Status of Breeding Bald Eagles in New Hampshire in 2010

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Adult bald eagle breeding pair at Squam Lake.
Photo by Lee Grenier.

Adult bald eagle along Connecticut River in Pittsburg, NH. Photo by Erik Neilsen.

Introduction

This document summarizes results from the 2010 bald eagle breeding season in New Hampshire and describes field monitoring and management activities coordinated by the New Hampshire Audubon (NHA) Conservation Department. Major funding for this work was provided by the federal State Wildlife Grant (SWG) program through a contract (State of New Hampshire 2010) with the New Hampshire Fish and Game Department (NHFGD). Contract work occurred during portions of the state's 2009 and 2010 fiscal years. Financial support was also provided by TransCanada Corporation through its Community Investment Grant program. Funding for satellite transmitter use in the Merrimack River watershed was provided by the National Fish and Wildlife Foundation. Additional support came from NHA donors and volunteers. More information about New Hampshire's breeding eagles can be obtained by contacting the NHFGD Nongame and Endangered Wildlife Program at www.wildlife.state.nh.us, or from the NHA Conservation Department at www.nhaudubon.org.

Bald eagle (*Haliaeetus leucocephalus*) monitoring and management activities have been conducted in the State of New Hampshire since 1980. With no known bald eagle nesting confirmed in the state since 1950, NHA biologists in 1984 assessed the historical record from 1950 to 1983 for records of presence and abundance of bald eagles in the breeding season within 12 delineated areas of highly suitable habitat (Smith 1984). Staff and volunteers from the NHFGD and NHA began to monitor and manage the recovery of a slowly increasing number of territorial eagle pairs and nest sites in 1988, when one newly-formed territorial pair initiated nest-building at a historical site located on Umbagog Lake in Coos County. For nearly a decade, from 1988 through 1996, this site was the only known territorial pair documented in the entire state. However, beginning in the late 1990s, New Hampshire's breeding bald eagle population began to expand with new territorial pairs developing and being identified throughout the state on roughly an annual basis. In the last 10 years, the number of documented territorial eagle pairs in New Hampshire has grown impressively at annual rate of over 10%.

There has been a dramatic bald eagle population increase across the lower 48 States since federal recovery efforts were first initiated during the 1970s. In August 2007, the species was reclassified from threatened to recovered at the federal level (U.S.D.I., Fish and Wildlife Service 2007a). The federal Endangered Species Act (ESA) requires that species recovered and removed from the Endangered Species List (delisted) be monitored for a period of not less than five years, in cooperation with States. The purpose of monitoring is to detect any failure of the recovered species to sustain itself in the absence of ESA protections.

Concurrent with federal delisting, the U.S. Fish and Wildlife Service (USFWS) proposed to monitor the status of bald eagle nests over a 20-year period with sampling done once every five years (U.S.D.I., Fish

and Wildlife Service 2009) using a so-called "dual-frame" sampling strategy. Under this plan (Millar et al. 2007), intensive aerial surveys in a handful of states with high-density breeding populations ("area frame") are coupled with ongoing ground monitoring implemented by state agencies and cooperating organizations in state with low-density populations ("list frame"). Baseline area frame aerial surveys were conducted in 15 states in 2009 and list frame data were solicited from monitoring agencies across the nation. USFWS Patuxent Wildlife Research Center staff members are currently working on analysis of these data (Emily Bjerre, USFWS personal communication). Some raptor experts and conservation biologists (Watts and Duerr 2010) have formally expressed concerns that certain aspects of monitoring strategy may hinder the plan's ability to achieve its statistical objective of 80% probability of detecting a $\geq$25% change in number of occupied bald eagle nests between successive 5-year intervals.

The New Hampshire Wildlife Action Plan (State of New Hampshire 2005) ranked the revision of the State List of Threatened and Endangered Species (State T&E List) among its highest priorities (NH WAP Strategy 102). The most recent New Hampshire T&E List revision process concluded in September 2008 with numerous modifications to the state's T&E List, including reclassification of the bald eagle from endangered to threatened status in the state as a result of well-documented progress towards full recovery.

Twenty-two territorial bald eagle pairs are currently distributed across four of New Hampshire's five major watersheds. The Androscoggin River (3 pairs), Connecticut River (5 pairs), Great Bay/Coastal (3 pairs), and Merrimack River (11 pairs) watersheds all hosted territorial pairs in 2010. Additionally, the Connecticut River hosts five state border pairs whose nests are located on the Vermont side of the state line. Finally, the headwaters of the Androscoggin River at Umbagog Lake support two more trans-border pairs whose nests are located in Maine. Only the state's Saco River watershed currently lacks a confirmed nesting or territorial pair, although the presence of eagles in suitable breeding habitat on Ossipee Lake and other nearby border lakes has been reported over the past several years. Nearly two-thirds (90 of 140) of all the young bald eagles produced in New Hampshire over the past 60 years have fledged within the past five breeding seasons (2006-2010).

Objectives, Tasks, and Methods

Objectives and tasks

Statewide monitoring and management activities for breeding bald eagles are coordinated by NHA Conservation Department staff working with the guidance from, and under contract with, the NHFGD Nongame Program. The New Hampshire Fiscal Year 2011-2012 contract between NHFGD and NHA (FY2011-12 Contract) identifies one monitoring objective (Project I, Job 3.2, Objective 2) for breeding bald eagle monitoring:

- monitor bald eagle nest sites annually to obtain measures of population status and productivity.

In addition to the monitoring objective listed above, the FY2011-12 Contract identifies one management objective (Project II, Job 1.5) for breeding eagles:

- implement population management actions and provide technical expertise and/or training to individuals and organizations to further the goal of conserving and protecting New Hampshire's bald eagle population.

Methods

NHA Conservation Department staff conducted and coordinated fieldwork statewide during the 2010 bald eagle breeding season, directly supervising a total of 93 volunteer observers who gathered data on all 22 of the state's occupied bald eagle breeding territories (63 volunteers) and in other high-potential breeding

habitat across the state (30 volunteers). This two-tiered team approach enabled coverage of multiple locations during a compressed timeframe associated with the bald eagle breeding season. Standardized breeding season monitoring protocols (Martin 2005) were used at all surveyed sites. Monitoring and management tasks included the following, but not all techniques were used at every location:

- Search for and verify public reports of new nests and new territorial pairs
- Document territorial occupancy and nest productivity parameters at known sites
- Gather biometric and land ownership data on nest sites
- Assemble, install, and maintain land- or water-based signage and buoys near nests
- Install metal predator guards on selected nests
- Examine chicks to determine general condition/health as time and resources permit
- Place alphanumeric leg bands on chicks as time and resources permit
- Read leg bands on adult and immature eagles and report to USGS Bird Banding Lab
- Provide technical assistance to NHFGD staff involved in environmental reviews
- Conduct outreach to the public on conservation and management issues.

For more specific information about monitoring and management techniques used, please consult the breeding season monitoring protocol (Martin 2005), or contact NHA staff for more details.

Results

Breeding Activity and Productivity

The 2010 New Hampshire bald eagle breeding season was moderately successful and similar in outcome to 2009. In comparison, there were more occupied breeding territories and more active nests in 2010, but very similar productivity results. The highly productive 2008 breeding season remains a benchmark for evaluating the success of other recent breeding seasons in New Hampshire. NHA biologists and volunteer observers, with support and cooperation from federal and state agencies and local landowners, confirmed a record-high total of 22 occupied territories in 2010. This was a one-year increase of 10% compared to the previous high of 20 occupied territories documented in both 2009. In all 22 cases, NHA biologists and volunteer observers documented presence of pairs, as opposed to single individuals, on territory.

New Hampshire gained two new nesting pairs in 2010; one at the Groveton Oxbows on the Connecticut River in Northumberland, and one at Marks Wildlife Management Area on Merrymeeting Marsh in New Durham. In addition, two more newly occupied territories without identified nest loactions were also confirmed; one at Massabesic Lake in Auburn, and another on the Merrimack River in Boscawen. We were not able to locate one previously known nesting pair located at the southern half of Umbagog Lake in 2009, nor could we reconfirm the presence of an occupied territory at Newfound Lake in 2010.

Also not included in New Hampshire's record-high total number of territories in 2010 are seven nesting pairs whose nests were located just beyond New Hampshire's borders in neighboring states, but whose territories include sizable areas within the Granite State. Five of these sites are located along the Connecticut River in Vermont; at Upper Meadows in Rockingham, along Route 5 in Windsor, and on the

McIndoe, Comerford, and Moore impoundments in the Vermont towns of Barnet, Waterford, and Concord, respectively. Two more territories and nests are located on Umbagog Lake along the Maine border.

We confirmed incubation behavior at 14 active New Hampshire eagle nests in 2010, up 27% from the 11 pairs that were documented incubating in 2009. A total of 9 of 14 incubating pairs fledged young this year, the same number of successful pairs as last year but lower in terms of percentage. A total of 17 young bald eagles reached fledging age in the Granite State in 2010, up 6% from 2009 by still below the record-high 24 young that fledged in 2008. Only one New Hampshire nest produced a trio of fledglings in 2010.

Adult and 5-wk old chick at nest on Connecticut River in Orford, NH. Photo by Judy Lombardi.

New Hampshire's statewide bald eagle breeding season parameters for 2010 are briefly summarizes in Table 1 below. Overall productivity trends in New Hampshire's bald eagle population for a 25-year period from 1986-2010 are shown in Figure 1 on page 5. The line graph indicates how total reproductive output by bald eagles during the past five breeding seasons alone accounts for nearly two-thirds (90 of 140) of all the young eagles that have fledged from New Hampshire nests since breeding pairs began to reoccupy the state in the late 1980s. In fact, over 60% of the state's documented successful nesting attempts since 1950 (48 of 78) have occurred within just the most recent 5-year period. The annual growth rate in territorial pairs of bald eagles in New Hampshire over the past decade has exceeded 10.5% annually, rising from eight pairs in 2001 to 22 pairs in 2010. This is clear evidence of a strongly recovering population.

Table 1. New Hampshire bald eagle breeding season totals for 2010.

Occupied territories confirmed = 22 (new NH post-DDT era high, previous was 20 in 2009)

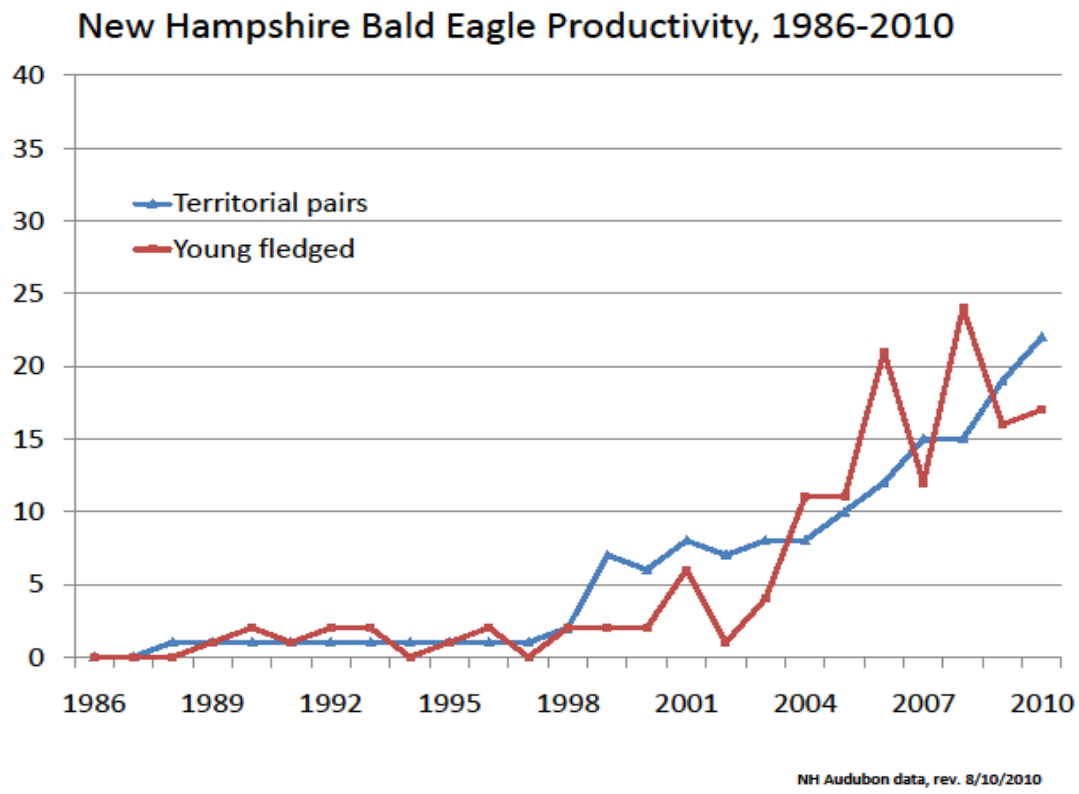
Territorial pairs confirmed = 22 (new NH post-DDT era high, previous was 19 in 2009)

Incubating pairs confirmed = 14 (NH post-DDT era high is 13 in 2008)

Successful nests = 9 (NH post-DDT era high is 12 in 2008)

Young fledged = 17 (NH post-DDT era high is 24 in 2008)

Figure 1. Productivity trends in New Hampshire's bald eagle population, 1986-2010.



The geographic distribution of eagle breeding territories in New Hampshire in 2010 is shown in Figure 2 on page 6. This map also includes locations of trans-border territories where the nests are located just outside of New Hampshire's state borders.

Outcome of breeding attempts at individual territories in 2010 is shown in Table 2 on page 7-8. This year's statewide productivity rate of 1.21 young fledged/active nest decreases the state's long-term productivity average (1988-2010) slightly to 1.35 young fledged/active nest. A summary of New Hampshire bald eagle productivity for the entire recovery period from 1988-2010 is shown in Table 3 on page 9. Cumulative reproductive contributions of individual breeding territories from 1988-2010 are shown in Table 4 on page 10-11. Banding and sampling information for all New Hampshire bald eagle nest sites in 2010 is listed on Table 5 on page 11.

NHA biologists and cooperators banded 29% (5 of 17) of the state's nestling bald eagles at three productive nests in 2010. NHA conducted banding as a sub-permittee on a federal banding permit issued to Michael Amaral of the USFWS. We banded and obtained blood and feather samples from two chicks at the nest in Plainfield. We also banded, obtained blood and feather samples, and fitted battery-powered, backpack-style transmitters (PTTs) on two chicks at the Blueberry Island nest in Moultonborough and one chick at the Marks WMA nest in New Durham. In a first for New Hampshire bald eagles, the PTTs placed on these three juveniles from nests in the Merrimack River watershed will provide wildlife managers with new information about dispersal patterns of young eagles from our area. Staff from Maine's BioDiversity Research Institute (BRI) assisted with banding and tissue sampling at eagle nests. In particular, the tree-climbing skill of BRI staff biologist Rick Gray was crucially important to safe access and safe bird-handling at these three nests. USFWS New England Field Office and NHFGD personnel have greatly facilitated our efforts with the satellite transmitter tracking project.

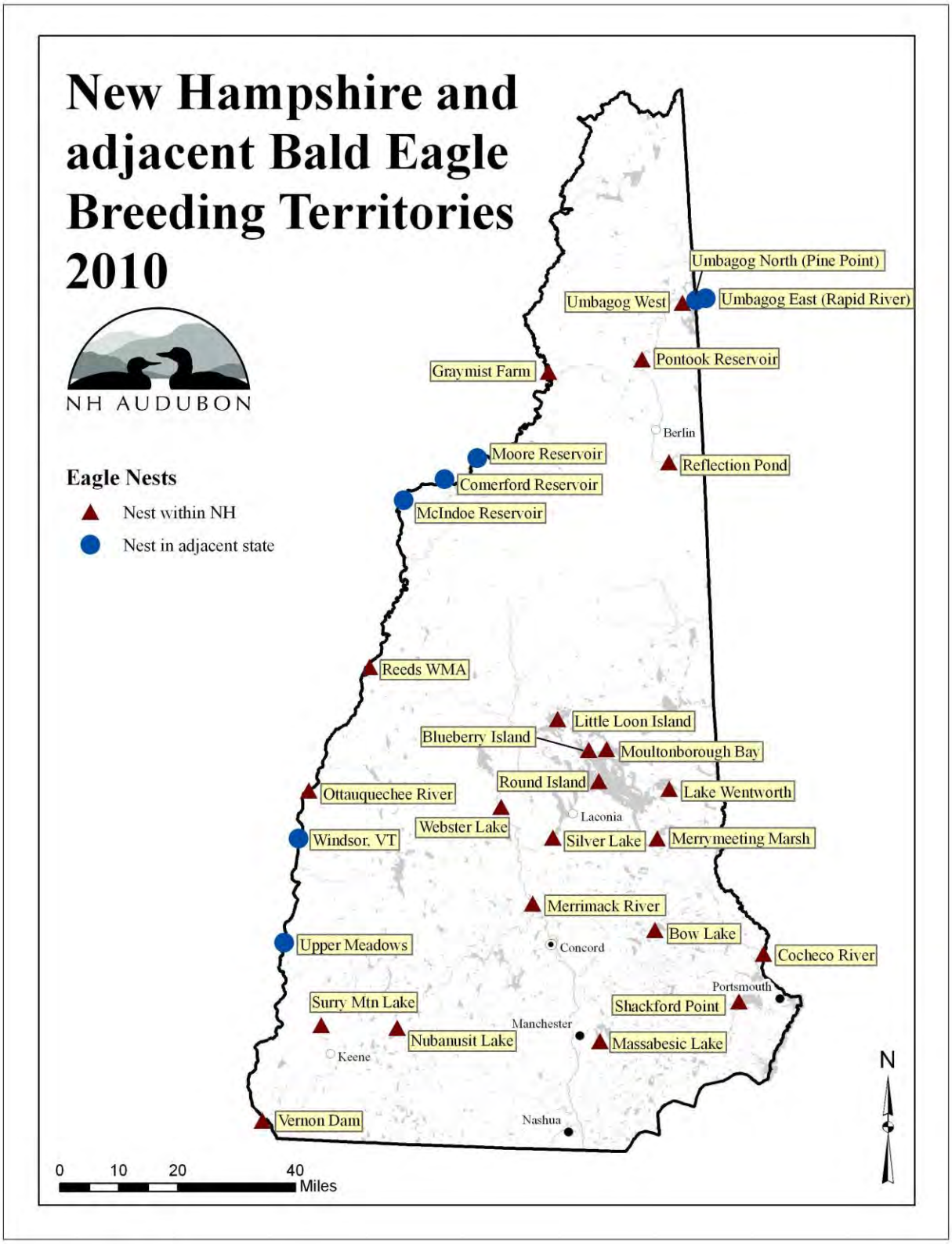


Figure 2. Distribution of bald eagle breeding territories in NH and adjacent states in 2010.

Table 2. Outcome at New Hampshire's 22 bald eagle breeding territories in 2010.

Bow Lake territory (Northwood) – failed after at least 1 egg hatched; 4-yr old sub-adult female banded red X/R right leg, silver left leg; 6-yr old adult male banded red K/U right leg, silver left leg; no closure signs used

Center Harbor territory (Moultonborough) – fledged 2 banded chicks with PTTs; adult female not banded, adult male banded silver right, none left; no closure signs used; nest collapsed at end of season

Cocheco River territory (Dover) – fledged 1 chick; banded status of adult female uncertain; adult male not banded; no closure signs used; major wind damage to forest stand late July, but nest remained intact

Great Bay territory (Newmarket) – territorial pair and single eagle seen intermittently March-May, but no nest located; banded status of both members of the pair uncertain; no closure signs used

Groveton Oxbows territory (Northumberland) – new nest site; fledged 2 chicks; sub-adult female not banded, adult male not banded; no closure signs used

Lake Wentworth territory (Wolfeboro) – territorial pair on Lake Wentworth in April-July; no nest located; banded status of both sub-adult members of the pair uncertain; no closure signs used

Massabesic Lake territory (Auburn) – new territorial pair present May-September, but no nest located; sub-adult female not banded; adult male not banded**;** no closure signs used

Merrimack River territory (Boscawen) – new territorial pair present, but no nest located; banded status of both sub-adult members of the pair uncertain**;** no closure signs used

Merrymeeting Marsh territory (New Durham) – new nest site; fledged 1 banded chick with PTT; 6-yr old adult female banded gold WP3 right, silver left, adult male not banded**;** no closure signs used

Moultonborough Bay territory (Moultonborough) – failed to incubate, loss of one adult likely based on local sighting of a floating dead eagle within territory, lack of pair sightings, lack of incubation behavior; new mate obtained later in season; banded status of both adults uncertain; no closure signs used

Nubanusit Lake territory (Hancock) – fledged 3 chicks; 18-yr old adult female banded silver right, gold W22 left; 13-yr old adult male banded silver right leg, gold W84 left leg; water-based closure buoys installed and maintained by volunteers; nest collapsed at end of season

Ottauquechee River territory (Plainfield) – fledged 2 banded chicks; both adults not banded; no closure signs used

Pontook Reservoir territory (Dummer) – failed during incubation after heavy snow; banded status of both members of the pair uncertain; no closure signs used

Reeds Wildlife Management Area territory (Orford) – fledged 2 chicks; 6-yr old adult male banded silver right, gold WP2 left; adult female not banded; no closure signs used; nest collapsed at end of season

Reflection Pond territory (Shelburne) – failed during incubation after heavy snow; banded status of both adults uncertain; no closure signs used

Round Island territory (Gilford) – fledged 2 chicks; banded status of both adults uncertain; no closure signs used

Silver Lake territory (Tilton) – failed without evidence of hatch; adult female not banded, adult male banded silver left leg, none right leg; no closure signs used

Squam Lake territory (Moultonborough) – fledged 2 chicks; 11-yr old adult female banded silver right leg, gold WA8 left leg; 13-yr old adult male banded silver right leg, gold W86 left leg; water-based closure buoys installed and maintained by Squam Lakes Association and volunteers

Surry Mountain Lake/Chickering Farm territory (Surry/Westmoreland) – territorial pair at Chickering early in season, at Surry late in season, but no nest located; one adult at Chickering banded silver right leg, gold WN7 left leg, sub-adult female at Surry not banded, adult male at Surry not banded; no closure signs used

Umbagog Lake West territory (Errol) – failed before/during incubation when nest collapsed after heavy snow; banded status of both members of the pair uncertain; water-based closure signs managed by USFWS

Vernon Dam territory (Hinsdale) – failed without evidence of hatch; adult female not banded; adult male banded silver right leg, black left leg; no closure signs used

Webster Lake/Pemi River territory (Franklin/Hill) – adult/sub-adult pair present May-August; no nest located; banded status of adult female uncertain; adult male not banded; no closure signs used

Fledgling eagles shadow parent at Blueberry Island on Lake Winnipesaukee. Photo by Lauren Goldsmith.

Table 3. New Hampshire bald eagle productivity throughout recovery period, 1988-2010.

Year	Territorial Pairs	Active Nests	Successful Nests	Young Fledged	Young per Active Nest	Young per Terr. Pair
1988	1	0	0	0	---	---
1989	1	1	1	1[a]	1.00	1.00
1990	1	1	1	2	2.00	2.00
1991	1	1	1	1	1.00	1.00
1992	1	1	1	2 [a]	2.00	2.00
1993	1	1	1	2	2.00	2.00
1994	1	1[c]	0	0	0.00	0.00
1995	1	1	1	1	1.00	1.00
1996	1	1	1	2	2.00	2.00
1997	1	1	0	0	0.00	0.00
1998	2	1	1	2	1.00	1.00
1999	7	2	1	2	1.00	0.29
2000	6	4 [c]	1[c]	2 [c]	0.50	0.33
2001	8	5	4	6	1.20	0.75
2002	7	4	1	1	0.25	0.14
2003	8	5	3	4 [d]	0.80	0.50
2004	8	7	6	11	1.57	1.38
2005	10	7	6	11	1.57	1.10
2006	12	11	10	21	1.91	1.75
2007	15	11	8	12	1.09	0.80
2008	15	13	12 [b]	24 [b]	1.85	1.60
2009	19	11	9	16	1.45	0.84
2010	22 [b]	14 [b]	9	17	1.21	0.77
Totals for 1988-2010	**149**	**104**	**78**	**140**	**1.35**	**0.94**

[a] includes two cases where one captive-hatched chick was fostered into Umbagog Lake North nest

[b] state record high for the post-DDT period (1970s to present)

[c] includes one instance where eggs were laid/incubated in a nest tree located in Maine

[d] subtracts one pre-fledging age chick whose remains were discovered below nest during subsequent year

Territorial pair -- routine presence of two potentially breeding birds in suitable nesting habitat in breeding season; pairs typically exhibit courtship, copulation, stick-carrying, and/or nest construction behaviors.

Active nesting -- physical evidence (presence of eggs, shell fragments, or young) or behavioral evidence (incubation exchanges) indicating that eggs were laid in the nest.

Successful nest -- nest producing at least one young reaching fledging age.

Young fledged -- number of nestlings observed, or believed capable of, making flights from the nest.

Table 4. Reproductive contribution from individual bald eagle breeding territories, 1988-2010.

Breeding Territories (by # years used)	Years Occupied	Years Nesting	Young Fledged	Young / Nesting	Fledged Banded	%Fledged Banded
Umbagog Lake N (1988-2009)	22	18 [c]	25 [b, d]	1.39	8	32%
Nubanusit Lake (1997-2010)	14	12	16	1.33	6	38%
Pontook Reservoir (1999-2010)	12	10	14	1.40	13	93%
Vernon Dam (1999-2010)	12	10	7	0.70	2	29%
Squam Lake (2000-2010)	11	8	12	1.50	1	8%
Umbagog Lake S (2000-2009)	10	9 [c]	13 [a]	1.44	8	62%
Ottauquechee River (2003-2010)	8	7	14	2.00	2	14%
Umbagog Lake W (2005-2010)	6	5	6	1.20	0	0%
Moores Crossing (2001-2006)	6	0	0	0.00	0	0%
Round Island (2006-2010)	5	5	9	1.80	0	0%
Cocheco River (2006-2010)	5	5	8	1.60	1	13%
Reflection Pond (2006-2010)	5	5	5	1.00	2	40%
Surry Mtn Lake (1999, 2007-2010)	5	0	0	0.00	0	0%
Moultonboro Bay (2007-2010)	4	2	4	2.00	3	75%
Bow Lake (2007-2010)	4	1	0	0.00	0	0%
Silver Lake (2008-2010)	3	3	1	0.33	0	0%
Merrymtg Lake (2005, 2007, 2010)	3	1	1	1.00	1	100%
Reeds WMA (2009-2010)	2	2	4	2.00	0	0%
Blueberry Island (2009-2010)	2	1	2	2.00	2	100%
Great Bay (2009-2010)	2	0	0	0.00	0	0%
Lake Wentworth (2009-2010)	2	0	0	0.00	0	0%
Webster Lake/Pemi (2009-2010)	2	0	0	0.00	0	0%
Groveton Oxbows (2010)	1	1	2	2.00	0	0%
Massabesic Lake (2010)	1	0	0	0.00	0	0%
Boscawen Merrimack (2010)	1	0	0	0.00	0	0%
Newfound Lake (2009)	1	0	0	0.00	0	0%
Lake Francis (2001)	1	0	0	0.00	0	0%
15-Mile Falls (1999)	1	0	0	0.00	0	0%
Totals for 1988-2010	**151**	**105**	**143**	**1.36**	**49**	**34%**

Notes for Table 4 on previous page:

[a] subtracts one pre-fledging age chick whose remains were discovered below nest during subsequent year
[b] includes two captive-hatched chicks fostered into Umbagog Lake North nest in 1989 and 1992
[c] includes one instance where eggs were laid/incubated in a nest tree located in Maine
[d] includes three young fledged from Umbagog North territory nest on Pine Point in Maine in 2009

Breeding territory -- area of suitable nesting habitat, with or without a nest, defended by a pair during the breeding season.
Years occupied -- breeding seasons with routine presence of a pair of potentially breeding birds.
Years nesting -- breeding seasons in which physical evidence (presence of eggs, shell fragments, or young) or behavioral evidence (incubation exchanges) indicates that eggs were laid; more than one nest may occur in a breeding territory.
Young fledged -- number of nestlings observed, or believed capable of, making flights from the nest.
Fledged banded -- number of young fledged with federal leg bands and, in most cases, an additional alphanumeric color band (excludes banded chicks confirmed to have died prior to fledging age).

Attempts to identify the banded status of free-flying bald eagles at New Hampshire breeding sites in 2010 yielded the following results. Of 44 territorial individuals (22 pairs) documented in 2010, banded status was confirmed for 25 (57%) and unconfirmed for 19 (43%). Of the 25 individuals where banded status was determined, 11 (44%) were confirmed to be banded and 14 (56%) were confirmed to be unbanded.

Of the 11 known banded individuals, positive identifications were obtained on eight (73%). Positive identifications included the following:

- 18-yr old female from Massachusetts breeding with 13-yr old male from Massachusetts at Nubanusit Lake in Hancock, NH
- 11-yr old female from Massachusetts breeding with 13-yr old male from Massachusetts at Squam Lake in Moultonborough, NH
- 4-yr old female from Maine breeding with a 6-yr old male from Maine at Bow Lake in Northwood, NH
- 6-yr old male from New Hampshire breeding on Connecticut River in Orford, NH
- 6-yr old female from Massachusetts breeding at Merrymeeting Marsh in New Durham, NH.

Table 5. Banding and sampling effort for New Hampshire bald eagles in 2010.

Nest Site	Town, State	Date	Bander	Fed band#	Color band	Comments
Ottaquechee	Plainfield, NH	5/10	Chris Martin	629-52978 (right)	black A / N (left)	blood /feather sample
				629-52979 (right)	black A / P (left)	blood/feather sample
Blueberry Island	Moultonboro, NH	6/17	Chris Martin	629-52980 (right)	black A / R (left)	blood/feather sample PTT 79604 attached
				629-52981 (right)	black A / S (left)	blood/feather sample PTT 79606 attached
Merrymeeting	New Durham, NH	6/17	Chris Martin	629-52982 (right)	black A / U (left)	blood/feather sample PTT 79607 attached

Since the conclusion of the 2009 breeding season, NHA has obtained 13 locations on 13 individual post-fledging age bald eagles either as a result of NHA staff or volunteers field-reading legs bands, from reports received by the Bird Banding Laboratory, or from recovery of injured or dead birds. Information on the status of these 13 individuals is detailed in Table 6 on page 18. Table 7 on page 19 provides further information on five injured and/or dead eagles recovered in New Hampshire since last year.

NHA staff, trained volunteers, and cooperators from state and federal natural resource agencies search for potential new breeding territories and for new nests. Locations checked are determined by the nature and frequency of public reports received by NHA or NHFGD, by actionable information acquired in prior field seasons, and by logistical constraints and opportunities. Starting in March, and continuing throughout the remainder of the spring and summer breeding season, sites are checked using standard breeding season monitoring protocols (Martin 2005). Specific details concerning observations made in 2010 at potential new breeding territories may be obtained by contacting the NHA Conservation Department.

Population Management Actions, Training, and Technical Expertise

Site management:

The following section describes specific nest site management strategies that were implemented during the 2010 breeding season and suggests several high priority management steps that might be considered for the future. Some steps would be triggered by certain observed circumstances or activities; for example, deploying warning signs only when "significant human disturbance" occurs.

Creating, deploying, and maintaining water- and/or land-based signs that establish a restricted zone around a bald eagle nest site requires an investment of personnel time, material, and scarce financial resources. Consequently, in most cases, we would prefer to assess whether the level of disturbance at a particular site reaches the threshold where such action is preferred or required. We assess this using direct observations of NHA staff and volunteers, by reports received from the general public, or by considering physical conditions that create a reasonable expectation that such disturbance might occur (e.g., an informal campsite or campfire ring located beneath a nest tree).

Bow Lake territory (Northwood)
Photo: Bow Lake color-banded sub-adult female by Jon Winslow

Current (2010) status: nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; direct communication maintained with land owner.

Future management needs: consider installing predator guard on nest tree and deploy land-based signs and/or water-based buoys only if hatch; continue volunteer monitoring; banding/sampling as resources permit.

Center Harbor territory (Moultonborough)
Photo: Unbanded adult near Blueberry Island by Lauren Goldsmith

Current (2010) status: nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; direct communication maintained with land owner/caretaker; conducted exam and banding of young.

Future management needs: install predator guard on nest tree only after evidence of mammalian predation; install land-based signs; continue volunteer monitoring; banding/sampling as resources permit.

Cocheco River territory (Dover)
Photo: Nest after July 2010 windstorm by Chris Martin / NH Audubon

Current (2010) status: nest location known; no closure signs deployed; no predator guard installed; no active volunteer monitoring; direct communication maintained with land owner.

Future management needs: install predator guard on nest tree only after evidence of mammalian predation; deploy land-based signs only if significant human disturbance; promote active volunteer monitoring; banding/sampling as resources permit.

Great Bay territory (Newmarket)
Photo: Two eagles at Vols Island by Ken Ernstoff

Current (2010) status: no nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; land owner not yet identified.

Future management needs: locate nest; identify land owner; install predator guard on nest tree only after evidence of mammalian predation; deploy land-based signs only if significant human disturbance; continue volunteer monitoring.

Groveton Oxbows territory (Northumberland)
Photo: Two chicks in nest by Chris Martin / NH Audubon

Current (2010) status: nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; land owner identified.

Future management needs: contact land owner; install predator guard on nest tree; deploy land-based signs only if significant human disturbance; continue volunteer monitoring; banding/sampling as resources permit.

Lake Wentworth territory (Wolfeboro)
Photo: Sub-adult at Lake Wentworth by Jonas Pilot

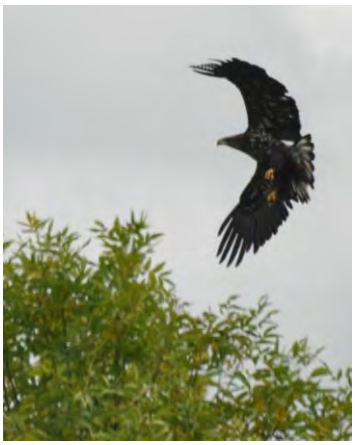
Current (2010) status: no nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; land owner not yet identified.

Future management needs: locate nest; identify land owner; install predator guard on nest tree only after evidence of mammalian predation; deploy land-based signs only if significant human disturbance; continue volunteer monitoring.

Massabesic Lake territory (Auburn)
Photo: Sub-adult at Massabesic Lake by Mark Wilson

Current (2010) status: no nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; land owner not yet identified.

Future management needs: locate nest; identify land owner; install predator guard on nest tree only after evidence of mammalian predation; deploy land-based signs only if significant human disturbance; continue volunteer monitoring.



Merrimack River territory (Boscawen)
Photo: Osprey-faced immature at Crete Farm by Debbie LaValley

Current (2010) status: no nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; land owner identified and contacted.

Future management needs: locate nest; install predator guard on nest tree only after evidence of mammalian predation; deploy land-based signs only if significant human disturbance; continue volunteer monitoring.

Merrymeeting Marsh territory (New Durham)
Photo: Recently fledged young with transmitter by unknown photographer

Current (2010) status: nest location known; no closure signs deployed; predator guard installed; active volunteer monitoring; direct communication maintained with land owner; conducted exam and banding of young.

Future management needs: deploy land-based signs only if significant human disturbance; continue volunteer monitoring; banding/sampling as resources permit.

Moultonborough Bay territory (Moultonborough)
Photo: Poplar Island nest by Donna Ulbricht

Current (2010) status: nest location known; no closure signs deployed; camouflaged predator guard maintained; active volunteer monitoring; direct communication maintained with land owner.

Future management needs: deploy land-based signs at land owners request; continue volunteer monitoring; banding/sampling as resources permit.

Nubanusit Lake territory (Hancock)
Photo: Floating buffer zone signs by Chris Martin / NH Audubon

Current (2010) status: nest location known; water-based buoys deployed; camouflaged predator guard maintained; active volunteer monitoring; direct communication maintained with land owner.

Future management needs: deploy land-based and/or water-based buoys; replace camouflaged predator guard; continue volunteer monitoring; banding/sampling as resources permit.

Ottauquechee River territory (Plainfield)
Photo: Banding 6-wk old chick by Chris Martin / NH Audubon

Current (2010) status: nest location known; no closure signs deployed; camouflaged predator guard maintained; active volunteer monitoring; direct communication maintained with land owner; conducted exam and banding of young.

Future management needs: deploy land-based signs only if significant human disturbance; maintain predator guard; continue volunteer monitoring; banding/sampling as resources permit.

Pontook Reservoir territory (Dummer)
Photo: Magill Bay nest area by Chris Martin / NH Audubon

Current (2010) status: nest location known; no closure signs deployed; no predator guard; active volunteer monitoring; indirect communication with land owner.

Future management needs: deploy land-based signs only if significant human disturbance; consider replacing predator guard; continue volunteer monitoring; banding/sampling as resources permit.

Reeds Wildlife Management Area territory (Orford)
Photo: Adult and fledgling on nest tree by Judy Lombardi

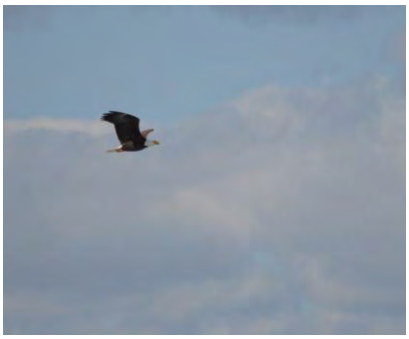
Current (2010) status: nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; direct communication maintained with land owner.

Future management needs: deploy water-based or land-based signs only if significant human disturbance; encourage active volunteer monitoring; maintain direct communication with land owner.

Reflection Pond territory (Shelburne)
Photo: Measuring chick by Derrick Jackson / Boston Globe

Current (2010) status: nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; direct communication maintained with land owner.

Future management needs: deploy land-based signs only if significant human disturbance; install predator guard; continue volunteer monitoring; banding/sampling as resources permit.



Round Island territory (Gilford)
Photo: Eagle flying over Saunders Bay by Brian Milzoff

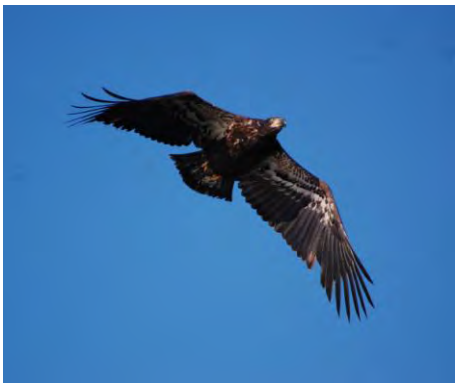
Current (2010) status: nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; land owner not yet identified.

Future management needs: deploy land-based signs only if significant human disturbance; install predator guard; continue volunteer monitoring; establish direct communication with land owner; banding/sampling as resources permit.

Silver Lake territory (Tilton)
Photo: After-hatch-year immature eagle in Tilton by Peter Gray

Current (2010) status: nest location known; no closure signs deployed; installed camouflaged predator guard; active volunteer monitoring; direct communication maintained with land owner.

Future management needs: deploy land-based signs only if significant human disturbance; continue volunteer monitoring; banding/sampling as resources permit.



Squam Lake territory (Moultonborough)
Photo: Squam eagle fledgling on the wing by Lee Grenier

Current (2010) status: nest location known; water-based buoys deployed by Squam Lakes Association (SLA); camouflaged predator guard maintained; active volunteer monitoring; indirect communication with land owner.

Future management needs: land-based and/or water-based buoys deployed by SLA; maintain predator guard; continue volunteer monitoring; maintain relationship with local caretakers.

Surry Mtn Lake/Chickering Farm territory (Surry/Westmoreland)
Photo: Eagle pair on Connecticut River by Judy Lombardi

Current (2010) status: no nest location known; no closure signs deployed; no predator guard installed; active volunteer monitoring; indirect communication with land owner.

Future management needs: locate nest; evaluate need for water-based buoys and/or land-based signs; continue volunteer monitoring.

Umbagog Lake West territory (Errol)
Photo: Androscoggin River sunrise by Laura Deming

Current (2010) status: nest location known; water-based closure signs deployed by USFWS; predator guard maintained; no active volunteer monitoring; direct communication maintained with land owner.

Future management needs: water-based closure signs deployed by USFWS; maintain predator guard; promote more timely USFWS reporting of monitoring results.

Vernon Dam territory (Hinsdale)
Photo: Nest site buffer sign below Vernon Dam by Chris Martin

Current (2010) status: nest location known; seasonal closure signs deployed; camouflaged predator guard installed; active volunteer monitoring; direct communication maintained with land owner.

Future management needs: deploy closure signs annually due to significant human disturbance risk; continue volunteer monitoring; banding/sampling as resources permit.

Webster Lake/Pemi River territory (Franklin/Hill)
Photo: Adult male on Pemigewasset River by Chris Martin

Current (2010) status: no nest location known; no closure signs deployed; no predator guard; active volunteer monitoring; land owner not yet identified.

Future management needs: locate nest; evaluate need for water-based buoys and/or land-based closure signs; install predator guard; continue volunteer monitoring.

Table 6. New Hampshire bald eagle band recovery data since conclusion of 2009 breeding season.

Individual bird ID	Recovery Date	Recovery Location	Banding Location	Reporter/ collector	Outcome
HY2006 sub-adult female, 629-52248 (left), red X/R (right)	3/10/2010	Bow Lake, Northwood, NH	Square Pond, Shapleigh, York Co., ME	C. Martin, NHA staff	4 yrs old, alive and well, at nest
HY2004 adult male, 629-48121 (right), gold WP2 (left)	3/11/2010	Connecticut River, Orford, NH	Vernon Dam, Hinsdale, Cheshire Co., NH	C. Martin, NHA staff	6 yrs old, alive and well, at nest
HY2004 adult, 629-50010 (right), black 5/P (left)	3/27/2010	Magalloway River Wilsons Mills, ME	Pontook Res., Dummer, Coos Co., NH	Janne Provencher, NHA volunteer	6 yrs old, alive and well, at wintering site
HY2005 adult male, 629-48127 (right), gold WP8 (left)	4/?/2010	Lake Shirley, Lunenburg, MA	Vernon Dam, Hinsdale, Cheshire Co., NH	Dale Martin, MassWildlife volunteer	5 yrs old, live and well, at nest
HY2001 adult, 629-45908 (left), none (right)	5/17/2010	Dodge Falls Dam, Bath, NH	Attean Lake, Jackman, Somerset Co., ME	Bob Thornton, Dodge Falls Dam operator,	9 yrs old, found dead
HY1999 adult female, 629-35782 (right), gold WA8 (left)	5/27/2010	Little Loon Is., Squam Lake, Moultonboro, NH	Little Quabbin Is., Quabbin Res., Ware Co., MA	Rick Libbey, NHA volunteer	11 yrs old, alive and well, tending young
HY2004 adult, 629-48116 (right), WN7 (left)	6/3/2010	Chickering Farm, Westmoreland, NH	unid. territory West Springfield, MA	Debra Gode, NH wildlife rehabilitator	6 yrs old, in distress, died under vet's care
HY1997 adult male, 629-38545 (right), gold W86 (left)	6/23/2010	Little Loon Is., Squam Lake, Moultonboro, NH	Russ Mtn,, Quabbin Res., MA	Rick Libbey, NHA volunteer	13 yrs old, alive and well, tending young
HY2004 adult male, 629-45164 (left), red K/U (right)	6/26/2010	Bow Lake, Northwood, NH	Cobboseecontee Lake, West Gardiner, Kennebec Co., ME	Jon Winslow, NHA volunteer	6 yrs old, alive and well, at nest
HY1997 adult male, 629-38546 (right), gold W84 (left)	7/1/2010	Nubanusit Lake, Hancock, NH	Little Quabbin Is., Quabbin Res., Ware Co., MA	Chris Martin, NHA staff	13 yrs old, alive and well, tending young
HY1992 adult female, 629-36675 (right), gold W22 (left)	7/1/2010	Nubanusit Lake, Hancock, NH	Little Quabbin Is., Quabbin Res., Ware Co., MA	C. Martin, NHA staff	18 yrs old, alive and well, tending young
HY2004 adult female, 629-48122 (left), gold WP3 (right)	7/4/2010	Merrymeeting Marsh, New Durham, NH	Quabbin Res., New Salem, Franklin Co., MA	Sue Randall, NHA volunteer	6 yrs old, alive and well, tending young
HY2007 immature, 629-52960 (r), black K/9 (left)	8/18/2008	unid location, Brunswick, ME	Cocheco River, Dover, Strafford Co., NH	Bird Banding Lab via Michael Amaral, USFWS	1 yr old, found alive, present status?

Primary nests are known for 16 of the 22 occupied bald eagle breeding territories in New Hampshire in 2010; nests have not yet been located for the other six occupied territories. NHA staff maintains records of and contacts with landowners/managers of eagle nests locations within the state. Appendix 1 (available to wildlife agency cooperators only) includes specific information about site name, township, status of land (public or private), land owner name, land manager name, and other important contact information. Nest site ownership classification of the 16 primary nests documented in 2010 includes three sites on public land (19%) and 13 sites (81%) on private land. Only 23% (3 of 13) of primary nests on private land have the management benefit of formal conservation easements. GPS location data for all nest sites have been provided to NH Natural Heritage Bureau.

Technical expertise:

NHA staff provided technical assistance on breeding bald eagles, their habitat, and management to state wildlife agency personnel (primarily in New Hampshire, but also Vermont and others), land owners, environmental non-profit groups, and members of the public. Most significant contacts to date during the current contract year are listed in Table 8 on page 20. Numerous less significant contacts, usually involving only single phone calls or one-time e-mail correspondence are not listed, nor are contacts which occurred prior to April 1, 2010.

Volunteer training:

In 2010, NHA staff interacted with and directly trained volunteers on an individual basis. NHA staff interacted frequently (in the field, by telephone, and via e-mail) with experienced volunteers, many of whom have attended field training sessions in prior years. During the 2010 breeding season, a total of 63 individuals actively reported observations from specific eagle breeding sites. Given their level of experience, many of these individuals required minimal direct supervision or additional training, yet they provided invaluable observational data on eagle breeding attempts. In addition, a total of 30 volunteers contributed observations from elsewhere across the state, including from areas that are considered potential future breeding territories.

Table 7. Dead/injured eagles recovered in New Hampshire since end of 2009 breeding season.

Individual bird ID	Recovery Date	Recovery Location	Reporter/ collector	Comments
AHY imm GOEA, unbanded	10/15/2009	Large upland field, Bodge Hill Road, Moultonboro, NH	2 citizens found, Tony Tur, USFWS staff	Found alive, but recovered dead, necropsy done, lead poisoning ruled out
HY2009 imm BAEA, unbanded	10/22/2009	Clear cut west of Millsfield Pond, Millsfield, NH	Will Staats and Andy Timmins, NHFG staff	Recovered alive, 3 pieces of shot removed, released 12/14/2009 banded 629-52973 (r), black A/D (l)
HY2001 adult BAEA, 629-45908 (left), none (right)	5/17/2010	Dodge Falls Dam, Ryegate, VT / Bath, NH	Bob Thornton, Dodge Falls Dam operator	9 yrs old, found dead, transported to Maine for necropsy, results pending
HY2004 adult BAEA, 629-48116 (right), gold WN7 (left)	6/3/2010	Chickering Farm, Westmoreland, NH	Debra Gode, NHA wildlife rehabilitator	6 yrs old, recovered in respiratory distress, later died, on breeding terr?
adult BAEA, unknown age, unbanded	9/13/2010	Chestnut Cove, Lk Winnipesaukee, Alton, NH	citizen report, Jim Juneau, NHFG C.O.	5+ yrs old, death captured on video over 3-hr period, necropsy pending

Table 8. Bald eagle technical assistance contacts for the period from April 1 - October 15, 2010

Date	Individual	Organization	Contact Type	Contact Topic
04/07/2010	Kai Bicknell	AMC	email	Blueberry Island BAEA site mgmt
04/08/2010	Kim Tuttle	NHFG	email	NHB10-0840 Friends of Hanover Crew
04/09/2010	Rachel Stevens	NHFG	email, field visit	Wilcox Point WMA
04/09/2010	Lee Carbonneau	Normandeau Assoc.	email	Carthagena Island human-built nest
04/16/2010	Kim Tuttle	NHFG	email	Nat Grid G-33 line in Hinsdale
04/30/2010	Kim Tuttle	NHFG	email	NHB10-0892 I-93 in Bow
05/03/2010	Tim Fleury	UNH Coop Extension	email, phone	Merrimack River activity
05/04/2010	Tony Tur	USFWS-NEFO	email, phone	permits
05/06/2010	Kim Tuttle	NHFG	email	CT River Project 14747
05/10/2010	Chris DeSorbo	BRI	field visit	Plainfield banding/sampling
05/12/2010	various	various	email	announce Groveton pair discovery
05/17/2010	Earl Brissette	TransCanada	email	request permission to climb
05/20/2010	Greg Jellison	NHFG	phone	dead eagle from Dodge Falls dam
05/25/2010	Dave Robinson	Nubanusit Lake Asso	field visit	deploy BAEA buoys
06/06/2010	Debra Gode	Wildways Rehab	email	sick/dead eagle Chickering Farm
06/10/2010	Iain MacLeod	Squam Lakes NSC	email	photographer has band IDs
06/14/2010	Kai Bicknell	AMC	email	Blueberry Island BAEA site mgmt
06/23/2010	Mark Wilson	Boston Globe	email	BAEA recovery questions
06/23/2010	Jon Winslow	citizen	email	photographer has band IDs
06/28/2010	Julie Robinson	NHFG	phone	injured BAEA call
06/29/2010	Nancy Carmer	Strafford Rivers Cons.	field visit	windstorm damage at BAEA nest site
07/07/2010	public report	citizen	field visit	report of dead BAEA in Harrisville
07/13/2010	Madeline Buckley	Concord Monitor	office visit	media interview re: BAEAs
07/20/2010	Andy Hershberger	WMUR	office visit	media interview re: BAEAs
07/23/2010	Harrison Haas	Laconia Citizen	office visit	media interview re: BAEAs
07/28/2010	Kai Bicknell	AMC	field visit	BAEA public presentation
07/29/2010	Harry Vogel	LPC	field visit	BAEA public presentation
07/30/2010	John Wimsatt	NHFG	email, phone	report of citizen feeding BAEAs
08/03/2010	John Jurcynzski	Rockywold	field visit	BAEA public presentation
08/06/2010	Haven North	citizen	email, phone	contact owner of BAEA nest site
08/13/2010	various	various	email	distribute 2010 BAEA season summary
09/02/2010	Chris Devine	SLA	email	BAEA buoy maintenance issues
09/09/2010	Pete Bowman	NHNHI	email	provide NH BAEA info
09/10/2010	Dave Robinson	Nubanusit Lake Asso	field visit	BAEA buoy removal/storage
09/16/2010	John Buck	VT F&W	email	provide NH BAEA info
09/16/2010	Jim Juneau	NHFG	field visit	dead BAEA from Alton
09/17/2010	Judy Tumosa	NHFG	email, phone	planning BAEA teacher workshop
09/17/2010	Tony Tur	USFWS-NEFO	field visit	dead BAEA from Alton
09/23/2010	John Briggs	Security Team North	phone	video of dead BAEA from Alton
09/28/2010	Emily Bjerre	USFWS	phone	discuss BAEA post-delisting plan
09/29/2010	Judy Tumosa	NHFG	phone	planning BAEA teacher workshop
10/01/2010	Kim Tuttle	NHFG	email, phone	NHB10-2293 Concord River Trail
10/06/2010	Wade Eakel	US Army Corps	email	planning mid-winter BAEA survey
10/19/2010	Charlie Todd	ME DIF&W	email, phone	Androscoggin watershed BAEAs
10/22/2010	Kim Tuttle	NHFG	email	Alton traffic circle site
10/27/2010	Kim Tuttle	NHFG	email	NHB10-2608 Sleepers Is.

Recommended Actions for Future Monitoring and Management

The following five recommendations are broad monitoring and management steps that will influence our capacity for effective breeding bald eagle monitoring and management in New Hampshire in the future:

1. **Support and seek funding to sustain post-delisting monitoring –** The NHFGD Nongame Program, and cooperators such as NHA, should fully cooperate with and participate in the USFWS's post-delisting monitoring plan for bald eagles (see U.S.D.I., FSW 2009) by continuing to track and report on breeding attempts and productivity at New Hampshire nests during the 20-yr proposed post-delisting assessment period. NHFGD should make direct inquiries with USFWS project coordinators to determine whether supplemental funding may be available to assist states like ours as we carry out such work, which is critical to the success of the federal post-delisting monitoring program.

2. **Implement bald eagle conservation actions listed in the NH WAP** – The NHFGD Nongame Program should strive to implement recommended actions listed in the Bald Eagle Conservation Actions section of the New Hampshire Wildlife Action Plan, Appendix A: Bald Eagle Species Profile, Element 4 (State of New Hampshire 2005). These actions include continued monitoring of breeding sites, developing a state recovery plan, determining contaminant loads, managing potential conflicts with human activities, and developing clearer guidelines and stronger regulations to protect the integrity of shoreline habitat. Specific conservation actions are discussed in greater detail below. Additional financial resources may be required to accomplish some of these recommendations, but further funding through State Wildlife Grants program may be an option.

3. **Create a New Hampshire bald eagle recovery plan –** The NHFGD and its cooperators should develop a written bald eagle recovery plan that is patterned after Vermont's Bald Eagle Recovery Plan (State of Vermont 2010), which is currently available only in draft form. This is needed to establish numerical delisting/recovery goals for breeding bald eagles in New Hampshire and to guide how managers will address present and future threats to the eagle population.

4. **Determine contaminant loads in eagles –** Whenever possible, wildlife managers in New Hampshire should work collaboratively with colleagues and researchers in neighboring states to monitor contaminant loads in New Hampshire eagles. Fortunately, because bald eagles in New England are essentially part of a multi-state meta-population, wildlife managers in New Hampshire can benefit significantly by applying findings on contaminant issues already produced by Maine's Department of Inland Fish & Wildlife, from cooperating groups such as BRI, and from similar monitoring efforts in other northeastern states. Maine in particular has conducted an extensive evaluation of mercury contamination in eagles (DeSorbo and Evers 2007, Mierzykowski 2010), and BRI has extensively reviewed the situation in New England and adjacent parts of Canada (Evers et al. 2007). Finding and recommendations from these studies can and should be applied to present and future contaminant concerns throughout New England, including in New Hampshire.

5. **Manage human-eagle conflicts and strengthen shoreline protection mechanisms –** these two closely related actions are the key to continued recovery and breeding success of bald eagles in the state, regardless of their official classification on state and federal T&E lists. River and lake shorelines continue to be targeted for development at an alarming rate, with negative consequences for all riverine and lacustrine wildlife. NHFGD should continue to pursue active partnerships with other New Hampshire state agencies to improve overall shoreline protection regulations and enforcement.

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