

SPECIES PROFILE

Bald Eagle

Haliaeetus leucophalus

Federal Listing: Threatened

State Listing: Endangered

Global Rank: G4

State Rank: S1

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ELEMENT 1: DISTRIBUTION AND HABITAT

1.1 Habitat Description

Endemic to North America, bald eagles occur widely across the continent in association with aquatic habitats such as lakes, rivers, reservoirs, and coastal estuaries (Buehler 2000). Bald eagles presently have established nests in all of the contiguous United States and in Alaska, as well as in all of the Canadian provinces, and in Mexico's Baja Peninsula. Except for coastal Alaska and parts of northern Canada, where they nest on cliffs or on the ground, eagles nest primarily in forested areas, typically near large water bodies, in mature trees near forest edges, or in super-canopy trees within more uniform forest cover. Distances between nests and water bodies are variable, but are often less than 2 km. Proximity to foraging areas that harbor abundant, diverse, accessible prey may be a more important factor than actual distance from water. Most of the 13 bald eagle nest structures documented in New Hampshire from 1988 to 2004 have been in white pines (77%), although cottonwoods (15%) or red oaks (8%) have also been used.

Populations in different parts of their continent-wide range exhibit variable migratory behaviors, depending on age, breeding status, geographic location of breeding area, and year-round availability of food sources. While territorial on their breeding sites, eagles frequently assemble in higher densities on preferred wintering areas. Such places offer a combination of readily available food and roost sites with

good thermal cover and protection from disturbance. Breeding adults from territories in interior Canada typically leave breeding areas for the winter months, while adults breeding in the northern United States often remain on or near breeding territories year-round. Adults breeding in the southern United States raise young during the winter when local weather conditions are more moderate.

1.2 Justification

Bald eagle populations have been closely monitored in the United States since they experienced severe population declines beginning around 1950 (Broley 1958, Buehler 2000). Historical evidence from before European settlement suggests that eagles were abundant across the continent; however, by 1963 only 417 breeding pairs were estimated to remain in the lower 48 states. Some regional breeding populations, especially in eastern and southern states, became locally extirpated. This serious decline led to the designation of the bald eagle as Endangered under the Endangered Species Act. Subsequent research clearly demonstrated that population losses during that period resulted primarily from reproductive failure associated with the presence of high levels of DDT and other persistent organochlorine pesticides in the aquatic food web, which caused severe eggshell thinning and extremely poor hatching success (Wiemeyer et al. 1972, Grier 1982).

Biologists and natural resource managers now recognize that bald eagles can function as useful living barometers or bio-indicators of general environmental quality in aquatic systems because they rapidly accumulate chemical contaminants, such as the organochlorine pesticide DDT and its metabolite DDE, contained in fish.

In New Hampshire, historical records (Allen 1902, Brewster 1925, Dearborn 1898, Scott 1921) from the

early 1900s suggest a minimum of about 10 breeding, including some near the following lakes and coastal areas: Connecticut, Newfound, Squam, Umbagog, Wentworth, Winnepesaukee, as well as Great Bay and Hampton Harbor state (Smith 1984). Before eagles were extirpated as a breeding species in the state, New Hampshire's last documented active nest occurred on Umbagog Lake in 1949 (T. Richards, unpublished data). Eagles ceased to breed successfully in New Hampshire by 1950 but continued to occur thereafter in reduced numbers on the state's major rivers and lakes as migrants and during the winter months (Evans 1994). Since 1980, NHA and NHFG have partnered to conduct extensive annual field monitoring of the state's breeding and overwintering eagle population.

1.3 Protection and Regulatory Status

Bald eagles are protected in the United States under the Migratory Bird Treaty Act of 1918, which prohibits the possession or killing of most non-game birds and the collection of their eggs or nests. They are also protected under the Bald Eagle Protection Act of 1940 (now the Bald and Golden Eagle Protection Act), which prohibits the take, possession, or commerce involving eagles, their body parts, or their eggs. United States populations south of the fortieth parallel were first listed as Endangered by the federal government in 1967 under the Endangered Species Preservation Act of 1966 (Federal Register 32:4001), and this authority was later transferred to the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.). Bald eagles in states north of the fortieth parallel were first protected as federally Endangered in 1978, except in Minnesota, Wisconsin, Michigan, Washington, and Oregon, where they were listed as Threatened (Federal Register 43:6230-6233). The species was first listed as Endangered by the State of New Hampshire in 1979 (R.S.A. 212-A:1 et seq.), and it currently remains classified as Endangered in the state.

Because of significant population recovery throughout much of the United States during the 1980s and 1990s, the species was reclassified in 1995 to Threatened status in all 48 contiguous states (Federal Register 60:35999-36110). In 1999, as a result of continued progress and attainment of regional recovery goals, the United States Fish and Wildlife Service

(USFWS) formally proposed delisting the bald eagle throughout the lower 48 states (Federal Register 64:36454-36464). At the start of 2005, a rule that formally removes the bald eagle from the Endangered Species list has yet to be enacted. As required for any de-listing under the ESA, the USFWS, in cooperation with state wildlife agencies, must develop and implement a post de-listing monitoring plan to track the status of bald eagle populations in the United States for a period of at least 5 years after de-listing.

Other indirect federal protective measures for eagles include those offered by the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136) for new and existing pesticide registration and use, the National Forest Management Act (16 U.S.C. 1600), and the Federal Land Management and Policy Act (43 U.S.C. 1701). Bald eagles are also protected from unregulated international trade by an agreement of the 1975 Convention on International Trade in Endangered Species of Wild Flora and Fauna.

1.4 Population and Habitat Distribution

Following a low point of only 417 breeding pairs estimated present in the lower 48 states in 1963, and subsequent to the banning of DDT in the early 1970s, bald eagle breeding populations have recovered substantially. There were an estimated 1,500 breeding pairs in the contiguous 48 states in 1982 and an estimated 5,300 pairs in the same area in 1997 (derived from data in Buehler 2000). Wintering populations in the continental United States, which include thousands of individuals that breed in Canada, have shown similarly dramatic increases, from an estimated 13,800 individuals in 1982 to an estimated 26,100 individuals in 1997 (Buehler 2000). In the northeastern states, breeding bald eagle population recovery has been led by the states of Maine and New York, which supported 94% of the 459 territorial bald eagle pairs documented in the northeast in 2004 (table 1).

In New Hampshire in 2004, there were 8 breeding territories distributed widely across the state (figure 1), including in the Androscoggin, Connecticut, and Merrimack River watersheds. New Hampshire supported only 1 documented breeding territory from 1988 to 1997, but over the past decade the number of territorial pairs has risen to 8 pairs in 2004 (table 2). From 1988 through 2004, there were 37 active

nesting attempts documented in the state, 24 (65%) attempts were successful, resulting in 39 fledglings (1.05 young per active nest). The detailed status of the state's eagle breeding territories is described in table 3.

New Hampshire has participated in the national midwinter survey since 1981 (Steenhof 2002), surveying major wintering areas along the Androscoggin, Connecticut, and Merrimack rivers, as well as the state's Lakes Region and Great Bay/Seacoast area, and other portions of the state where eagles winter in lesser numbers. As shown in table 3, the number of individual eagles documented in the midwinter survey has risen from an average of 8 individuals detected during the 1981 through 1984 surveys, to an average of greater than 43 individuals detected during the 2001 through 2004 surveys. Minimum estimates for the overall number of eagles wintering in New Hampshire during portions of the December-March wintering season have grown from fewer than 20 individuals annually from 1980 to 1983, to greater than 90 individuals from 2001 to 2003 (table 5).

1.5 Town Distribution Map

Not completed for this species.

1.6 Habitat Map

1.7 Sources of Information

General natural history information and some sources of original research discussed in this document were obtained primarily from *The Birds of North America*, No. 506: Bald Eagle (Buehler 2000)). Unless otherwise noted, the source for New Hampshire specific data is field monitoring and management activities conducted by NHA from 1983 to 2004 under annual contracts and/or grants received from the NHFG and/or the USFWS (see Martin 2004a, Martin 2004b, and prior annual reports).

1.8 Extent and Quality of Data

Since the early 1980s, the bald eagle has been one of the most intensively monitored and managed species in New Hampshire. Breeding site data are derived from field monitoring conducted for nearly 2 decades by NHA staff and trained volunteer observers, who employed standardized monitoring techniques to determine nest occupancy and productivity, as well as

locations and numbers of individuals present within the state's 5 major wintering areas (Deming 2004, Deming and Martin 2004, Martin 2004b).

1.9 Distribution Research

Future distribution and abundance of bald eagles in New Hampshire should be monitored by conducting spring breeding surveys of known and potential breeding habitat, by participating in the mid-winter counts in the state's 5 major wintering areas, and by site-specific monitoring at important overnight roost sites. Active breeding territories should be checked annually to determine occupancy status and reproductive outcome, and surveys of potential breeding territories should be conducted on a rotating basis, with annual survey intensity determined by funding and human resources available. For example, sites could be checked on a biennial or triennial rotating basis, covering 50% or 33% of potential sites annually. New Hampshire should continue to participate in the national mid-winter bald eagle survey (Steenhof, K., L. et al. 2002). When bald eagles are formally removed from the federal List of Threatened and Endangered Wildlife, New Hampshire should actively participate in the required federal post de-listing monitoring program that will be established by the USFWS.

ELEMENT 2: SPECIES CONDITION

2.1 Scale

Major watersheds will be used as conservation planning units for bald eagle breeding and wintering habitat due to differences in the physical characteristics, human population density, and human land use patterns associated with each major watershed.

2.2 Relative Health of Populations

All of New Hampshire's 11 recently documented occupied breeding territories through 2004 are listed in table 3. All sites listed are associated with a large lake, reservoir, or major river. Of the 11 territories documented, 8 (73%) have been occupied for more than one year, and 7 (64%) have produced fledglings.

Bioaccumulation of chemical contaminants is a major concern in high trophic-level predators, such as bald eagles (Dominguez et al. 2003, Evers 2005,

Welch 1994). Although preliminary and with minimal sample size to date, cooperative studies have begun to assess mercury levels in New Hampshire bald eagle nestlings. Although 2004 data is not included here, sampling was expanded in 2004 to include 1 additional study site (Nubanusit Lake) and 7 additional individuals.

2.3 Population Management Status

Ongoing management strategies for bald eagles in New Hampshire fall into 4 main categories:

(1) Locate territorial pairs

From 1988 to 2004, NHA biologists solicited and evaluated public reports of bald eagles in areas of potential breeding habitat and followed up with field surveys to identify occupied territories. Over the past decade, this survey activity has resulted in detection of 1 new breeding pair roughly every 1 to 2 years.

(2) Monitor and manage nesting attempts and wintering areas

Nesting attempts were monitored by trained volunteers observers and NHA staff biologists from 1988 to 2004, which resulted in the documentation of 56 occupied territory-years, 37 nesting attempt-years, 39 young fledged (1.05 young/nesting attempt), and 13 nest failures (35% failure rate). Monitoring also facilitated efforts by the USFWS, NHA, and BioDiversity Research Institute to examine and color band 56% (22 out of 39) of all fledglings produced in the state from 1988 to 2004. The NHA staff installed sheet metal predator guards around the bases of nest trees to deter tree-climbing mammalian nest predators, and NHA staff and trained volunteers also monitor numbers and distribution of bald eagles in winter foraging and roosting areas.

(3) Manage human activity at breeding and wintering sites

Acting under the guidance of NHFG and the USFWS, NHA biologists evaluated potential negative impacts of human recreation on nesting sites and implemented temporary closures when appropriate. In situations where the volume of boating or pedestrian activity threatens to jeopardize the nesting attempt, land-based or floating signs have been placed to create a buffer zone around the nest area. The NHA staff

assists NHFG personnel with implementation of appropriate closures and landowner outreach strategies at important winter roost sites.

(4) Public outreach and education

Disseminating information on the goals, objectives, and status of bald eagle conservation efforts in New Hampshire has occurred in a variety of ways and has involved many different target audiences. Extensive efforts have been made to educate the public on accurate identification and reporting of bald eagles. Articles and media news releases on the state's bald eagle recovery efforts and opportunities for direct public volunteer involvement appear annually in newspapers, on radio, and in newsletters of various natural resource agencies and conservation groups. The NHA staff offers public lectures and conduct volunteer training sessions annually to encourage effective public participation in bald eagle conservation. Outreach to landowners, developers, and others concerning bald eagle habitat needs are ongoing and essential.

2.4 Relative Quality of Habitat Patches

Currently occupied breeding habitat appears to provide the key ecological attributes required to support a healthy, expanding breeding population. Large lakes, reservoirs, and ice-free areas below dams will likely provide habitat for additional breeding pairs over the coming decade. Bald eagles are generalist feeders; in addition to fish, they feed on aquatic mammals, waterfowl and gulls, and often carrion. Suitable nesting substrate does not appear to be a limiting factor, except perhaps in the Connecticut Lakes area where there are very few super-canopy pines available. The greatest ongoing habitat quality concerns include the following:

- Additional shoreline development on rivers and large lakes, especially in the Merrimack River watershed and Lakes Region areas
- Increasing use of powerful motorized watercraft and growing popularity of kayaks and canoes, especially in the lakes Region and in the Androscoggin River watershed
- Growing pedestrian use in the winter months near wintering sites along the Merrimack River and in the Lakes Region

- Increasing concerns about mercury and other contaminants, especially in the Merrimack River watershed and in the Great Bay/Seacoast area

2.5 Habitat Patch Protection Status

Of the 8 bald eagle nest sites active in 2004, 4 (50%) were located on public lands (2 federal, 1 state, 1 municipal), while the other 4 (50%) were located on private lands. One of the 4 sites on private land was subject to a conservation easement. Only a few of the state's winter roost sites are on protected land.

2.6 Habitat Management Status

Nest sites on public land are managed in a manner that promotes "no activity" buffer zones around nest trees. Nest sites on private land are subject to landowner decisions, but outreach and education with landowners has usually resulted in land use practices that benefit eagles. Formal management of winter roost areas has been a great challenge because so few sites are on protected land.

2.7 Sources of Information

Information on the state's bald eagle population and habitat is derived directly from summary reports and field data on monitoring and management activities conducted by NHA from 1983 to 2004 under annual contracts and grants received from the NHFG and the USFWS (Deming 2004, Martin 2004a, Martin 2004b).

2.8 Extent and Quality of Data

Because bald eagles have been listed as endangered or threatened on both federal and state lists for much of the past 4 decades, few New Hampshire wildlife species have a more complete data set on occurrence, productivity, and habitat condition. Annual summaries of this information are on file at NHFG.

2.9 Condition Ranking

2.10 Condition Assessment Research

Long-term baseline monitoring of bald eagle breeding and overwintering sites in New Hampshire remains

an important task in order to detect any future threats to a stable or growing population. Creation and formal adoption of a state recovery plan that includes specific targets for reclassification to threatened status and for de-listing should be a priority. Analyses of the contaminant loads present in New Hampshire bald eagle chicks should be encouraged and facilitated by NHFG in order to determine the potential effect on statewide productivity and population recovery. Fieldwork, conducted by NHA and others, designed to detect and identify banded individuals should be directly supported by NHFG because the existence of an individually marked population in northern New England offers a unique opportunity to obtain critically important and hard-to-acquire data on dispersal patterns and population demography, individual longevity, and nest site fidelity.

ELEMENT 3: SPECIES AND HABITAT THREAT ASSESSMENT

3.1.1 Non-Point Source Pollution (Heavy Metals)

(A) Exposure Pathway

Bald eagles are subject to lead poisoning by consuming lead shot or lead sinkers contained within prey or carrion that they consume (Kramer and Redig 1997). Continued use of lead shot or fishing tackle (in violation of state laws) would threaten eagles in these areas. Physical or biological mechanisms in lakes and reservoirs that would bring long-buried lead back to the surface would also threaten eagles.

(B) Evidence

Lead poisoning of bald eagles has been reported from at least 34 states (Buehler 2000). In New Hampshire, a 10-year old founding member of the first breeding pair to become established in the state in the post-DDT era was killed when it consumed lead shot during its 1994 breeding attempt.

3.1.2 Development (Habitat Loss and Conversion)

(A) Exposure Pathway

Shoreline development affects nesting, perching, roosting, and foraging by eagles, with direct and indirect effects on reproductive success and suitability of overwintering areas (Buehler 2000). Development

can limit the future expansion of a recovering population and act to reduce future carrying capacity of areas that currently support eagles (Fraser et al. 1996). New Hampshire is among the fastest growing states in the northeastern United States, and shoreline real estate is under intense development pressure in a relatively lightly regulated environment.

(B) Evidence

Many studies over the past 3 decades have demonstrated that bald eagles prefer to avoid human-developed areas for nesting, perching and roosting. Development brings the secondary problems of increased pollution, pedestrian use, and water-based recreational activities that deter eagle use of otherwise suitable habitat.

3.1.3 Recreation (Boats)

(A) Exposure Pathway

Many studies have found that recreational boating activities can modify foraging patterns of bald eagles by reducing or precluding use of foraging areas, potentially with long-term effects on productivity (McGarigal et al. 1991).

(B) Evidence

Motorized boat traffic on New Hampshire water bodies is increasing, as are the size of vessels and their top speed. Creation of additional access points to public waters in the form of boat ramps, while desirable to the public, has the potential to add to the disturbance problem by increasing the number of boats on the water. The growing popularity of small personal watercraft (motorized jet skis as well as self-propelled canoes and kayaks) has the added effect of bringing increased human traffic into shallow coves and other areas where eagles perch, feed, and rest.

3.1.4 Non-Point Source Pollution (Chemical Contaminants)

(A) Exposure Pathway

Many types of pollutants bioaccumulate in animal tissue and to biomagnify as they reach higher trophic levels, such as bald eagles. While only infrequently resulting in direct mortalities, these pollutants have

a range of more common sub-lethal effects, especially in long-lived predators such as eagles that accumulate toxins over a long period. These various neurotoxins produce reproductive, behavioral, neurological, and physiological changes that can result in reduced vigor and breeding success (Dominguez et al 2003, Evers 2005).

(B) Evidence

Brominated fire retardants, commonly known as PBDEs, are similar in chemical structure to PCBs. They are used in a wide range of synthetic household and consumer products. PBDEs have recently been shown to accumulate in wildlife populations worldwide, including in raptors.

3.1.5 Mercury

(A) Exposure Pathway

Mercury bioaccumulates in animal tissues and can reach high levels in piscivorous birds. At low doses, sub-lethal effects on birds include reproductive and developmental abnormalities; at higher doses, adults suffer broader behavioral deterioration.

(B) Evidence

Mercury levels are high and pervasive in northeastern North America, not only in aquatic food webs, but in terrestrial systems as well (Wiemeyer et al. 1972, Welch 1994, Evers 2005). Major sources of atmospheric mercury include coal-fired power plants and medical, industrial, and municipal incinerators. Mercury that makes its way into water can combine with carbon, forming compounds such as methylmercury that are more readily taken up by animals.

3.2 Sources of Information

Information on various threats to bald eagles was obtained from literature review, from NHA field data, and from consultation with specialists employed by the USFWS, NHFG, and NHA, all located in Concord, New Hampshire, and from BioDiversity Research Institute located in Gorham, Maine.

3.3 Extent and Quality of Data

Most of the threats described above have been examined carefully by researchers working outside of

New Hampshire. There are sufficient data on the lead threat in New Hampshire that legislation has recently been passed that prohibits the use of certain size lead sinkers and jigs. Other state legislation is pending. On the threat posed by shoreline development, there is sufficient concern about habitat loss to justify strengthening land use policies and investing in more land protection efforts by federal and state agencies, and by non-profit conservation groups. The negative effects of mercury, PBDEs, and PCBs on aquatic species are well known and well documented by researchers nationwide. The effect of increased boating activity is poorly understood for New Hampshire.

3.4 Threat Assessment Research

There are several areas where additional threat assessment research is warranted, including the following:

- Investigation of the tolerance thresholds of bald eagles for recreational boating activity in the vicinity of nest sites and foraging areas
- Additional investigation on current levels of mercury, PCBs, DDE, and other bio-accumulative pollutants in New Hampshire eagles
- Investigation into the likely future extent of shoreline development on water bodies in New Hampshire, its potential impact of bald eagle breeding and wintering areas, and development of a proactive plan that would better protect wildlife values associated with shorelines.

ELEMENT 4: CONSERVATION ACTIONS

4.1.1 Document breeding status and wintering distribution, Restoration and Management

Distribution and abundance of breeding bald eagles should be monitored by spring surveys at active and potential breeding sites to determine occupancy status and reproductive outcome. Monitoring of wintering areas and roost sites is especially important in areas with high development pressure. Direct threats addressed under this conservation action include shoreline development and increased watercraft use.

4.1.2 Develop state recovery plan for bald eagles, Regulation and Policy

Develop a formal state recovery plan for bald eagles that includes specific targets for reclassification to threatened status and for de-listing. This conservation action builds on more than 20 years of ongoing management activities to insure population viability and establish clear targets for population recovery and reclassification. Direct threats addressed under this conservation action include lead pollution, shoreline development, increased watercraft use, and mercury, PBDEs, and PCBs contamination.

4.1.3 Determine contaminant loads, Restoration and Management

Conduct more extensive monitoring of contaminant loads present in New Hampshire bald eagle chicks to determine the potential effect of toxics on statewide productivity and population recovery. This conservation action builds on more than 20 years of ongoing management activities to insure population viability and understand the effects of environmental contaminants. Direct threats addressed under this conservation action include mercury, PBDEs, and PCBs contamination.

4.1.4 Manage human activity around breeding and wintering sites, Restoration and Management

Manage the potentially conflicting public values of viable bald eagle habitat and outdoor recreational opportunities in a manner that addresses the reality of increasing recreational use of New Hampshire's lakes and rivers. Minimize effects of frequent boating activity on bald eagle breeding success. This conservation action builds on more than 20 years of ongoing management activities. Direct threats addressed under this conservation action include increased watercraft use.

4.1.5 Develop clearer guidelines and stronger regulations to protect shoreline habitat from habitat conversion through development, and pursue ways to protect such areas directly through acquisition in fee or easement, Regulation and Policy.

Work with state regulatory agencies to determine the likely future extent of shoreline development in New Hampshire, identify areas of high habitat value for

bald eagles and their prey, and develop guidelines, regulations, and land conservation mechanisms to protect these key areas. Direct threats addressed under this conservation action include shoreline development.

ELEMENT 5: REFERENCES

5.1 Literature

- Allen, G.M. 1902. A list of the birds of New Hampshire. Proceedings of the Manchester Institute of Arts and Sciences 4. Manchester, New Hampshire, USA.
- Brewster, W. 1925. The birds of Lake Umbagog region of Maine, Pt. 2. Bull. Comp. Zool. 66. Harvard College, Cambridge, Massachusetts, USA.
- Broley, C.L. 1958. Plight of the American bald eagle. Audubon 60:162-163, 171.
- Buehler, D.A. 2000. Bald eagle (*Haliaeetus leucocephalus*). In The Birds of North America, No. 683 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, Pennsylvania, USA.
- Dearborn, N. 1898. A preliminary list of the birds of Belknap and Merrimack counties, New Hampshire, with notes. M.S. thesis, New Hampshire College of Agricultural and Mechanical Arts, Durham, New Hampshire.
- Deming, L. 2004. Winter eagle habitat on the Merrimack River, New Hampshire, field verification. Report submitted by New Hampshire Audubon and New Hampshire Fish and Game. 7 pp., plus maps and appendices.
- Deming, L., and C. Martin. 2004. Wintering bald eagle roost sites in New Hampshire. Report submitted by New Hampshire Audubon and New Hampshire Fish and Game. 3 pp., plus 26 maps.
- DeSorbo, C., and D. Evers. 2004. Summary of BioDiversity Research Institute bald eagle banding and mercury sampling efforts in Maine and New Hampshire, 2001-2003. Unpublished report from BioDiversity Research Institute, Gorham, Maine, USA. 5 pp.
- Dominguez, L., W.A. Montevecchi, N.M. Burgess, J. Brazil, and K.A. Hobson. 2003. Reproductive success, environmental contaminants, and trophic status of nesting bald eagles in eastern Newfoundland, Canada. Journal of Raptor Research 37:209-218.
- Evans, D. 1994. Bald eagle. Pp. 373-374 in Atlas of breeding birds in New Hampshire. (C. R. Foss (ed.). Arcadia Press, Dover, New Hampshire, USA.
- Evers, D.C. 2005. Mercury connections: The extent and effects of mercury pollution in northeastern North America. BioDiversity Research Institute. Gorham, Maine, USA. 28 pp.
- Fraser, J.D., S.K. Chandler, D.A. Buehler, and J.K.D. Seegar. 1996. The decline, recovery, and future of the bald eagle population of the Chesapeake Bay, U.S.A. Pp. 181-187 in Eagle Studies (B. U. Meyburg and R. D. Chancellor, eds.). World Working Group for Birds of Prey, Berlin, Germany.
- Grier, J.W. 1982. Ban on DDT and subsequent recovery of reproduction in bald eagles. Science 218: 1232-1235.
- Kramer, J.L. and P.T. Redig. 1997. Sixteen years of lead poisoning in eagles, 1980-1995: an epidemiologic view. Journal of Raptor Research 31: 327-332.
- Martin, C.J. 2004a. New Hampshire Nongame and Endangered Wildlife Program Status and Management Report, July 1, 2003-June 30, 2004. New Hampshire Fish and Game Department Federal Aid Project EW-1-22. 24 pp.
- Martin, C.J. 2004b. Wintering bald eagles in New Hampshire, 2003-2004 Season. T-2 Progress Report submitted to New Hampshire Fish and Game Department. 10 pp.
- McGarigal, K., R.G. Anthony, and F.B. Isaacs. 1991. Interactions of humans and bald eagles on the Columbia River estuary. Wildlife Monographs 115: 1-47.
- Scott, C.F. 1921. Notes on land birds of southern New Hampshire. M.S. thesis, University of New Hampshire, Durham, New Hampshire, USA.
- Smith, C.F. 1984. Assessment of historical and potential bald eagle breeding areas in New Hampshire. Unpublished report to New Hampshire Fish and Game Department Federal Aid Project EW-1-3. 15 pp.
- Smith, C.F. and C. Ricardi. 1983. Ospreys and bald eagles in New Hampshire: status, habitat, and nest site characteristics. Pp. 149-156, in Biology and management of bald eagles and ospreys (D. M. Bird, ed.). Harpell Press. Ste. Anne de Bellevue, Quebec. 325 pp.
- Steenhof, K., L. Bond, K.K. Bates, and L.L. Leppert. 2002. Trends in midwinter counts of bald eagles in the contiguous United States, 19886-2000. Bird

Populations 6:21-32.

United States Fish and Wildlife Service. 1983. Northern states bald eagle recovery plan. United States Fish and Wildlife Service, Washington, D.C.

Welch, L. 1994. Contaminant burdens and reproductive rates of bald eagles breeding in Maine. M.S. Thesis, Univ. Maine, Orono. 86pp.

Wiemeyer, S.N., B.M. Mulhern, F.J. Ligas, R.J. Hensel, J.E. Mathisen, F.C. Robards, and S. Postupalsky. 1972. Residues of organochlorine pesticides, polychlorinated biphenyls, and mercury in bald eagle eggs and changes in shell thickness – 1969 and 1970. *Pesticide Monitoring Journal* 6:50-55.

5.2 Data Sources

Bald eagle wintering area surveys, winter roost counts, breeding site surveys, and productivity data from 1980-2004, New Hampshire Audubon, Concord, New Hampshire, USA.

ELEMENT 6: LIST OF FIGURES

Figure 1. Distribution of bald eagle breeding territories in New Hampshire in 2004.

Table 1. Bald eagle territorial pairs and fledged young in the northeastern United States, 2004, 2003, 2002, and 2001.

Table 2. New Hampshire bald eagle productivity summary: 1988-2004.

Table 3. New Hampshire bald eagle breeding territories: 1988-2004.

Table 4. New Hampshire mid-winter bald eagle survey results, 1981-2004.

Table 5. New Hampshire bald eagle wintering estimates, 1980-1981 through 2003-2004.

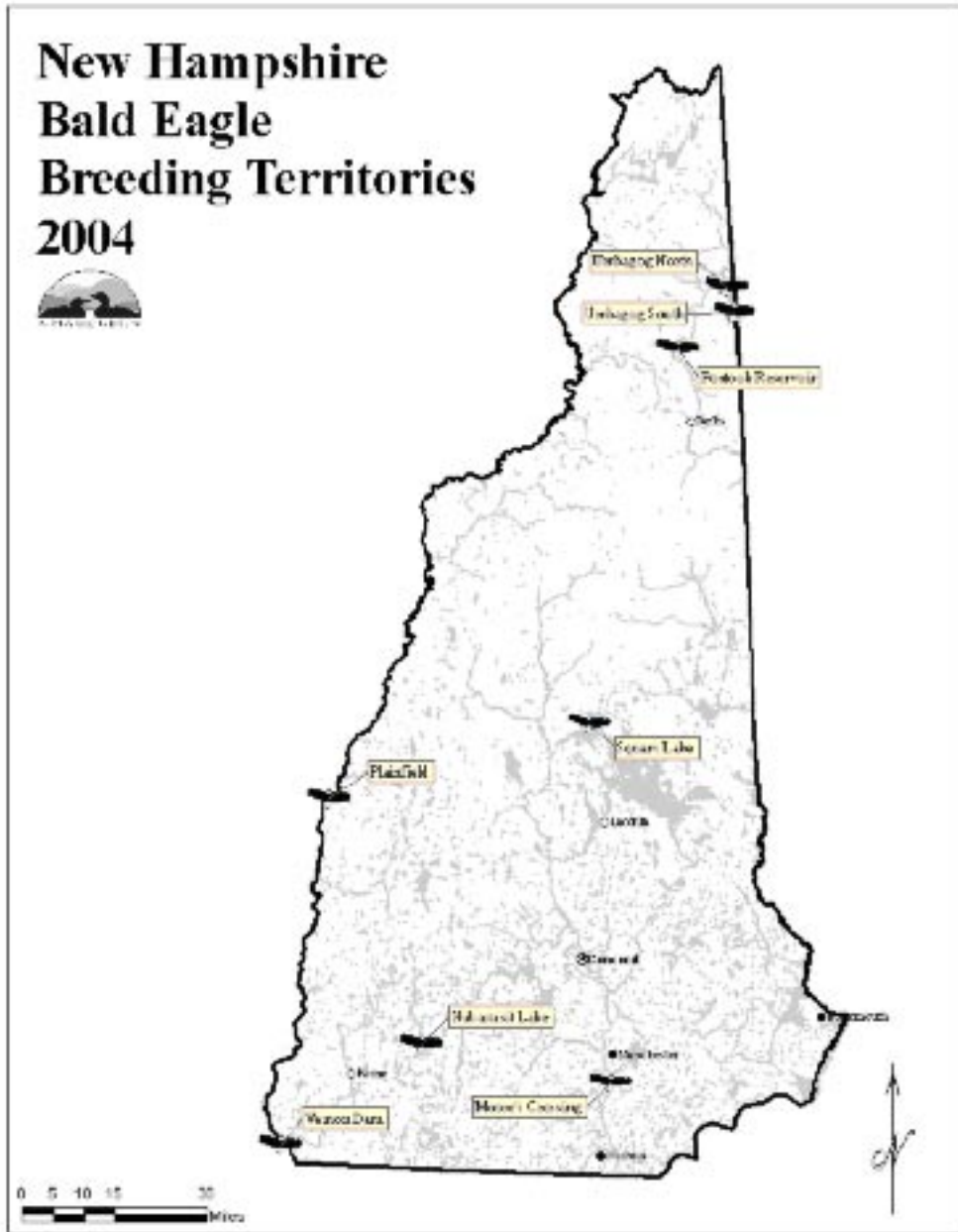


Figure 1. Distribution of bald eagle breeding territories in New Hampshire in 2004.

State	Territorial Pairs 2004	Territorial Pairs 2003	Territorial Pairs 2002	Territorial Pairs 2001	# Successful Pairs 2004	#	# Young Fledged 2004	# Young Fledged 2003	# Young Fledged 2002	# Young Fledged 2001	Source
NY	84	75	70	65	66	53	111	87	94	83	P. Nye
VT	0	0	0	0	0	0	0	0	0	0	M. Fowle
NH	8	8	7	8	6	3	11	5	1	6	C. Martin
ME	346	309	290	269	202	190	298	273	280	266	C. Todd
CT	8	8	8	6	4	6	7	10	7	3	J. Victoria
MA	12	15	12	12	13	8	14	13	15	10	T. French
RI	1	1	0	0	1	1	2	1	0	0	M. Amaral
Total	459	416	387	360	292	261	443	389	397	368	
Total in New England	375	341	317	295	226	208	332	302	303	285	

Table 1. Bald eagle territorial pairs and fledged young in the northeastern United States, 2004, 2003, 2002, and 2001.

Year	Territorial Pairs	Active nests	Successful Young Nests	Fledged	Young per Active Nest
1988	1	0	0	0	
1989	1	1	1	1a	1
1990	1	1	1	2	2
1991	1	1	1	1	1
1992	1	1	1	2a	2
1993	1	1	1	2	2
1994	1	1c	0	0	0
1995	1	1	1	1	1
1996	1	1	1	2	2
1997	1	1	0	0	0
1998	2	1	1	2	1
1999	7	2	1	2	1
2000	6	4c	1c	2c	0.5
2001	8b	5	4	6	1.2
2002	7	4	1	1	0.25
2003	8b	5	3	4d	0.8
2004	8b	7b	6b	11b	1.57
Totals for 1988-2004	56	37	24	39	1.05

Table 2. New Hampshire bald eagle productivity summary: 1988-2004.

Breeding Territories (by # years used)	Years Occupied	Years Nesting	Young Fledged	Young / Nesting	Fledged Banded	%Fledged Banded
Umbagog Lake North (1988-2004)	17	14g	16f	1.14	8	50
Nabanut Lake (1997-2004)	8	6	3	0.5	3	100
Vernon Dam (1999-2004)	6	5	3	0.6	1	33
Pontook Reservoir (1999-2004)	6	4	6	1.5	6	100
Umbagog Lake South (2000-2004)	5	5g	7e	1.4	4	57
Squam Lake (2000-2004)	5	2	2	1	0	0
Moore's Crossing (4	0	0	0	0	0
Ottawaquechee River (2003-2004)	2	1	2	2	0	0
Lake Francis (2001)	1	0	0	0	0	0
Surry Mountain Lake (1999)	1	0	0	0	0	0
15-Mile Falls (1999)	1	0	0	0	0	0

Table 3. New Hampshire bald eagle breeding territories: 1988-2004.

Year	Total Eagles	Adults	Immatures	Unknown	Participants
2004	41	27	14	0	55
2003	40	26	14	0	69
2002	50	31	19	0	89
2001	42	28	13	1	58
2000	(no data available)				
1999	35	19	16	0	56
1998	25	15	10	0	39
1997	37	26	11	0	76
1996	33	21	12	0	84
1995	30	16	14	0	94
1994	25	14	11	0	75
1993	21	14	7	0	56
1992	25	20	5	0	50
1991	19	13	6	0	57
1990	19	12	7	0	46
1989	15	9	6	0	42
1988	14	7	7	0	48
1987	9	6	3	0	47
1986	10	7	3	0	31
1985	13	8	5	0	39
1984	12	10	2	0	17
1983	7	5	2	0	17
1982	5	3	2	0	17
1981	8	2	6	0	18

Table 4. New Hampshire mid-winter bald eagle survey results, 1981-2004.

Year	Adults	Sub-ads	Immatures	Totals
2003-2004	57	2	34	93
2002-2003	47	8	37	92
2001-2002	45	12	28	85
2000-2001	29	6	22	57
1999-2000	35	7	16	58
1998-1999	25	7	17	49
1997-1998	32	3	23	58
1996-1997	34	8	32	74
1995-1996	38	5	37	80
1994-1995	37	9	37	83
1993-1994	33	18	19	70
1992-1993	43	5	23	71
1991-1992	38	6	20	64
1990-1991	31	2	20	53
1989-1990	42	8	15	65
1988-1989	39	--	13	52
1987-1988	29	--	27	56
1986-1987	30	--	26	56
1985-1986	40	--	24	64
1984-1985	41	--	29	70
1983-1984	32	--	10	42
1982-1983	9	--	9	18
1981-1982	10	--	6	16
1980-1981	10	--	8	18

Table 5. New Hampshire bald eagle wintering estimates, 1980-1981 through 2003-2004.

Distribution of Breeding Bald Eagles in New Hampshire

Distribution
■ Known



0 10 20 40 Miles

Known = verified nesting areas as reported by
Audubon Society of New Hampshire

