other contaminants also declined. These declining concentrations of contaminants correlate with improvements in reproductive success that were reported during the years of sterile egg collection, although mean shell thickness has not significantly improved (see Table 4). The mean shell thickness of bald eagle eggs from Delaware, Maryland, and Virginia for the years 1975-79 was significantly thinner than the pre-DDT norm (Wiemeyer et al. 1984). No consistent or major improvement in shell thickness was noted for the area in the years 1980-85, and shell thinning exceeded 15% for the nest in New Jersey for the years 1982-86. This trend, however, may

Table 4. Shell thickness of bald eagle eggs collected 1973-1986

	Years	N	Mean thickness (mm)	% change from pre-1946 norm
New Jersey	1982-86	1	0.481	-22
Delaware	1977-78 1982-85	1 3	0.473 0.523	-23 -15
Maryland	1977-79 1980-85	7 8	0.548 0.530	-11 -14
Virginia	1975-79 1980-85	5 11	0.506 0.539	-18 -13

N = Number of breeding territories represented be biased by the fact that only eggs that did not hatch were collected and submitted for analysis. Young production in sample breeding areas was somewhat lower than in the overall population, confirming the bias in sampling.

Residues in tissues: Formerly, all bald eagles found dead or dying in the wild were submitted to the NWHR and the PWRC for necropsy and chemical analysis. A number of the adult bald eagles acquired in the Mid-Atlantic region showed residue concentrations of organochlorines in their brains and carcasses. The concentrations in these bald eagles indicated that this population was one of the more highly contaminated populations in the United States (Reichel et al. 1969, 1984; Mulhern et al. 1970; Belisle et al. 1972, Cromartie et al. 1975; Prouty et al. 1977, Kaiser et al. 1980). Current levels of reproductive success suggest that this is no longer the case, and tissue analysis is no longer conducted on a routine basis.

Elimination of DDT, aldrin (which is metabolized to dieldrin), and dieldrin since the early 1970s has been the major reason for the steadily increasing numbers and productivity rates in the CBR bald eagle population. However, although organochlorines are no longer a major threat to the CBR bald eagle population overall, their persistence may still impair the reproduction of a few pairs, especially in more contaminated areas such as Delaware Bay. DE Department of Natural Resources has noted that recurrence of contamination is a serious problem around the Delaware Bay. Their work on peregrine falcons and ospreys indicates increasing contaminant loads and corresponding shell thinning in both species that may be related to the age of the population; reproductive declines in bald eagles due to the continued presence of DDE and shell thinning in CBR bald eagles may not yet be apparent only because the population is young -- this remains to be determined.

Organophosphorus and Carbamate Pesticides. Use of organophosphorus and carbamate compounds continues to pose threats to bald eagles in the region. The type and magnitude of threat differ from that formerly posed by DDT; the newer contaminants cause localized effects from acute toxicity.

These pesticides have been associated with the lethal poisonings of both bald and golden eagles in the United States (e.g., Sutton 1987, U.S. Environmental Protection Agency 1989). Since there is no national system for monitoring and reporting wildlife poisonings related to pesticides, records of eagles poisoned by pesticides are only an indication that such poisonings have occurred and continue to occur. There is no accounting of the total number of eagles in the CBR or elsewhere that are affected by pesticides.

Still, NWHR records show that the CBR has the most concentrated clustering of organophosphate/carbamate poisonings of bald eagles in the country. Their records also indicate that carbofuran was a major factor in the death of bald eagles from the Chesapeake Bay area in 1988. Numerous eagles have been found poisoned in the CBR in recent years, and both accidental poisoning and deliberate misuse has been documented (Kuncir 1988, U.S. Environmental Protection Agency 1989, Windingstad pers. comm.). These poisonings have been associated with both normal agricultural use of carbofuran as well as cases of overt misuse. NWHR has confirmed carbofuran poisoning in 15 bald eagles in the CBR since 1985 (Windingstad pers. comm.). There have also been bird kills of other species in the CBR attributed to carbofuran (e.g., Lyon 1990); these kills are of concern because of the potential for eagles to succumb via secondary exposure.

In 1985-86, the cause of mortality of two bald eagles from Virginia was diagnosed as carbofuran poisoning. Carbofuran poisoning is also suspected in the mortality of two other eagles at this site (NWHR unpubl. data) and three additional cases at other sites (FWS unpubl. data). Four bald eagles from the western shore of Maryland found in March 1987 died from carbofuran poisoning. The loss of ten other birds from Maryland and one from Delaware from this chemical in 1988 was confirmed. Several other associated cases of poisoning were suspected but not confirmed because the eagle carcasses were not suitable for analysis. Most of the 1988 cases were deliberate poisonings, stemming primarily from the use of the toxicant as a predacide for raccoons. At least two are thought to be attributable to legal use of carbofuran (FWS unpubl. data).

In 1985, EPA began a special review of carbofuran because of a long history of bird mortality. Information about all of the eagle deaths has been provided to EPA in the intervening years since the review began. At this time, the material is still registered and is used in significant quantities in the Chesapeake Bay region. The Service has repeatedly requested that EPA complete the species review, and has taken the position that further losses of wildlife, whether endangered or not, are intolerable.

Other pesticides also continue to affect bald eagles survivorship in the CBR, although to a lesser extent than carbofuran. In 1983, a sick adult female bald eagle was found alive on the ground in Delaware and transported to the NWHR, where it died the following day of suffocation which resulted from immobilization caused by Famphur toxicosis. Famphur (= Warbex, an organophosphorus insecticide used on livestock) was found in the eagle's stomach. The stomach contents suggested a case of secondary poisoning (Franson _et_ _al_. 1985).

In May, 1987, a bald eagle found near Blackwater National Wildlife Refuge, Dorchester County, Maryland, was diagnosed as having died of parathion poisoning. The source of the parathion is unknown.

In addition to causing direct mortality, unsuccessful nesting attempts could be occurring in cases of sublethal exposure to anticholinesterase compounds. Anticholinesterase poisoning in raptors was seldom detected in earlier years because brain cholinesterase activity was rarely examined, and because secondary poisoning was thought to have been unlikely.

Oil. With increased petrochemical transport activities in the Chesapeake Bay region, the potential exists for eagles to come into contact with oil. Oil on their breast feathers could be transferred to their eggs. Small quantities of oil (as little as one microliter of No. 2 fuel oil) on the surface of duck eggs have been shown to cause a significant reduction in ability to hatch (Albers 1977). At least 146 bald eagles are known to have died in association with the 1989 oil spill in Prince William Sound, Alaska (_Ecology USA_, September 11, 1989, page 176). Furthermore, reproductive success was depressed among eagles nesting in that area.

Lead. While lead poisoning has been documented in only four bald eagles from the CBR, all but one from peripheral areas (NWHR unpubl. data), frequent use of waterfowl carrion in winter indicates a continuing potential for ingestion of lead shot (Mersmann 1989). In Mersmann's study, radiographs of 1,089 collected pellets revealed that 14 pellets (1.3%)

contained lead shot and nine pellets (0.8%) contained steel shot. Shot was found in pellets containing remains of Canada geese, mallards, common merganser, and common goldeneye.

The risk of individual eagles dying from lead poisoning will be reduced when the use of lead shot for waterfowl hunting is totally banned in 1991-92. However, the NWHR has noted that, although it may be reduced, the risk of eagles dying from lead poisoning will not be eliminated as long as lead shot is used for hunting of upland game. Predation or scavenging by eagles on crippled or dead pheasnats, grouse, rabbits, squirrels, etc. shot with lead shot will result in continued eagle mortality. In addition, the ban of toxic lead shot has not been extended into Canada, so lead shot still may be present in waterfowl. Nevertheless, this threat appears minor with respect to recovery of the CBR bald eagle population.

<u>Other contaminants</u>. Mercury has not been a threat to the CBR bald eagle population. However, other sources of contamination such as sedimentation and excessive nutrients have the potential to adversely affect Chesapeake Bay water quality, prey populations secondarily, and ultimately CBR bald eagles.

Diseases and Other Natural Environmental Factors[1]

Avian cholera, recognized as a cause of mortality in waterfowl in several areas including the Atlantic Flyway (Locke <u>et</u> <u>al</u>.

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[1] It should be noted that the focus of the National Wildlife Health Research Center is not on contaminants, but all disease factors involving wildlife. The comparison of relative significance of mortality factors is completely dependent on the degree of uniform submission of dead eagles from the Chesapeake Bay Region. If eagle carcasses are sent to diagnostic centers other than the NWHR and records of findings are not centrally located for examination, information regarding relative significance of mortality factors cannot be considered reliable.

1970, Windingstad et al. 1988), poses a potential threat to bald eagles, especially under conditions of extensive outbreaks such as reported in the Chesapeake Bay region. Carcasses of ducks that have died of avian cholera frequently are scavenged by gulls and other predators with subsequent transmission of the disease to the scavengers (Rosen 1971). While there are no known cases of avian cholera among bald eagles in the Chesapeake Bay region, bald eagles have contracted the disease in northern California (Rosen 1972).

The threat to bald eagles is diminished by the monitoring that occurs to prevent a major outbreak of avian cholera among waterfowl, and by the retrieval of waterfowl carcasses when outbreaks do occur. (However, mortality may go unnoticed if scavenging removes carcasses at the same rate that the waterfowl are dying.) Despite the occurrence of various other diseases in the region, disease does not appear to be a limiting factor for CBR bald eagles at this time.

A number of other natural environmental factors may affect reproduction and direct mortality of both young and adult bald eagles. These factors include predation, parasites, weather, inter- and intraspecific interactions, and relations with competitors. There is no strong evidence that any of these circumstances are limiting factors.

Accidents

Accidents that most commonly cause mortality among bald eagles are collisions with powerlines and other obstructions, and less frequently with aircraft. Data on mortality consequent to accidents were included in a series of papers from the Patuxent Wildlife Research Center (Coon et al. 1970, Mulhern et al. 1970, Belisle et al. 1972, Cromartie et al. 1975, Prouty et al. 1977, Kaiser et al. 1980, and Reichel et al. 1984). Accidental deaths included cases of electrocution, trauma, impact injuries, being struck by a vehicle, drowning, and asphyxiation. Accidents involving man-made objects appear to have raised mortality rates.

CONSERVATION MEASURES

A number of measures have been implemented over the past three decades to promote recovery of the Chesapeake Bay bald eagle population. Some of the more notable conservation measures are described below.

The 1969 establishment of the Mason Neck National Wildlife Refuge on the Potomac River precluded development of a city of 20,000 people, which was proposed in an area that once supported three pairs of nesting eagles and was a significant eagle roosting area (Abbott 1978). Because of the establishment of the refuge and adjacent parks, this area continues to support one eagle nest as well as a summer and winter roost.

In 1984, Maryland enacted the Chesapeake Bay Critical Area Law (Code of Maryland 14.15.02-1986), which included criteria for limiting development activities within a 305 m shoreline management zone and creating resource conservation areas where shoreline development was <1 house/2 ha. New development within these areas cannot exceed 1 house/8 ha. Further, logging is prohibited within the first 50 feet and very restricted within the first 100 feet of the shoreline. This is the first comprehensive shoreline management legislation, with built-in provisions for wildlife habitat protection and enhancement, to be applied over a large area in the United States. Special habitat protection measures for endangered species must be provided within the Critical Area by law, and guidelines prepared by Cline (1985) are being used for bald eagle nest site protection.

This legislation should serve to protect much potential nesting habitat and aid in maintaining potential breeding sites throughout tidewater Maryland. However, because the Maryland Critical Areas Law is being used as a model for other states, it is important to note that a much larger management zone is needed to fully protect bald eagle perching, roosting, and nesting habitat. For instance, while Maryland's 305 m zone would encompass 76% of northern Chesapeake roosts if they occurred in designated resource conservation areas, the zone would allow development far in excess of the development density observed within 500 m of northern Chesapeake roost sites now in use (mean = 1.67 houses/78 ha), does not protect roosts from development outside the zone, and does not limit human activity (Buehler 1990).

In comparison, a 1000 m management zone would encompass all roost sites identified on the northern Chesapeake and buffer 85% of those sites from inland human activity. This zone would also provide an adequate buffer for eagles on the shoreline during daytime periods, given the maximum effect distances reported at foraging areas (800 m, McGarigal 1988). A 1000 m zone would encompass most of the nest sites, but would only provide a 363 m buffer from inland human activity, on average (Andrew and Mosher 1982), suggesting that site-specific management zones around nest sites would be more effective.

Virginia also has promulgated regulations aimed at water quality improvement through shoreline protection (Code of

Virginia 10.1-2100-1988), that prohibit new development within 30.5 m of the shoreline in designated resource protection areas.

The Virginia Department of Game and Inland Fisheries is currently directing funding and staff resources toward key recovery tasks. They have initiated a particularly aggressive program aimed at securing protection for existing and potential nesting and roosting sites and concentration areas. Long-term protection will be facilitated by the direct involvement of state resource agencies with private citizens and corporations.

Beginning with Dorchester County, Maryland in 1986-87, lead-shot free zones were designated in waterfowl hunting areas. More zones will be phased in throughout the CBR until 1991-92, at which time lead shot will be totally banned for use in waterfowl hunting (51 FR 31429-31451).

Other significant protective measures include:

- an Environmental Protection Agency proposal to cancel granular carbofuran (not yet passed);
- acquisition of an important James River roost site by The Nature Conservancy;
- addition of lands to Bombay Hook and Blackwater National Wildlife Refuges to protect bald eagle nest sites;
- designation of Caledon State Park in Virginia as an "eagle park" with limited human access; and
- withdrawal of proposals to start commercial barging, mine sand, and site a hazardous waste facility, thus preserving nesting and foraging habitat along the Delaware Bay, New Jersey (Niles pers. comm.).

RECOVERY STRATEGY

The recovery strategy for the CBR bald eagle is predicated on the realization that habitat availability is the major factor limiting establishment a secure, self-sustaining eagle population in the region. Protection of nesting, foraging, and roosting habitat will thus be the predominant strategy in accomplishing full recovery of this population. Suitable habitat will be identified and evaluated as consistently and comprehensively as possible throughout the Chesapeake/Delaware Bay region, and region-wide habitat protection priorities will be set. State resource agencies and others will work in concert with the U.S. Fish and Wildlife Service to identify all possible protection mechanisms and management options for eagles and their habitat in the CBR. Habitat protection will be accomplished through landowner cooperation, land easements and acquisition, possible incentive programs, and a continuing effort to pursue broad-based shoreline protection through state legislation and policy initiatives.

CBR bald eagle distribution and abundance will be managed through long-term maintenance of suitable shoreline habitat and adequate food resources. In addition to protection of active nest territories, shoreline habitat will be maintained (1) to ensure that adequate undisturbed perching areas are preserved in conjunction with good aquatic foraging habitat, (2) for protection of nocturnal roosting areas, and (3) to provide foraging habitat adjacent to nest sites for breeding pairs. Comprehensive effort will be given to maintaining a forested shoreline strip wide enough to include the perch and roost sites and provide a visual barrier from inland human activity and disturbance.

Within broad habitat zones, eagle managers will direct their management efforts toward individual groups of eagles using their area, with management priorities set for the group of birds in most need of management action. Efforts to reduce mortality and increase productivity of CBR bald eagles will continue through law enforcement, monitoring and control of contaminant levels, and monitoring of any other threats facing individual eagles.

The campaign to heighten public awareness, particularly in regard to habitat protection needs, will continue. A renewed focus will be placed on recognition by the public that the survival, recovery, and maintenance of the CBR bald eagle population is an important element in the wise management of our natural resources.

PART II: RECOVERY PROGRAM

RECOVERY GOAL

The goal of this recovery program is to reclassify the bald eagle in the Chesapeake Bay region from endangered to threatened, working toward full recovery and eventual delisting of this species.

RECOVERY OBJECTIVES

The threshold for **downlisting** the CBR bald eagle population from endangered to threatened status is a sustained nesting population of bald eagles in the CBR of 175-250 pairs, with a productivity rate of 1.1 eaglets per active nest. Concurrent with demonstrating sustained population levels and productivity, active efforts to protect suitable nesting, roosting, and foraging habitat must continue at a level which will support a growing bald eagle population in the region.

Two conditions are necessary to meet the threshold for **delisting** the CBR bald eagle population, i.e., for achieving full recovery of the species: (1) a nesting population of 300-400 pairs with an average productivity of 1.1 eaglets per active nest, sustained over 5 years; and (2) permanent protection of sufficient nesting habitat to support 300-400 bald eagle pairs, and enough roosting habitat to accommodate population levels commensurate with increases throughout the Atlantic region resulting from increased productivity.

A population of 175-250 nesting pairs is well within currently available habitat and current productivity rates. In 1990, 230 nesting pairs produced 328 young for a productivity rate of 1.43 young per active nest. The full recovery objective assumes that approximately half the habitat available in 1936 is still available. The total Chesapeake Bay bald eagle population in 1936 was estimated at 600-800 nesting pairs. Productivity of 1.6 eaglets per active nest was documented in a population sample of 39 nests of known outcome.

RECOVERY TASKS

This section describes ongoing projects and studies implemented under the auspices of the 1982 CBR Bald Eagle Recovery Plan, tasks that have been modified, and tasks that address new or intensified threats to the Chesapeake Bay region bald eagle population. Tasks from the original plan that have been completed or eliminated are summarized in Appendix B.

Successful implementation of the following recovery actions will require continuing cooperation and coordination among Federal and state agencies and private conservation organizations. The primary task of these agencies and organizations will be to identify and protect habitat wherever possible.

1. <u>Protect bald eagle habitat</u>.

   Habitat protection efforts will focus on providing nesting habitat for 300-400 pairs of bald eagles as specified in the recovery objective, as well as associated roosting and foraging habitat for resident and migratory eagles. Protection of (1) current nesting and concentration sites, and (2) large habitat blocks will be the initial emphasis. A preliminary habitat protection strategy for the CBR is presented in Appendix C. All tasks below have been initiated.

1.1 Map former and current bald eagle nest sites. This task is ongoing, with sites being recorded on USGS 7.5 minute quadrangle sheets. Nest site information is updated as the CBR bald eagle population grows and as nests are established or abandoned. These maps can be consulted to identify habitats and specific nests deserving of protection. Map files are maintained in state fish and wildlife offices.

1.2 Describe and evaluate existing and potential bald eagle nesting habitat. In addition to locating current use areas, it is critical to determine why eagles use particular areas in order to identify and protect potential nesting habitat. A number of projects have been undertaken in regard to describing nesting habitat:

- Ground and aerial surveys and analysis of maps to locate those areas that have no known history of bald eagle nesting but may be suitable nesting sites is an ongoing task. Documentation is maintained in state fish and wildlife offices.

- Description of nesting habitat in Maryland using a standard format has been completed and detailed in Andrew and Mosher (1982).

- The State of Virginia, through a project completed by the National Wildlife Federation, has information that identifies active bald eagle nesting habitats, and primary, secondary, and tertiary potential nesting habitat. This information is available through the VA Department of Game and Inland Fisheries in a report titled "Description and Mapping of Potential Bald Eagle Nesting Habitat in Virginia."

- A similar study was completed in Maryland by Taylor and Therres, titled "A computer generated description of potential bald eagle nesting habitat in Maryland," is being used to protect habitat in the state. From information contained in both these reports, key bald eagle habitats can be identified and areas and measures to afford permanent protection to this habitat can be determined.

- Buehler et al. (unpubl. data) have developed a habitat model for the upper Chesapeake Bay.

Similar studies will be initiated in other portions of the CBR, in order to maintain reliable, region-wide data on which to base protection priorities and develop predictive models.

1.3 Locate and evaluate existing concentration sites and potential roosting and foraging habitat for bald eagles in the CBR. This task is ongoing, but has not received the same degree of attention as the description of nesting habitat. The Buehler et al. work should provide information regarding permanent roosts, and further characterization of existing roosting and foraging habitat will be developed to assess potential habitat areas.

1.4 Identify land for protection. Based on evaluation of the information gathered in Tasks 1.1-1.3, the Fish and Wildlife Service will work with the recovery team, respective state agencies, conservation organizations, and other concerned interests to determine land protection priorities. Nesting habitat, along with significant roosting habitat and terrestrial and aquatic foraging habitat, will be considered for protection, and criteria will be developed to help set land protection priorities. Habitat availability and the degree of protection being afforded significant habitats will be reviewed every five years, at a minimum. Appropriate emphasis will be given to protecting identified habitat in the Delaware Bay portion of the region, where small losses are more significant and equivalent protection is not generally available at the present time.

1.5 Initiate land protection procedures for the habitats identified in Task 1.4. Means to protect habitat will include land acquisition, as funds allow, and/or use of cooperative agreements, formal and informal, for all bald eagle nesting territories and other habitat areas. Private landowners, including major wood products industries, will be contacted. While experience has shown that voluntary agreements can be an effective method of habitat protection, each situation will be evaluated independently; voluntary agreements may not constitute sufficient protection for nests currently at most risk due to development.

Federal and state resource agencies will work together to extend habitat protection to large blocks of shoreline habitat. Efforts will be directed toward extending the type of broad protection afforded by Maryland's Critical Area Law to eagle habitat in other CBR states.

Habitat protection measures also will be initiated at the local level. State planning agencies will be encouraged to work with the zoning and planning boards of those counties and municipalities in which active and potential nesting habitat exists. The focus will be on developing specific guidelines for landowners and developers that include measures to protect habitats in their communities.

Innovative land protection tools will be implemented as feasible. Land protection efforts will be founded, in part, on the five-year review of available habitat mentioned in Task 1.4. This task is ongoing.

2. <u>Conduct surveys</u>.

Surveys are conducted to determine the nesting and nonbreeding populations of the bald eagle in the CBR, and to monitor their seasonal and annual status and long-term trends. All survey tasks below are ongoing.

2.1 <u>Monitor bald eagle nesting pairs</u>. Aerial and ground surveys are conducted each year from December to March, the period during which most new nests are built and old ones repaired, to locate and monitor all nesting pairs of bald eagles. Annual aerial surveys are conducted to locate active nests within the nesting territories in the CBR during the period February 15 to March 25, when CBR bald eagles are incubating their eggs. Nests found active in the February-March survey are rechecked in April. A second active nest recheck by aerial survey is conducted in May-June to determine the final results of the nesting season.

2.2 Locate and monitor bald eagle concentration points and roosts. Aerial and ground surveys are conducted during the periods December-January and May-July to locate and monitor bald eagle concentration points and roosts.

3. Conduct research.

Management plans for the bald eagle must be based on adequate data on all factors affecting the species. To provide these data, research is required on causes and impacts of disturbance and mortality.

3.1 Determine causes of eagle mortality. All necropsy procedures have been developed at the National Wildlife Health Research Center. The NWHR analyzes bald eagle mortality from all causes; however, submission of specimens for necropsy to the NWHR does include a proportionately higher number of certain suspected causes of mortality than others because of law enforcement cases or cases attached to particular ongoing management goals, such as electrocution or documentation of lead poisoning. Data collected permits comparison of the relative significance of various causes of mortality. This task is ongoing.

3.2 Monitor movements of adult and immature bald eagles. Standard radio telemetry techniques have been used to determine short distance dispersal distances and directions of adult and juvenile bald eagles. This information is used primarily to identify the impacts of human disturbance on bald eagle concentration areas and to determine habitat preferences. Telemetry projects by the U.S Army and Virginia Polytechnic Institute and State University have been conducted on Aberdeen Proving Grounds in Maryland and in the other parts of the CBR. Other studies were conducted in Virginia by biologists at the College of William and Mary in 1980 and 1981. This task is near completion.

3.3 Investigate factors affecting survival of immatures and nonbreeding adults. Bald eagle populations are more sensitive to changes in survival rates than in reproductive rates, yet little is known about factors affecting survival of immatures and nonbreeding adults. To improve the ability to manage this endangered species, researchers must begin to address the ecology of this portion of the population.

3.4 Develop predictive models. Predictive models to assess the expected impact of future projects and developments on the CBR bald eagle population, based on an understanding of the factors that attract or repel eagles as well as knowledge of particular habitat requirements, will be further developed and refined.

4. Develop habitat management plans.

Habitat management plans are being developed for areas essential to the protection and recovery of the CBR bald eagle population. The tasks listed below have all been partially completed through documents such as Cline (1985) and by actions such as the Maryland Chesapeake Bay Critical Area Program. Other programs are needed.

4.1 Develop habitat management plans or recommendations for each active nesting territory. This task is ongoing. Management techniques such as the seed tree timber harvest technique, buffer zones around nest sites, and effective law enforcement are typical components of these plans.

4.2 Develop habitat management strategies for other areas of suitable habitat. Former nesting territories that are now suitable but vacant constitute potential nesting habitat. Strategies for managing these areas, as well as current and potential roosting and foraging areas, will be developed on an ongoing basis.

Future plans may include manipulation of environmental variables to create new habitat as necessary to mitigate unavoidable habitat losses that occur due to shoreline development.

5. Release rehabilitated eagles into appropriate habitat.

The principal focus of this task is to release rehabilitated birds back to the wild. When injured or sick birds are not capable of being returned to the wild following rehabilitation activities, they are used for display or educational purposes. This task is ongoing.

6. Reduce shooting mortality.

Shooting continues to be a significant contributing cause of direct loss of CBR bald eagles, although the full extent is unknown. The aim of this task is to minimize direct disturbance and loss of bald eagles through law enforcement and public awareness (as discussed in Task 9.5). The tasks below are ongoing.

6.1 Enforce existing regulations. Cooperative efforts by both Federal and state agencies to ensure rigorous enforcement of existing regulations and maximum application of the law by the judicial system are continuing. Stringent penalty enforcement is fostered through thorough investigative techniques and by pressure from an informed public.

6.2 Increase surveillance of nesting sites and concentration areas. This task is ongoing.

7. Eliminate or reduce environmental contamination.

The aim of this task is to eliminate or restrict the use of contaminants deleterious to bald eagles in the CBR. A regular evaluation of the role of environmental contaminants is necessary in order to assess the impact of pollution and contaminants on this bald eagle population.

7.1 Identify contaminants and sources of contaminants. This task is being implemented through investigation of reports of contaminant use, observations made during field work, and evaluation of the results of necropsy work to ascertain the impacts of contaminants on bald eagles and their prey in the CBR. Federal, state, and private conservation agencies are instructed about how to submit and ship dead eagles to the U.S. Fish and Wildlife Service for necropsy (see Appendix D).

7.2 Monitor contaminant levels. Monitoring of contaminant levels in tissues of birds found dead as well as in nonviable eggs where special conditions exist will continue. These data help determine the impact contaminants may be having on eagle survival. These studies are ongoing.

7.3 Enforce existing regulations restricting use of contaminants. Oversight for enforcement of existing regulations restricting the use of contaminants deleterious to bald eagles in the CBR is the responsibility of state agriculture departments and the U.S. Environmental Protection Agency. Further, incidents of probable misuse, illegal use, or legal but harmful use of contaminants deleterious to bald eagles in the CBR are reported to regulatory agencies. This task is ongoing.

7.4 Work with other agencies to restrict contaminants. The aim of this task is to provide appropriate agencies with the data needed to restrict use of contaminants detrimental to bald eagles in the CBR. The Fish and Wildlife Service regularly provides the Environmental Protection Agency with data regarding potential risk to endangered species, and interacts with state natural resource agencies. These agencies in turn, work with other state regulatory agencies in overseeing contaminant regulation.

Regulations to restrict use of carbofuran are of key importance at this time.

7.5 Continue to support the phase-in of steel shot for waterfowl hunting in the CBR. This task will be completed in 1992, at which time lead shot for waterfowl hunting will be absolutely banned. Impacts from the continued use of lead shot in hunting of upland game species will be monitored.

8. Minimize the effects of disease on the CBR bald eagle population.

This task is ongoing. Appropriate agencies are apprised of the potential effects of natural mortality factors on the bald eagle, such as major disease outbreaks in prey species. Preventive actions, such as removal of dead prey species and provision of alternative food sources, to minimize the effects on bald eagles of disease outbreaks in prey species are encouraged. Necropsy submittal procedures (Appendix D) are made widely available.

9. Continue educational activities.

The aims of this task are to encourage cooperation among Federal and state resource management agencies and private conservation organizations, and to provide the public with information on the current status, problems, and needs of the bald eagle in the Chesapeake Bay region.

9.1 Prepare news updates. This is an ongoing task. Periodic news releases are prepared to update public knowledge of the status of the bald eagle in the CBR. As a result of successful news campaigns in the past, public support for bald eagle protection and restoration efforts is strong.

9.2 Prepare slide/lecture programs. This task is ongoing. Slide/lecture programs are presented regularly on bald eagles to schools, clubs, and other interested groups. As the bald eagle approaches recovery, these programs will be updated to emphasize past successes and continuing needs.

9.3 Update the CBR bald eagle fact sheet as appropriate. An informative fact sheet for the bald eagle was prepared under the auspices of the USFWS Chesapeake Bay program. At this writing, the fact sheet is sufficient for use in response to general interest inquiry letters, meetings, and as an educational tool in conjunction with programs and presentations like that described in Task 9.2. As recovery proceeds, or as new information or issues arise, this fact sheet will be updated or supplemental fact sheets will be developed. A fact sheet for Maryland has also been produced and distributed.

9.4 Participate in radio/TV spots. Participation in interviews and radio/TV panels to inform the general public of the status of the bald eagle in the CBR occurs as opportunities become available.

9.5 Emphasize public education efforts during the nesting and hunting seasons. In addition to the slide programs, news releases, and fact sheets mentioned above, hunter-oriented posters, information sheets, and leaflets have been made readily available to the public. Further opportunities to increase public awareness at times when the bald eagle is especially vulnerable will be recognized and used to advantage.

9.6 Prepare eagle protection guidelines for landowners. Prepare appropriate guidelines for shoreline use and development for all active and potential bald eagle habitat in the CBR. Both Maryland and Virginia are using Bald Eagles in the Chesapeake -- A Management Guide for Landowners, published by the National Wildlife Federation, to promote protection of bald eagle nest sites. The recommendations contained in this guide will be implemented throughout the recovery region, and will be applied consistently and vigorously in the protection of active nest sites. These guidelines will also be adopted by the USFWS.

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PART III: IMPLEMENTATION SCHEDULE

The Implementation Schedule lists and ranks tasks that should be undertaken within the next three years in order to carry on recovery of the CBR bald eagle population. This schedule will be reviewed annually until the recovery goal is met, and priorities and tasks will be subject to revision.

Key to Priority Number (Column 1):

Priority 1: Those actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the future.

Priority 2: Those actions that must be taken to prevent a significant decline in species population, or some other significant negative impact short of extinction.

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

Priority	Task Number	Task Description	Task Duration	Responsible Agency*		Cost Estimates** ($000)			Comments
				FWS	Other	FY1	FY2	FY3	
2	1.1	Map former and current bald eagle nest sites.	Ongoing	R5 FWE	State agencies				
2	1.2	Describe and evaluate existing and potential nesting habitat.	Every 2 years	R5 FWE	State agencies	5.0	5.0		See Preliminary Habitat Protection Strategy (App. A)
2	1.4	Identify land for protection.	Ongoing	R5 FWE	State agencies	5.0	5.0	5.0	
2	1.5	Initiate land protection procedures.	Every 2 years	R5 FWE	State agencies/ TNC/ Chesapeake Bay Foundation	2.5	2.5	2.5	
2	2.1	Monitor bald eagle nesting pairs	Yearly	R5 FWE	State agencies	30.0	30.0	30.0	
2	2.2	Monitor concentration sites and roosts.	Yearly	R5 FWE	State agencies	2.5	2.5	2.5	
2	3.1	Determine causes of bald eagle mortality.	Ongoing	NWRH		5.0	5.0	5.0	
2	3.3	Investigate factors affecting survival of immatures and nonbreeding adults.	3 years		State agencies/ private organizations				
2	3.4	Develop predictive models.	3 years		State agencies/ private organizations				
2	4.0	Develop habitat management plans.	Ongoing	R5 FWE	State agencies	5.0	5.0	5.0	

Priority	Task Number	Task Description	Task Duration	Responsible Agency* FWS	Responsible Agency* Other	Cost Estimates** ($000) FY1	FY2	FY3	Comments
2	6.0	Reduce shooting mortality.	Ongoing	R5 FWE	State agencies	25.0	25.0	25.0	
2	7.1	Identify contaminants and sources.	Ongoing	R5 FWE	EPA/State agencies	10.0	10.0	10.0	
2	7.3	Enforce existing regulations restricting use of contaminants	Ongoing	R5 FWE	EPA/State agencies	19.0	20.0	21.0	
3	1.3	Evaluate existing concentration sites and potential roosting and foraging habitat.	Every 2 years	R5 FWE	State agencies	1.5	1.5	1.5	Partially completed.
3	3.2	Monitor movements of adult and immature bald eagles.	Every 2 years	R5 FWE	State agencies/ Federal agencies				
3	5.0	Release rehabilitated eagles into appropriate habitat.	Ongoing	R5 FWE	State agencies/ private foundations				
3	7.2	Monitor contaminant levels.	Ongoing	R5 FWE	EPA/State agencies				
3	7.4	Work with other agencies to restrict contaminants.	Ongoing	R5 FWE	EPA/State agencies				
3	7.5	Continue to support phase-in of steel shot for waterfowl hunting.	2 years	R5 FWE	State agencies				Will be completed in 1992.
3	8.0	Minimize effects of disease on CBR bald eagles.	Ongoing	R5 FWE	State agencies				
3	9.1	Prepare news updates.	Yearly	R5 FWE	State agencies	1.0	1.0	1.0	
3	9.2	Update slide/lecture programs.	Ongoing	R5 FWE	State agencies				

Priority	Task Number	Task Description	Task Duration	Responsible Agency*		Cost Estimates** ($000)			Comments
				FWS	Other	FY1	FY2	FY3	
3	9.3	Update fact sheets.	Every 2 years	R5 FWE	State agencies	2.5		2.5	Partially completed.
3	9.4	Participate in ratio/TV broadcasts.	Ongoing	R5 FWE	State agencies				
3	9.5	Emphasize education during nesting and hunting seasons.	Ongoing	R5 FWE	State agencies				
3	9.6	Prepare guidelines for landowners.	Every 2 years	R5 FWE	State agencies				Partially completed.

APPENDIX A

Organochlorine Residues in Bald Eagle Eggs and Tissues Collected in the Mid-Atlantic States, 1962-85

A. Residues of selected organochlorines in eggs, 1962-1985

State and collection years	N	Residues (ppm wet weight)				
		DDE	DDD + DDT	Dieldrin	Total chlordanes	PCBs
New Jersey:						
1962	3	15.0 5-29	na	na	na	na
1964	1	4.8	4.5	1.0	na	na
1982	1	13.0	0.87	0.23	0.84	13.0
Delaware:						
1977-78	1	37.0	3.5	1.2	1.1	38.0
1982	1	16.0	1.4	0.38	0.80	17.0
1983-85	2	2.2 2.1-2.4	0.14 0.07-0.30	0.07 0.04-0.14	0.66 0.43-1.0	2.9 2.8-3.1
Maryland:						
1973	1	6.3	0.53	1.5	ai	8.9
1977-79	7	9.3 3.1-16.0	0.83 0.21-1.6	0.94 0.50-2.1	2.1 0.48-4.2	24.0 5.7-51.0
1980-82	7	3.9 1.2-11.0	0.46 0.17-1.5	0.42 0.19-1.2	1.2 0.38-3.1	11.0 2.2-36.0
1983-85	5	5.1 2.5-9.1	0.44 0.19-0.82	0.27 0.14-0.45	1.2 0.49-2.9	17.0 4.4-39.0
Virginia:						
1976	3	13.0 10.0-17.0	1.9 1.3-3.5	1.5 1.2-2.3	3.7 2.5-6.2	31.0 22.0-56.0
1977-79	4	10.0 7.4-20.0	1.1 0.65-2.6	0.98 0.53-2.3	2.2 0.66-6.8	48.0 23.0-133.0
1981-82	5	5.3 3.9-7.1	0.37 0.17-0.96	0.23 0.11-0.61	1.1 0.46-2.1	18.0 11.0-37.0
1983-85	3	4.7 2.6-7.1	0.25 0.23-0.3	0.18 0.12-0.22	0.77 0.57-1.1	14.0 11.0-21.0

NOTES:

1. Residues are stated as geometric mean residues on a territory basis with ranges. PCBs = polychlorinated biphenyls. na = not analyzed. ai = analysis incomplete for all compounds.
2. N = Numbers of territories represented.
3. Total chlordanes include oxychlordane + cis-chlordane + trans-nonachlor + cis-nonachlor.
4. 1962 readings for New Jersey are colorimetric readings, primarily DDE; from Stickel et al. (1966).
5. All eggs for 1977-78 and 1982 Delaware readings were from Bombay Hook.

B. Continued

Source and tissues analyzed	N	Residues (ppm wet weight) DDE	DDD	DDT	Dieldrin	PCBs
Chesapeake Bay (MD,VA) adults, 1968-73:						
Brain	6	14.0*	1.2	-	4.1	12.0
		6,6***	6,6	6,1	6,6	5,5
		1.4**-32.0	0.12-4.5	nd-0.34	0.65-11.0	1.3-35.0
Carcass	6	92.0*	10.0	-	12.0	107.0
		6,6	6,6	6,2	6,6	5,5
		57.0-193.0**	3.5-33.0	nd-3.2	2.8-33.0	25.0-200.0
Chesapeake Bay (MD, VA) adults, 1974-77:						
Brain	6	4.9*	0.2	-	0.72	9.7
		6,6	6,6	6,1	6,6	6,6
		1.4-52.0**	0.06-0.69	nd-0.16	0.14-4.1	1.2-160.0
Carcass	6	39.0*	2.4	0.15	3.9	74.0
		6,6	6,6	6,4	6,6	6,6
		28.0-72.0**	1.1-5.5	nd-1.7	2.5-7.0	31.0-190.0
Chesapeake Bay (MD, VA) adults, 1980-83:						
Brain	2	5.6*	0.21	-	0.55	17.0
		0.72-43.0**	nd-1.7	nd	0.13-2.3	2.0-140.0
Carcass	2	22.0*	1.2	-	0.23	74.0
		7.3-64.0**	0.55-2.8	nd	nd-2.1	21.0-260.0
Chesapeake Bay (MD, VA) immatures, 1966-70:						
Brain	1	1.1	0.3	-	0.6	3.0
Carcass	2	13.0*	5.2	0.57	3.1	na-30.0
		12.0-14.0**	3.8-7.0	0.3-1.1	2.2-4.3	
Chesapeake Bay (MD, VA) immatures, 1974-75:						
Brain	4	1.9*	0.31	-	0.27	2.3
		4,4	4,4	4,0	4,3	4,4
		0.26-12.0**	0.06-1.9	nd	nd-2.1	0.34-39.0
Carcass	4	8.4*	2.0	0.07	0.90	17.0
		4,4	4,4	4,2	4,4	4,4
		1.6-44.0**	0.43-10.0	nd-0.33	0.13-5.0	1.5-130.0
Chesapeake Bay (MD, VA) immatures, 1981-83:						
Brain	6	1.3*	0.31	-	0.21	4.7
		6,4	6,4	6,1	6,4	6,4
		nd-23.0**	nd-3.0	nd-0.07	nd-1.3	nd-97.0
Carcass	7	3.1*	0.34	-	0.14	7.6
		7,7	7,6	7,0	7,5	7,7
		0.38-11.0**	nd-1.1	-	nd-0.4	0.7-44.0
Chesapeake Bay (MD, VA), age unknown, 1974:						
Brain	1	12.0	1.7	-	1.7	48.0
Carcass	1	44.0	6.0	-	5.8	120.0

NOTES:

1. - or nd = none detected. na = not analyzed.

B. Residues of selected organochlorines in brains and carcasses, 1966-1983

Source and tissues analyzed	N	Residues (ppm wet weight)				
		DDE	DDD	DDT	Dieldrin	PCBs
New Jersey adult, 1968:						
Brain	1	2.0	<0.1	-	<0.1	na
Carcass	1	42.0	1.2	0.2	0.7	na
New Jersey immature, 1973:						
Brain	1	7.0	0.88	0.10	1.5	18.0
Carcass	1	7.0	6.8	-	4.3	61.0
New Jersey adult, 1974:						
Brain	1	6.6	0.34	-	0.32	2.6
Carcass	1	85.0	7.5	0.12	3.0	52.0
Pennsylvania immature, 1977:						
Brain	1	0.06	-	-	-	0.16
Carcass	1	0.43	0.06	-	-	0.85
Pennsylvania adult, 1980:						
Brain	1	0.37	-	-	-	1.2
Carcass	1	13.0	2.1	-	0.63	38.0
Western Maryland immature, 1968:						
Brain	1	0.36	-	-	<0.05	na
Carcass	1	-	<0.05	-	<0.05	na
Western Maryland immature, 1976:						
Brain	1	-	-	-	-	-
Carcass	1	0.50	-	-	-	0.53
West Virginia and Western Maryland immatures, 1981-83:						
Brain	2	-*	-	-	-	-
		nd**	nd	nd	nd	nd
Carcass	2	0.29*	-	-	-	0.71
		0.25-0.34**	nd	nd	nd	0.52-0.98
Delaware adult, 1983:						
Brain	1	1.2	0.06	-	0.05	2.2
Carcass	1	11.0	0.83	-	0.30	19.0
Delaware immatures, 1979-82:						
Brain	2	0.07*	-	-	-	0.13
		nd-0.2**	nd	nd	nd	nd-0.66
Carcass	2	1.8*	0.22	0.04	0.04	4.0
		0.93**-3.3	0.14-0.35	nd-0:05	nd-0.08	1.9-6.5

2. * = geometric mean reported; nd = one-half the detection limit in calculations. Mean not reported when more than one-half of the samples had non-detectable values.

3. ** = range reported.

4. *** = number of samples analyzed, number with detectable residue.

APPENDIX B

Discontinued Tasks from the 1982 CBR Bald Eagle Recovery Plan

Note: The following tasks are numbered according to the original (1982) recovery plan and do not correspond to the numbering in the revised plan.

Education

Task 1.4: Produce radio/TV spots to inform the general public of the status of the bald eagle in the CBR.

This task has been modified to direct participation in, rather than production of, radio/TV spots.

Task 1.5: Cooperate with other Bald Eagle Recovery Teams to produce a film on the bald eagle, with sections relevant to each geographic population.

Surveys

Task 3.3: Selectively monitor water quality in bald eagle habitat in an effort to identify high levels and point sources of pollution.

Task 3.4: Continue to monitor contaminant levels in tissues of birds found dead as well as in nonviable eggs.

While this task will be continued at some level, monitoring will be more selective, primarily in cases where a contaminant is implicated in the cause of death.

Task 3.6: Ascertain the effect of Kepone on bald eagles.

Task 3.7.1: Band and color-mark eaglets.

Propagation and Rehabilitation:

Task 4.1.1: Produce bald eagle eggs and nestlings in captivity.

Task 4.1.2: Place captive-produced eggs into nests in the wild where the birds have a history of recent consistent reproductive failure.

Task 4.1.3: Introduce captive-produced young into active nests in the wild.

Task 4.1.4: Reintroduce captive-produced eagles into formerly occupied nesting habitat utilizing the technique of hacking.

Contamination

Task 7.1: Continually evaluate the role of lead shot in the mortality of waterfowl and other avian species in the CBR.

APPENDIX C

Preliminary Habitat Protection Strategy

I. The aims of this strategy are to:

A. identify and evaluate nesting, roosting, and foraging habitat for bald eagles in the Chesapeake/Delaware Bay region, which consists of a six-state area; and

B. determining priorities and methods for protecting existing and significant potential habitat.

II. General approach:

A. Information needs

Information that is necessary to develop a Chesapeake/Delaware Bay region-wide protection strategy is:

1. Location of current and former nesting sites

2. Description (text and maps) of existing and potential nesting habitat

3. Description and delineation of existing and potential foraging/roosting habitat

4. Land status (e.g., ownership and land use) of each area defined in 1-3

5. Threats to each area defined in 1-3

6. Level of protection (present and projected) for each area defined in 1-3

7. General regulatory protection provided by each state

Relevant information housed in individual state offices will be compiled into a region-wide information base.

B. Habitat evaluation

1. Criteria will be developed to determine (a) biological significance levels and (b) protection levels for each habitat area in the region.

2. Information from items 1-3 above will be evaluated to determine biological significance levels for all habitat areas in the region. Where practical, associated habitats will be classified together, and existing habitat will be identified and evaluated separately from potential habitat.

3. Information from items 4-7 above will be used to classify each area according to its level of current and anticipated protection. Habitats that are fully protected (e.g., on national wildlife refuges) will be exempted from further consideration. Monitoring of these areas will be conducted in accordance with tasks 1.4, 2.1, and 2.2 in the recovery plan.

4. A draft protection priority will be assigned to each habitat areas by combining the results of A and B. This will constitute the "preliminary findings" of the evaluation.

C. Final protection priorities and protection methods

1. Appropriate Federal, state, and private conservation interests will meet to determine final protection priorities for each habitat area. The final rankings will take into account the preliminary findings of the evaluation, practical considerations, and the balance of various interests.

2. Based on information about threats and protection mechanisms identified in A5-7 above coupled with a given area's protection priority, the appropriate agencies will propose effective protection methods for each existing and potential habitat.

D. Public notification

During the meeting mentioned above, consideration will be given to notifying the public and landowners about the development of a habitat protection strategy for the CBR bald eagle population. Materials to provide information and promote the strategy will be developed as appropriate.

III. Products

A. Report on preliminary findings

B. Final report on protection priorities and strategies

C. Region-wide information base that can be efficiently updated, <u>or</u> well-defined procedures for monitoring state-by-state progress of protection efforts (i.e., 5-year review as described in task 1.4)

D. Informational/promotional pamphlet

APPENDIX D

Necropsy Submittal Procedures

Bald eagles for necropsy should be sent to:

U.S. Fish and Wildlife Service
National Wildlife Health Research Center
6006 Schroeder Road
Madison, Wisconsin 53771

Telephone: 1-608-271-4640
FTS 364-5418

Key Contacts: Primary - Mr. Ronald M. Windingstad

Secondary - Nancy J. Thomas, D.V.M.

Contact Ron Windingstad or Nancy Thomas to agree on time/day for shipment and method of shipment.

The National Wildlife Health Research Center will forward parts of carcasses for pesticide work if indicated. Otherwise, all other postmortem analysis will be performed there.

APPENDIX E

List of Reviewers

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