

Maine's 2018 Survey of Nesting Bald Eagles: Evaluating the Health and Conservation Needs of a Recovered Endangered Species



Charles Todd, Thomas Schaeffer, Kendall Marden, Amy Meehan, and Mark Caron
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Table of Contents

	<u>Page</u>
List of Figures	ii
List of Tables	ii
1.0 Executive Summary	1
2.0 Historical Perspective	2
3.0 Introduction	3
4.0 Methods	4
5.0 Results and Discussion	5
5.1 Statewide status and changes	6
5.2 Androscoggin County status and changes	12
5.3 Aroostook County status and changes	13
5.4 Cumberland County status and changes	14
5.5 Franklin County status and changes	15
5.6 Hancock County status and changes	16
5.7 Kennebec County status and changes	18
5.8 Knox County status and changes	19
5.9 Lincoln County status and changes	20
5.10 Oxford County status and changes	22
5.11 Penobscot County status and changes	23
5.12 Piscataquis County status and changes	24
5.13 Sagadahoc County status and changes	26
5.14 Somerset County status and changes	27
5.15 Waldo County status and changes	28
5.16 Washington County status and changes	29
5.17 York County status and changes	31
6.0 Summary and Recommendations	32
7.0 Literature Cited	34
8.0 Acknowledgements	35

List of Figures

	<u>Page</u>
Figure 1. Typical appearance of a bald eagle nest in Maine	5
Figure 2. Statewide abundance of bald eagle nesting in Maine, 1962 - 2018	6
Figure 3. Distribution of bald eagles nesting in Maine, 2013	9
Figure 4. Distribution of bald eagles nesting in Maine, 2018	10
Figure 5. Abundance of bald eagle nesting in Androscoggin County, 1962 - 2018	12
Figure 6. Abundance of bald eagle nesting in Aroostook County, 1962 - 2018	13
Figure 7. Abundance of bald eagle nesting in Cumberland County, 1962 - 2018	14
Figure 8. Abundance of bald eagle nesting in Franklin County, 1962 - 2018	15
Figure 9. Abundance of bald eagle nesting in Hancock County, 1962 - 2018	16
Figure 10. Abundance of bald eagle nesting in Kennebec County, 1962 - 2018	18
Figure 11. Abundance of bald eagle nesting in Knox County, 1962 - 2018	19
Figure 12. Abundance of bald eagle nesting in Lincoln County, 1962 - 2018	20
Figure 13. Abundance of bald eagle nesting in Oxford County, 1962 - 2018	22
Figure 14. Abundance of bald eagle nesting in Penobscot County, 1962 - 2018	23
Figure 15. Abundance of bald eagle nesting in Piscataquis County, 1962 - 2018	24
Figure 16. Abundance of bald eagle nesting in Sagadahoc County, 1962 - 2018	26
Figure 17. Abundance of bald eagle nesting in Somerset County, 1962 - 2018	27
Figure 18. Abundance of bald eagle nesting in Waldo County, 1962 - 2018	28
Figure 19. Abundance of bald eagle nesting in Washington County, 1962 - 2018	29
Figure 20. Abundance of bald eagle nesting in York County, 1962 - 2018	31
Figure 21. MDIFW Warden Service pilots, 2018	35
Figure 22. Tom Schaeffer, MDIFW Regional Wildlife Biologist observer, 2018	36

List of Tables

	<u>Page</u>
Table 1. Changes in abundance (by county) of bald eagles nesting in Maine between the last statewide inventories conducted in 2013 and 2018	7
Table 2. Project accounting for the 2018 bald eagle nesting inventory	11

1.0 Executive Summary

The Maine Department of Inland Fisheries and Wildlife (MDIFW) conducted a statewide inventory of nesting bald eagles (*Haliaeetus leucocephalus*) during 2018. Maine's Outdoor Heritage Fund (project #181-01-06) in combination with Maine's Endangered and Nongame Wildlife Fund provided 25% of operational costs to match 75% federal aid from the U.S. Fish and Wildlife Service (USFWS) - Division of Wildlife and Sport Fisheries Restoration. The Pittman - Robertson Federal Aid in Wildlife Restoration Act (1937) established the latter funding mechanism as a trust for state wildlife agencies conducting tasks approved in five-year grant agreements with USFWS.

In 2018, MDIFW catalogued more than 2,600 observations at 2,090 traditional bald eagle nest locations during 239.5 hours of aerial survey flight time. All nest locations (past and present) had one or more overflights to determine the presence of an intact nest; residency of nesting pairs or single adults; and breeding activity at nests. Aerial monitoring of nesting bald eagles is a long-established technique preferred because of its efficiency and ease of monitoring remote areas. The 2018 survey averaged more than one observations every six minutes, a rate unapproachable by other methods.

Fifteen nests in neighboring New Hampshire, New Brunswick, and Quebec were monitored to ensure that resident eagles had not shifted to an alternate location in Maine. Population statistics reported here are limited to locations within the state of Maine during 2018:

- 834 intact bald eagle nests (+ 69 since the 2013 inventory)
- 734 nesting pairs statewide (+ 102 since 2013)
- 55 nesting areas unoccupied by apparently single adult eagles (+ 27 since 2013)
- 87 traditional nesting areas unoccupied by eagles in 2018
- 90% overall occupancy of traditional nesting territories monitored in 1962 - 2018

Population increases occurred in all sixteen counties across Maine. Three counties in eastern Maine continue to function as the population stronghold in the State but growth rates in two (Hancock County and Washington County) have notably decreased since 2013. The third, Penobscot County, achieved 16% growth over the past five years equaling the statewide average. Increases in nine other counties in central, western, and northern Maine far exceeded the statewide average during 2013 - 2018. Regional trends and status are discussed for each of Maine's sixteen counties.

Productivity of nesting eagles was not formally evaluated in 2018. That option ended at the onset of the nesting season after two major snowstorms in mid-March caused widespread breeding failures and nest destruction. Breeding birds that fail early are quite difficult to census. As many as seven rechecks of empty nests were sometimes necessary to detect pair residency. Nest repairs occurred throughout the year. This atypical timing again reinforced the extreme influence of weather events in 2018.

Conservation status and public ownership of bald eagle nest locations in Maine was evaluated after completion of surveys. These lands function as a “safety net” to minimize risks of setbacks to species recovery due to land use changes:

- 40% (N = 831) of all traditional nests are located on lands now located on either state, federal, municipal or other conservation ownership and / or appropriate conservation easements.
- 56% (N = 1,154) of all traditional nests are located within ¼ mile of lands in either state, federal, municipal or private conservation ownership and / or appropriate conservation easements.
- 82% (N = 1,701) of all traditional nests are located within one mile of lands in either state, federal, municipal or private conservation ownership and / or appropriate conservation easements.

2.0 Historical Perspective

There is no doubt that nesting bald eagles were once widely distributed. Past estimates of abundance are speculative. Early accounts of this species in Maine (Knight 1908, Palmer 1949) tallied known nests to generate very conservative estimates. Many remote coastal islands, lakes, and rivers favored as nesting habitat were inaccessible or visited infrequently. Vast rural areas over much of Maine were likely under-represented.

A few historic accounts hinted at an exceptional abundance of bald eagles locally in coastal Maine. Early settlers fed eagles to hogs on Casco Bay islands, and the town of Vinalhaven adopted an eagle bounty in 1806. The name “Eagle” at many lakes, ponds, streams, and islands implied that the species was not uncommon. A naturalist in the Midcoast region identified at least fifteen nesting pairs on the Kennebec River estuary downriver from Bath (Spinney 1926): an area that currently supports only half of that number despite the record high counts in 2018 noted in this report. The clear inference is that historic accounts vastly misjudged actual eagle numbers.

Public awareness escalated during the 1950s with mounting evidence of widespread declines among bald eagles across the U.S. An amateur bird bander questioned why all the bald eagle nests where he had frequently banded young eaglets in the past were becoming vacant across coastal Maine (Townsend 1957). The National Audubon Society initiated a continental survey of six populations (including Maine; Sprunt *et al.* 1973) to track the decline in numbers and poor reproductive success.

Efforts to monitor Maine’s statewide population began in 1962. Inventories were initially ground-based efforts or monitoring from boats. By 1970, low-altitude surveys from small aircraft became routine due to the improved efficiency of monitoring as well as the ability to search abundant and remote potential habitats available to the species in Maine (Todd 1988). After some initial changes in methods and survey intensity, Maine’s nesting inventory of bald eagles has maintained a consistent strategy for more than forty years to monitor all nest locations found since 1962 (Todd 2004).

Bald eagles in southern states (south of the 40th parallel) were listed as an “endangered species” in 1967 under the U.S. Endangered Species Preservation Act of 1966. From 1972 to 1975, USFWS coordinated bald eagle surveys in Maine. In 1978, bald eagles were classified as “endangered” in 43 of the conterminous states (including Maine) and “threatened” in five (Michigan, Minnesota, Oregon, Washington and Wisconsin) under the modern U.S. Endangered Species Act (ESA) enacted in 1973.

MDIFW entered into a cooperative agreement with USFWS in 1976 and assumed the lead role for bald eagle monitoring. Contracts with the University of Maine enabled early monitoring, research and management (Todd 1979, McCollough 1986, Livingston 1987, Welch 1994, Matz 1998). MDIFW staff independently performed all aerial surveys and related recovery tasks since 1986. The statewide nesting inventory also guided research, land use regulations, and landscape conservation in addition to its primary function to generate an index of population abundance and distribution.

3.0 Introduction

All traditional nest locations identified in Maine since 1962 were monitored for the presence of a nest, eagle residency, breeding activity, and conservation status of the nesting habitat. With few exceptions, this survey (1) generated annual indices to track population status for more than 40 years and (2) steered management, regulations, and research integral to species recovery.

Survey findings surpassed established benchmarks in 1995 to enable “down-listing.” The status of bald eagles formally changed from “endangered” to “threatened” under the U.S. Endangered Species Act across its range in the lower 48 states that year. In 1996, the State Legislature adopted a similar change under the Maine ESA as recommended by MDIFW. In 2007, “de-listing” occurred throughout the conterminous U.S. under the federal ESA. The analogous reclassification of bald eagles from “threatened” to “de-listed” occurred in 2009 under the Maine ESA (Title 12 MRS, §12810) after MDIFW verified that all five recovery criteria had been surpassed (Todd and Matula 2008).

Starting in 2008, MDIFW shifted to periodic monitoring of Maine’s recovered bald eagle population once every 5 years. The last statewide inventory occurred in 2013. That year MDIFW started with 1,391 locations of intact and former nests inherited from the 2008 survey and added 399 new nests found during 2013. Partial surveys during 2009 - 2012 helped maintain a robust and current list of nest locations, but the magnitude of searching inherent in periodic surveys was now apparent.

In the last statewide inventory conducted in 2013, MDIFW tallied 633 nesting pairs statewide. Twenty-seven nesting territories were occupied by apparently single adult eagles. A total of 765 nests were intact at some point during the season. It is important to note that the ever-increasing sample of nest locations reflects both actual population gains as well as new nests built by pairs that simply had to replace a fallen nest since the previous inventory. Over a thirty-year period of systematic monitoring, Maine’s eagle

population exhibited 6% annual growth in numbers as well as a 7% turnover in nest locations of established pairs.

Thus, MDIFW began the 2018 statewide inventory with a baseline of 1,790 traditional (intact and former) nest locations based upon the 2013 data. Unlike the previous five-year interval, the number of updates during 2014 - 2017 were insignificant. Thus, the 2018 inventory of Maine's bald eagle population took on the burden of a five-year backlog of new and changing nest locations. Spring snowstorms confounded the situation with unprecedented levels of fallen nests, damaged nests, and breeding failures early in the season.

Also, USFWS personnel resumed their "post-delisting" surveys of nesting bald eagles in 2018. This is an independent aerial survey that searches randomized plots for nesting eagles allowing statistical comparisons with the MDIFW statewide inventory. The results of that effort are still being evaluated. No monitoring effort yields a complete count, but this "dual frame" strategy enables statistical analyses, confidence intervals on the MDIFW inventory, and objective measures of the MDIFW survey efficiency.

4.0 Methods

MDIFW biologists and Warden Service pilots conducted 239.5 hours of aerial surveys during the period March 12 - July 31, 2018. Monitoring of all traditional nest locations and most searches occurred during the spring months. A Maine Warden Service pilot was accompanied by one or two biologists serving as observers. Our eighteen different observers collectively have more than 7,000 hours experience conducting aerial surveys for bald eagles. Experienced personnel are essential to both the quality and safety margins of low-altitude survey missions.

Cessna 185 Skywagon or Cessna 172 Skyhawk aircraft were flown at heights of 500 - 1,300 feet above ground level and airspeeds in the range of 90 - 120 miles per hour. We searched for alternate nests within a one-mile radius around all traditional nests. Initial searches occurred over a water body to optimize views of shorelines favored by eagles. Parallel flights over adjacent uplands were at ~0.5-mile intervals depending on topography and forest features that influence habitat quality and detectability of spotting undiscovered nests. Thus, coniferous forests with many dominant pines along an intricate shoreline or on uneven topography merit more attention than deciduous forests on uniform terrain before leaf emergence. Ground- or boat-based observations at twelve nest locations supplemented aerial monitoring to evaluate residency of nesting pairs.

Definitive criteria for pair residency included observing two adult eagles at a nest or in the immediate vicinity (Figure 1); an incubating adult eagle (prone posture), eggs, or shell fragments in the nest; a brooding adult eagle (hunched posture), nestling eaglets, or their remains in nests; and construction of a nest during the monitoring period. Occupancy reflects the presence of a nesting pair or a single adult. The latter is not tallied in the statewide count of nesting pairs.



Figure 1. Typical appearance of a bald eagle nest in Maine. The observation definitively documents residency of an eagle pair, but the posture of the adult in the nest does not validate that an active breeding attempt is in progress.

Occupied nests found during the spring nesting inventory are typically rechecked in June or early-July to count nearly full-grown eaglets in the nest to gauge nesting success rates ($\#$ nests with fledglings / $\#$ resident eagle pairs) and overall productivity ($\#$ fledglings / $\#$ resident eagle pairs). Because of the high incidence of non-breeding or early-season nest failures noticed in the spring inventory, we reallocated flight time planned for the summer productivity survey toward additional searches and rechecks of apparently unoccupied nests to repair the primary abundance index (the tally of nesting pairs) as much as possible.

A Geographic Information System (GIS) analysis of nest locations was compared with the geospatial layer of conservation lands in the state maintained by Maine GIS, Office of Information Technology. We added information on properties and easements held by several local land trusts where these data are lacking. Results were tallied on several scales: nests that are on conservation land, nests that benefit from conservation within one-quarter mile (primary nest habitat and buffer), and nests that benefit from conservation within one mile (core home range of nesting eagles).

5.0 Results and Discussion

MDIFW had never attempted a statewide nesting inventory after a complete lapse of monitoring during the previous five years. Staff anticipated some inefficiencies from the extent of time devoted to tedious searching for new nests. The discovery of 290 nests

newly documented since 2013 inventory was adequate validation that such an effort was feasible. The advanced stage of bald eagle recovery across Maine and diminished management intensity for those locations certainly does not warrant population monitoring more frequently than the current five-year cycle.

The trends in recovery status vary greatly across Maine. We report the findings here on both statewide and regional scales. A county framework is used here for the familiarity of readers, but watersheds are preferable to understand eagle numbers in relation to habitat quantity and available food resources. It is likely than any future eagle monitoring in Maine may be based on regional sampling. Hydrologic Unit Codes (e.g., HUC - 12) assemblages of river systems and coastal bays provide a hierarchical framework for future inventories if statewide efforts are deemed too costly or needless.

5.1 Statewide population status and changes in Maine

Breeding population abundance and distribution:

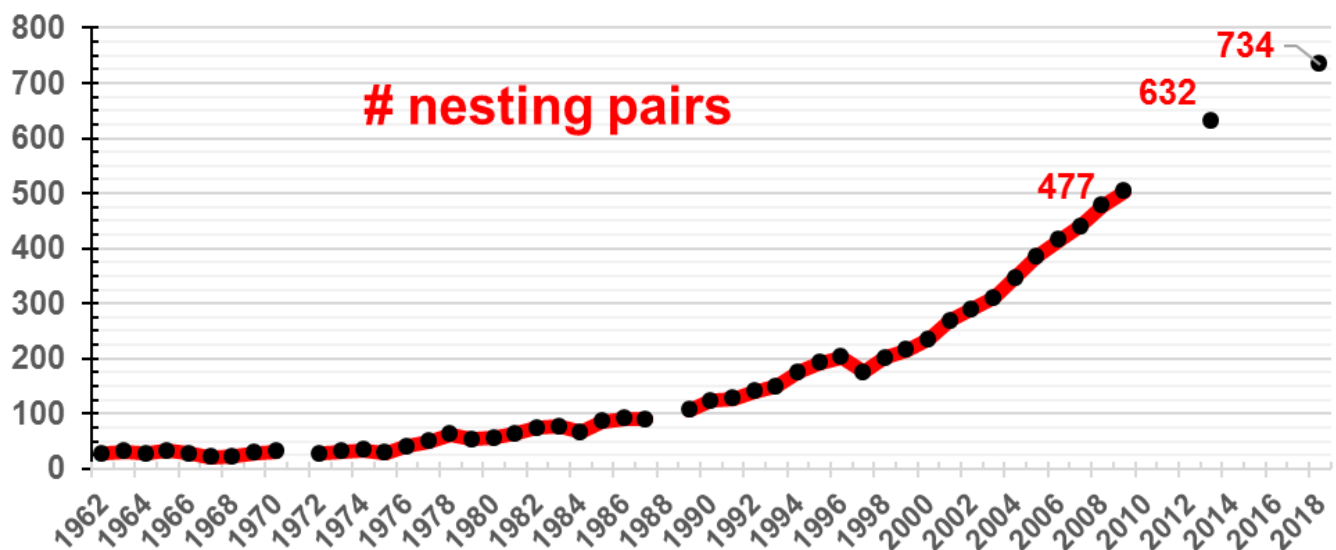


Figure 2. Statewide abundance of bald eagles nesting in Maine, 1962 - 2018.

The 2018 survey identified 734 nesting pairs across the state: an increase of 102 (16.1%) since the last comprehensive survey conducted in 2013. We observed single adults at another 55 nests, and 87 former nesting territories appeared to be unoccupied in 2018. The effort is always a “minimum count,” but this year’s preliminary total may have missed as many as forty pairs due to widespread, extreme weather events.

Eagles spend less time at nests if not tending eggs or nestlings. Large snowstorms in March caused widespread breeding failures. Some were confirmed by abandoned eggs or eggshell fragments, as well as numerous encounters of vacant eagle nests that were snow-filled except for a “donut-like” hole in the middle: a spot where a prone eagle had attempted to incubate its eggs even as the snow piled up around it.

Nest locations over time are clustered in so-called “territories.” Each territory represents the array of alternate nests used by a pair of breeding eagles or their successors. Most pairs maintain only a single nest at a time, and new nests typically arise when a nest or nest tree is damaged beyond repair. At least 32 territories have been in use for periods spanning 40 - 56 years indicating site loyalty by multiple generations of nesting eagles.

Three counties in eastern Maine (Hancock, Penobscot and Washington) retained their traditional notoriety as the population stronghold with at least 359 nesting pairs, 49% of the statewide count. The remnant stronghold for eagles nesting in the eastern U.S. was once confined to easternmost Washington County. However, the rates of increase among eagles in Washington County and Hancock County have significantly slowed since 2013 as these populations are possibly approaching density dependence. The expansion of eagle populations in these two counties previously equaled or exceeded Maine’s statewide average rate of increase.

County	# nesting pairs	change since 2013	% change since 2013
Androscoggin	13	+ 1	+ 8.3 %
Aroostook	46	+ 12	+ 35.3 %
Cumberland	26	+ 5	+ 23.8 %
Franklin	12	+ 3	+ 33.3 %
Hancock	115	+ 5	+ 4.5 %
Kennebec	44	+ 9	+ 25.7 %
Knox	30	+ 2	+ 7.1 %
Lincoln	31	+ 5	+ 19.2 %
Oxford	23	+ 6	+ 35.3 %
Penobscot	87	+ 12	+ 16.0 %
Piscataquis	59	+ 15	+ 34.1%
Sagadahoc	30	+ 9	+ 42.9 %
Somerset	32	+ 3	+ 10.3 %
Waldo	22	+ 1	+ 4.8 %
Washington	157	+ 8	+ 5.4 %
York	7	+ 5	+ 250 %
statewide	734	+ 102	+ 16.1 %

Table 1. Changes in abundance (by county) of bald eagles nesting in Maine between the last statewide inventories conducted in 2013 and 2018.

Nesting bald eagles increased numerically in all sixteen Maine counties since 2013. Rates of population growth over the past five years in nine Maine counties exceed the 16% statewide average; York, Oxford, Sagadahoc, Aroostook, Piscataquis, Kennebec, Cumberland, Franklin, and Lincoln Counties (in decreasing order of percent growth) exhibited proportionally greater gains over the last five years. The primary growth in numbers of bald eagles nesting in the State continued to shift westward and northward from the traditional stronghold and source population in Downeast Maine.

In 1978 when bald eagles were classified as Endangered in Maine, the distribution of the population (Figure 3) was heavily skewed to eastern Maine. Reduced range was one of the major challenges facing species recovery. Further, chronically depressed productivity was prevalent among Maine eagles except in the easternmost portion of Washington County adjacent to New Brunswick. Patterns of population recruitment and expansion of range among nesting bald eagles are limited by strong tendencies for young eagles to return to their natal region. Until new eagle pairs occupied a majority of the many potential nesting habitats available in eastern Maine, significant expansion of remnant populations in central, southern, western, and northern regions was unlikely.

Forty years later, eastern Maine is still the premiere region in the State for eagle nests owing to patterns of population recruitment. However, rates of population growth declined in eastern Maine over the last five years. For the first time, recovery rates there are less than the statewide average and levels measured in thirteen other counties across Maine. High nesting density encourages young eagles to pioneer other areas.

In 2018, the changes in distribution of eagle pairs (Figure 4) demonstrate vast range expansion. Areas of the State with relatively low nesting density (northern Maine and western Maine), now are most likely to benefit from further increases in the statewide population. Central Maine and the midcoast region have moderate nesting density of eagles relative to other areas of the State. Thus, it is likely that Kennebec, Knox, Lincoln, Penobscot, Sagadahoc, and Waldo Counties would be next to experience reduced rates of recovery as eagles approach regional carrying capacity there.

Conservation Status of Bald Eagle Nesting Habitat: We reviewed public and private conservation ownership overlaps within a one-mile radius of all 2,075 nest locations used in Maine during 1962 - 2018.

A total of 1,154 traditional nests (56%) in Maine benefit from public property, land conservation, and / or appropriate conservation easements within 400 yards (1/4 mile). Of that number, 831 traditional nests (40%) are located on the protected property. Within a one-mile radius, the clear majority (82%; N = 1,701) of all traditional nests have conservation lands or easements held by state or federal agencies, municipalities, Native American tribes, or non-governmental (NGO) conservation organizations. NGO partners include national and statewide partners as well as local land trusts.

Ten organizations (in order of decreasing number of nests influenced) were foremost in stewardship of eagle nests in Maine: Maine Bureau of Parks and Lands, Maine Department of Inland Fisheries and Wildlife, Maine Coast Heritage Trust, The Nature Conservancy, New England Forestry Foundation, National Park Service, U.S. Fish and Wildlife Service, Penobscot Nation, Passamaquoddy Nation, and Forest Society of Maine. At least 114 towns and cities also hold lands or easements within one-mile of an eagle nest in Maine. Except for a few wide-ranging projects, a variety of partners have converged attention to conserve individual nests in Maine. The result far exceeds objectives established for delisting bald eagles in the State (Todd and Matula 2008) as a safeguard from potential setbacks after special regulations for eagle nests ceased.

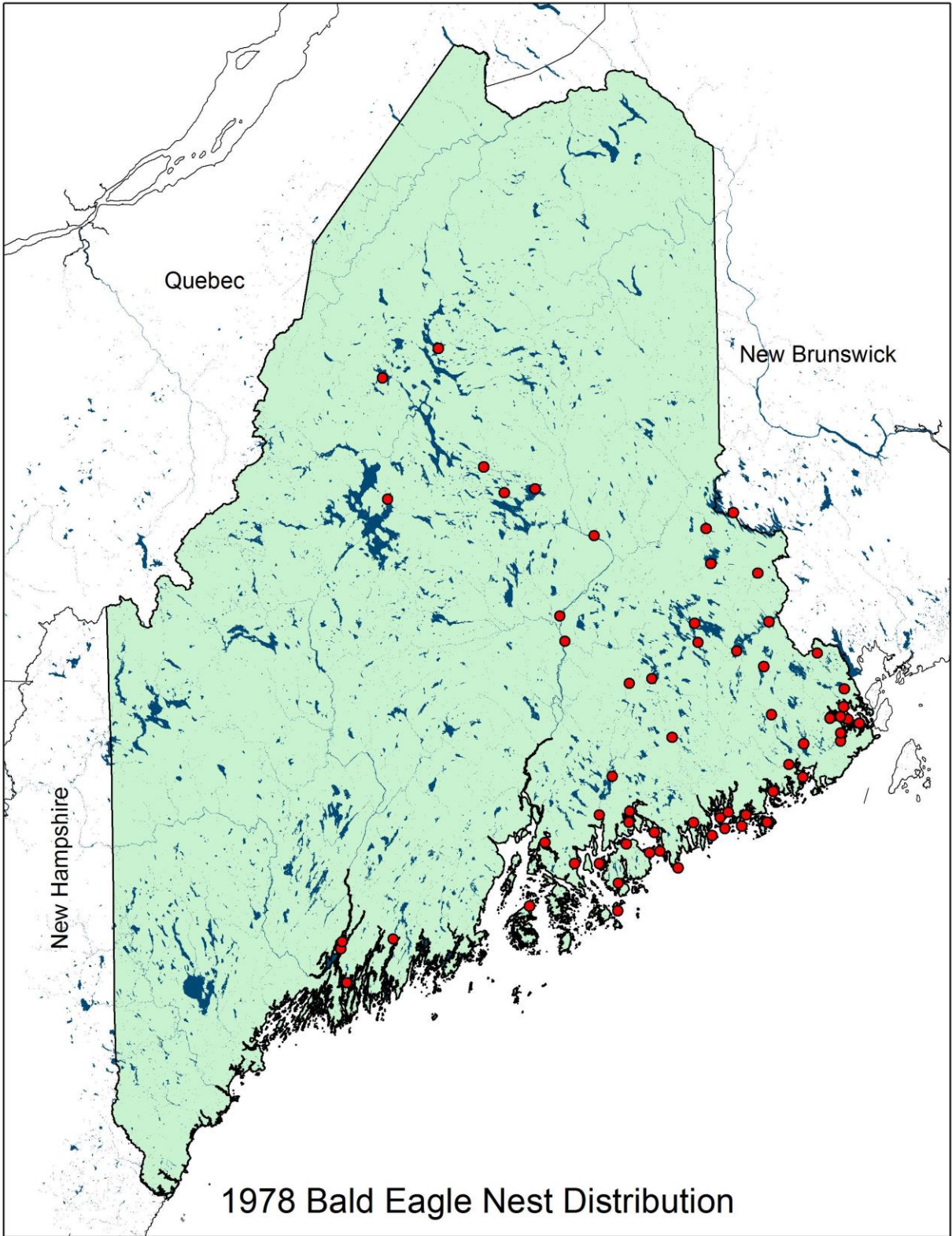


Figure 3. Distribution of bald eagles nesting in Maine, 1978.

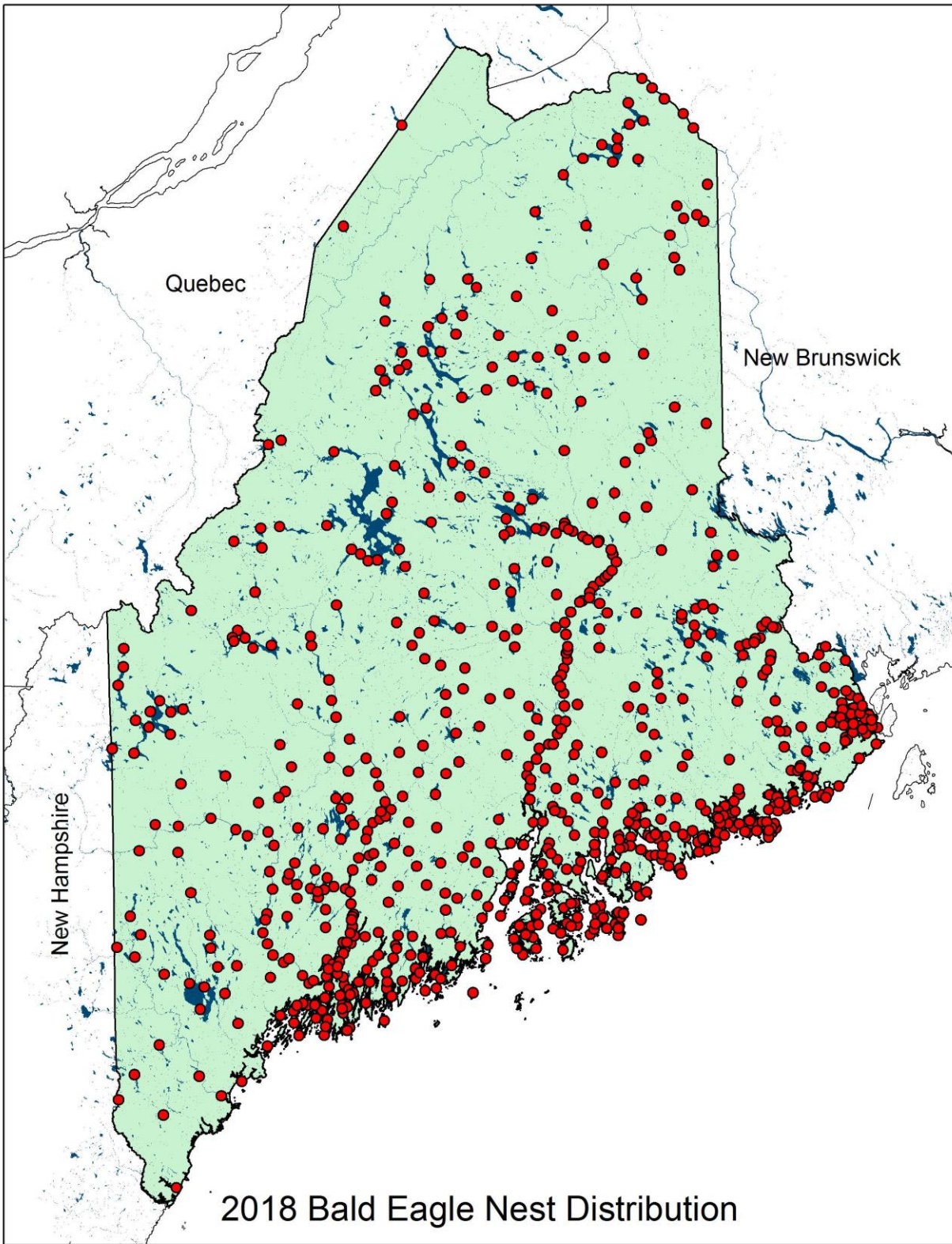


Figure 4. Distribution of bald eagles nesting in Maine, 2018.

2018 Survey Effort and Cost: We anticipated some extra challenges finding currently occupied eagle nests during this inventory because of the complete lack of active monitoring over a five-year interval since the last statewide survey in 2013. Overflights of known nest locations are straightforward and time-efficient. In contrast, searching for new nests is tedious and time consuming. Sufficient flight hours, personnel and operating funds were available to meet this challenge in 2018 (Table 2).

Survey personnel have also experienced local problems of unfavorable weather that also demand extra effort to avoid undercounting eagle pairs monitored after breeding failure. Past events of this nature were limited to a subset of the population affected by adverse weather. Weather impacts had a more finite influence in earlier surveys.

Unfortunately, early nest failures were widespread after two large snowstorms blanketed most of Maine with +/- three feet of snow in March, 2018 when most eagle pairs were either already incubating eggs or about to lay them. Prolonged snow accumulations in active nests often result in abandonment of nests and potentially false determinations that the site is unoccupied by eagles or only a single adult is present.

The only option to validate pair residency at nests lacking evidence of active breeding is to see both adults. We had to recheck these locations between one and seven times to finally detect the suspected presence of eagles since they can freely wander at that time of year if not tending eggs or nestlings. Since the problem was not localized, we depleted the remainder of our operational budget on this priority task rather than revisiting active nests to count fledgling eaglets and measure population productivity. Measures of eagle reproduction were much more critical twenty years ago during an era of low abundance and chronic population decline.

Project activity	Cost
Expenditures for aircraft flight time - 239.5 hours	\$23,471
Indirect costs - 9.02% for Maine Outdoor Heritage Fund	\$460
Indirect costs for WSFR federal aid - 15%	\$2,840
Total operational costs	\$26,771
In-kind personnel time - biologists and pilots	\$15,000
Total project costs	\$41,771
Project payments	Cost
Maine Outdoor Heritage Fund payment	\$5,000
Federal aid (WSFR Pittman - Robertson Fund) payment	\$36,771
Total payments	\$41,771

Table 2. Project accounting for the 2018 bald eagle nesting inventory.

5.2 Androscoggin County status and changes

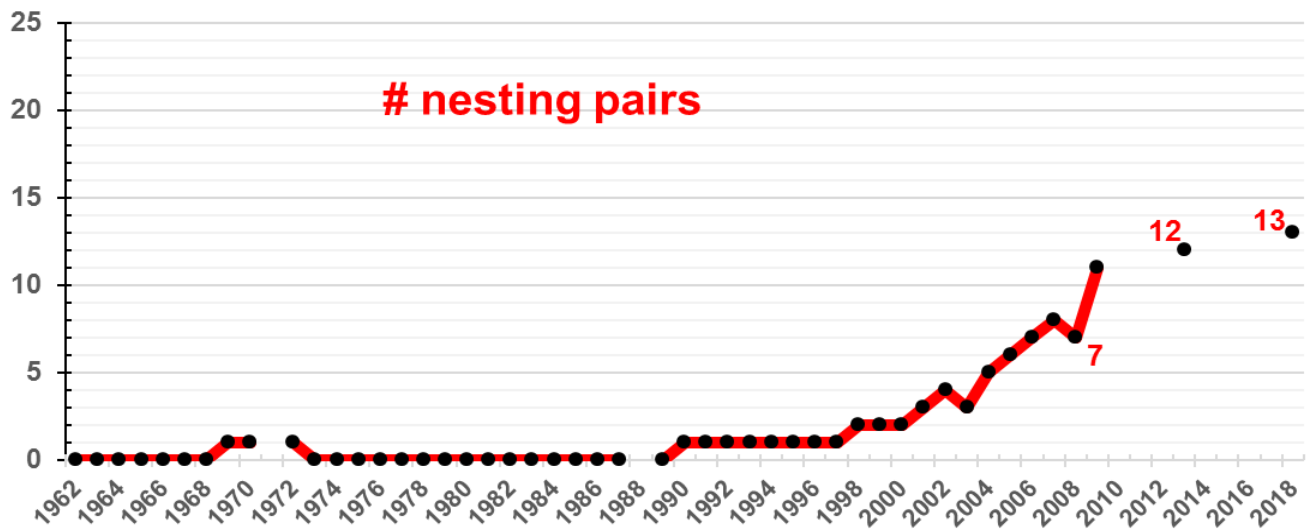


Figure 5. Abundance of bald eagles nesting in Androscoggin County, 1962 - 2018.

Survey summary statistics for Androscoggin County, 2018:

- Sample size =
 - 19 intact nests found at
 - 38 traditional nest locations monitored in
 - 14 distinct nesting territories
- Territory residency =
 - 13 territories occupied by nesting pairs
 - 1 territory occupied by an apparently single adult
 - 0 unoccupied territories
- Territory occupancy = 100.0%

Totals (by township) of bald eagles nesting in Androscoggin County, 2018:

- 2 nesting pairs = Auburn, Durham, Greene, Leeds, Livermore Falls.
- 1 nesting pair = Lewiston, Lisbon, Turner.

A single pair of bald eagles nested in Androscoggin County during 1969 - 1972. None were found over the next seventeen years. In 1990, eagles finally returned to the county and nested on the same island in the town of Leeds that last hosted eagles in the area. They remained the sole pair nesting in Androscoggin County for another eight years.

After this prolonged and minimal presence of nesting eagles in Androscoggin County, new pairs emerged in Greene (1998), Lisbon (2001), Livermore (2002), and Poland (2004). Slow growth has prevailed ever since. All eagles in the county currently nest in waters of the Androscoggin River corridor or the Sabattus River, a tributary.

5.3 Aroostook County status and changes

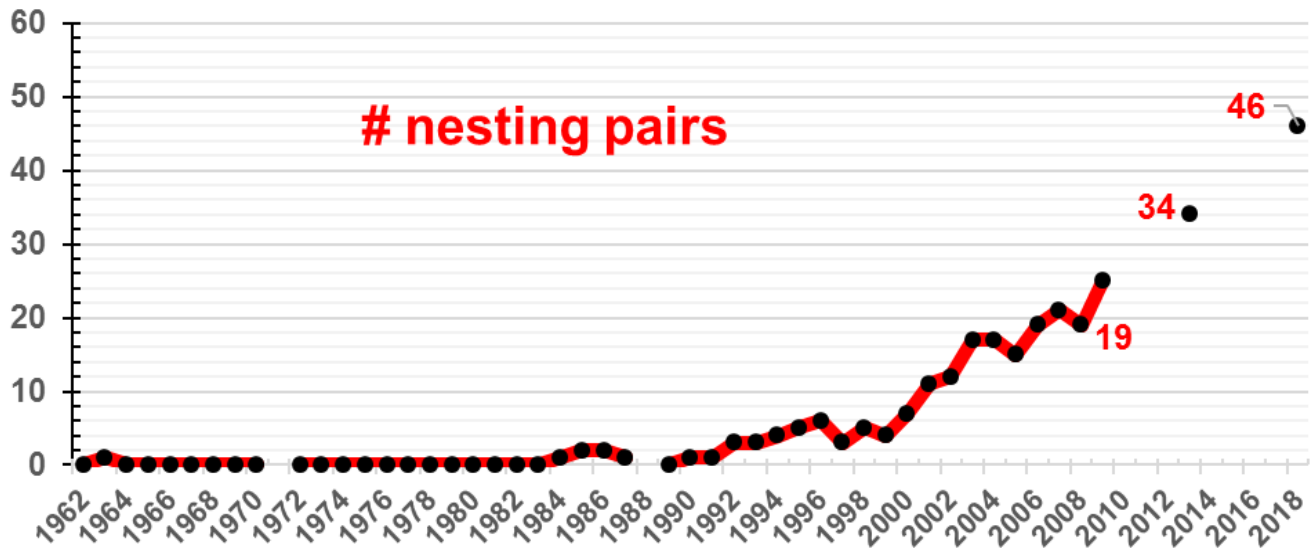


Figure 6. Abundance of bald eagles nesting in Aroostook County, 1962 - 2018.

Survey summary statistics for Aroostook County, 2018:

- Sample size =
 - 56 intact nests found at
 - 100 traditional nest locations monitored in
 - 54 distinct nesting territories
- Territory residency =
 - 46 territories occupied by nesting pairs
 - 5 territories occupied by apparently single adults
 - 3 unoccupied territories
- Territory occupancy = 94.4%

Totals (by township) of bald eagles nesting in Aroostook County, 2018:

- 3 nesting pairs = Presque Isle, Square Lake Township.
- 2 nesting pairs = Caribou, Fort Fairfield, Grand Isle, T17 R4 WELS.
- 1 nesting pair = Ashland, Cross Lake Township, Hamlin, Haynesville, Hodgdon, Island Falls, Limestone, Linneus, Madawaska, Madawaska Lake Township, Portage Lake, Saint Agatha, Saint Croix Township, Scopan Township, Sherman, Silver Ridge Township, T1 R5 WELS, T3 R4 WELS, T4 R3 WELS, T7 R5 WELS, T9 R8 WELS, T11 R4 WELS, T11 R9 WELS, T11 R11 WELS, T11 R13 WELS, T13 R16 WELS, T14 R8 WELS, T16 R6 WELS, T17 R14 WELS, Upper Molunkus Township, Van Buren, Winterville Plantation.

There were no nesting eagles in Aroostook County following the disappearance of a single nesting pair from the town of T13 R8 in 1964. The initial returns of nesting eagles

began twenty years later in Weston (1984) and T4 R3 WELS (1985). Very modest increases continued through 2000 as eagle numbers in Aroostook County fluctuated between 2 - 7 nesting pairs. Finally, significant growth began in 2001 and has not yet slowed. The result is a most impressive 550% net growth of Aroostook County's eagle population reaching 46 nesting pairs in 2018. We expect continued expansion in Maine's northernmost county.

The vast majority of nesting eagles in this region reside in water bodies in either the Allagash River, Aroostook River, Fish River, or the Saint John River drainages. Square Lake in northeastern Aroostook County is one of only four lakes in Maine to support three or more pairs of nesting bald eagles.

5.4 Cumberland County status and changes

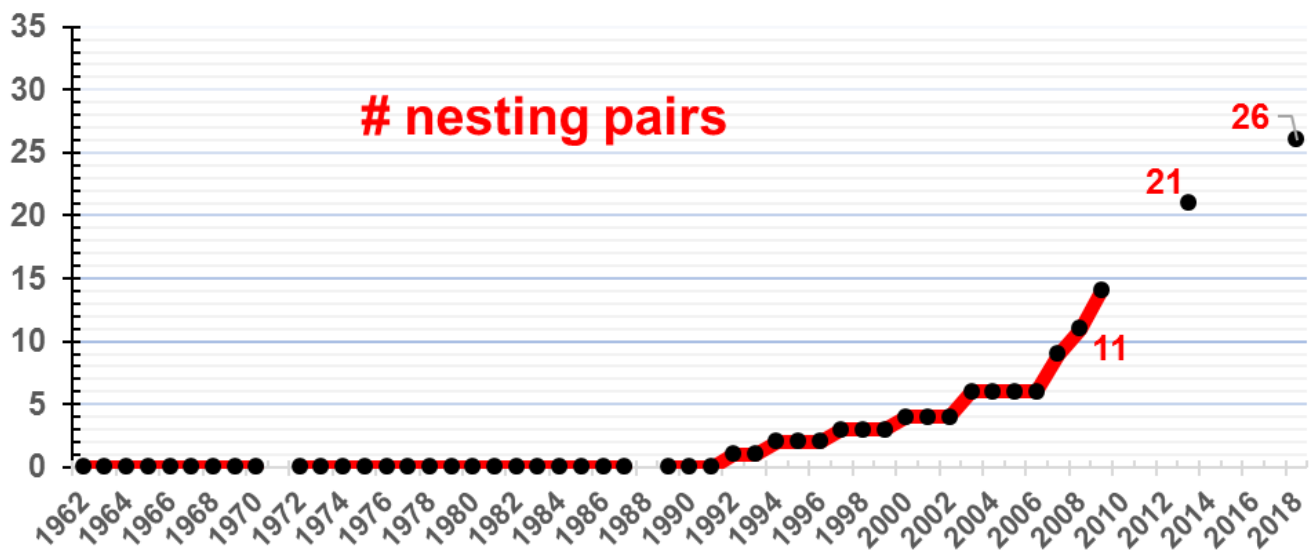


Figure 7. Abundance of bald eagles nesting in Cumberland County, 1962 - 2018.

Survey summary statistics for Cumberland County, 2018:

- Sample size =
 - 32 intact nests found at
 - 63 traditional nest locations monitored in
 - 36 distinct nesting territories
- Territory residency =
 - 26 territories occupied by nesting pairs
 - 2 territories occupied by apparently single adults
 - 7 unoccupied territories (excludes 1 territory where eagles moved to an alternate nest in adjacent Sagadahoc County)
- Territory occupancy = 94.4%

Totals (by township) of bald eagles nesting in Cumberland County, 2018:

- 9 nesting pairs = Harpswell.
- 3 nesting pairs = Brunswick.
- 2 nesting pairs = Freeport, Sebago.
- 1 nesting pair = Casco, Gray, New Gloucester, Portland, Pownal, Raymond, Scarborough, Standish, Windham, Yarmouth.

Nesting bald eagles were absent from Cumberland County during the first thirty years of statewide monitoring during 1962 - 1991. Breeding activity resumed quite gradually with the establishment of pairs in Freeport (1992), Brunswick (1994), Harpswell (1995), Yarmouth (2001), Gray (2002), and Sebago (2004).

Eagle numbers in Cumberland County increased more rapidly in the last twelve years: from six nesting pairs in 2006 to 26 nesting pairs in 2018. The dramatic increase of more than 350% during that time period is ongoing and suggestive that further population growth is likely.

Nesting eagles reside in both coastal waters and inland lakes, but favor the former in Cumberland County. Harpswell's nine nesting pairs ranked fifth among all Maine towns for abundance of nesting eagles. As in other coastal regions, high numbers of bald eagles may result in reductions in the local osprey population. The intense rivalry and sometimes lethal interactions between these two fish-eating raptors usually ends with bald eagles victorious. A locally high density of nesting ospreys can deter eagles from overtaking the area. The conflict between these species is now underway in Casco Bay.

5.5 Franklin County status and changes

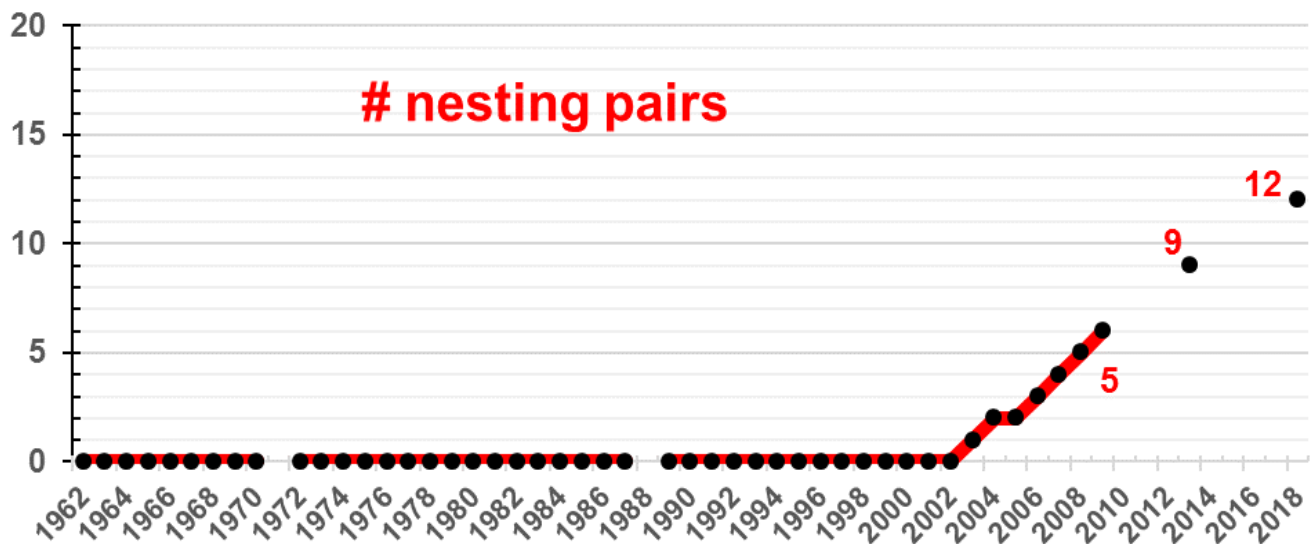


Figure 8. Abundance of bald eagles nesting in Franklin County, 1962 - 2018.

Survey summary statistics for Franklin County, 2018:

- Sample size =
 - 13 intact nests found at
 - 20 traditional nest locations monitored in
 - 12 distinct nesting territories
- Territory residency =
 - 12 territories occupied by nesting pairs
 - 0 territories occupied by an apparently single adult
 - 0 unoccupied territories
- Territory occupancy = 100.0 %

Totals (by township) of bald eagles nesting in Franklin County, 2018:

- 3 nesting pairs = Rangeley.
- 1 nesting pair = Chain of Ponds Township, Chesterville, Farmington, Industry, Jay, Rangeley Plantation, Strong, Weld, Wilton.

The return and expansion of nesting eagles in Franklin County is relatively recent. Nesting eagles were absent for at least 41 years and first arrived in Rangeley (2003). A steady increase in numbers and distribution followed yearly as new nests appeared in Jay (2004), Eustis (2005), Weld (2006), and Farmington (2007).

The 2018 survey located an additional two nesting pairs. Recent recovery rates have not slowed in the last fifteen years. Low nesting density prevails at this relatively early stage of eagle recovery in western Maine where the stage is set for continued increases.

5.6 Hancock County status and changes

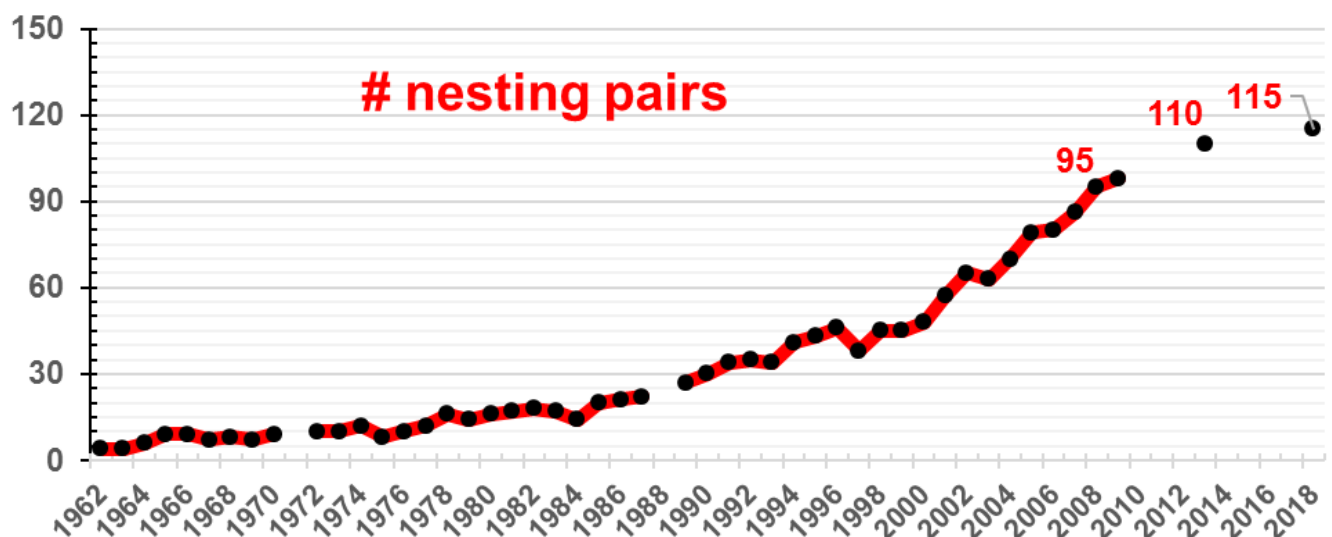


Figure 9. Abundance of bald eagles nesting in Hancock County, 1962 - 2018.

Survey summary statistics for Hancock County, 2018:

- Sample size =
 - 128 intact nests found at
 - 404 traditional nest locations monitored in
 - 139 distinct nesting territories
- Territory residency =
 - 115 territories occupied by nesting pairs
 - 8 territories occupied by apparently single adults
 - 16 unoccupied territories
- Territory occupancy = 88.5%

Totals (by township) of bald eagles nesting in Hancock County, 2018:

- 10 nesting pairs = Swans Island.
- 9 nesting pairs = Deer Isle.
- 8 nesting pairs = Frenchboro.
- 7 nesting pairs = Gouldsboro.
- 6 nesting pairs = Winter Harbor.
- 5 nesting pairs = Bar Harbor, Blue Hill, Franklin, Stonington.
- 4 nesting pairs = Brooksville, Ellsworth, Sorrento.
- 3 nesting pairs = Cranberry Isles, Mount Desert, Orland, Surry.
- 2 nesting pairs = Bucksport, Eastbrook, Hancock, Mariaville, Penobscot, Sullivan, T34 MD, T40 MD, Trenton.
- 1 nesting pair = Aurora, Dedham, Great Pond, Lamoine, Osborn, Sedgwick, T9 SD, T10 SD, T28 MD, T35 MD BPP, T39 MD, Tremont, Verona Island.

Hancock County is one of the two eastern Maine jurisdictions that has always had resident nesting eagles. Its low point was four occupied nests at the onset of statewide eagle monitoring in Maine during 1962 - 1963: single pairs in Frenchboro and Tremont along with two pairs in Gouldsboro. Very slow, but steady growth prevailed through 1999. More rapid expansion followed, and the numbers of nesting eagles increased in Hancock County by more than 150% over the last nineteen years.

Nesting bald eagles are now widespread across Hancock County with locally high density across all of its coastal waters from East Penobscot Bay to Frenchman Bay. Reduced rates of population growth suggest the local population may be close to carrying capacity. Nicasious Lake and Toddy Pond in Hancock County are two of the only five lakes in Maine to support three or more pairs of nesting bald eagles.

An individual nest in the town of Blue Hill has remained intact and in use by eagles for 41 consecutive years as the only location in that territory. The longevity of that nest is second only to one in Piscataquis County where resident eagles have used alternate nests in their territory during the 51-year lifespan of that nest.

5.7 Kennebec County' status and changes

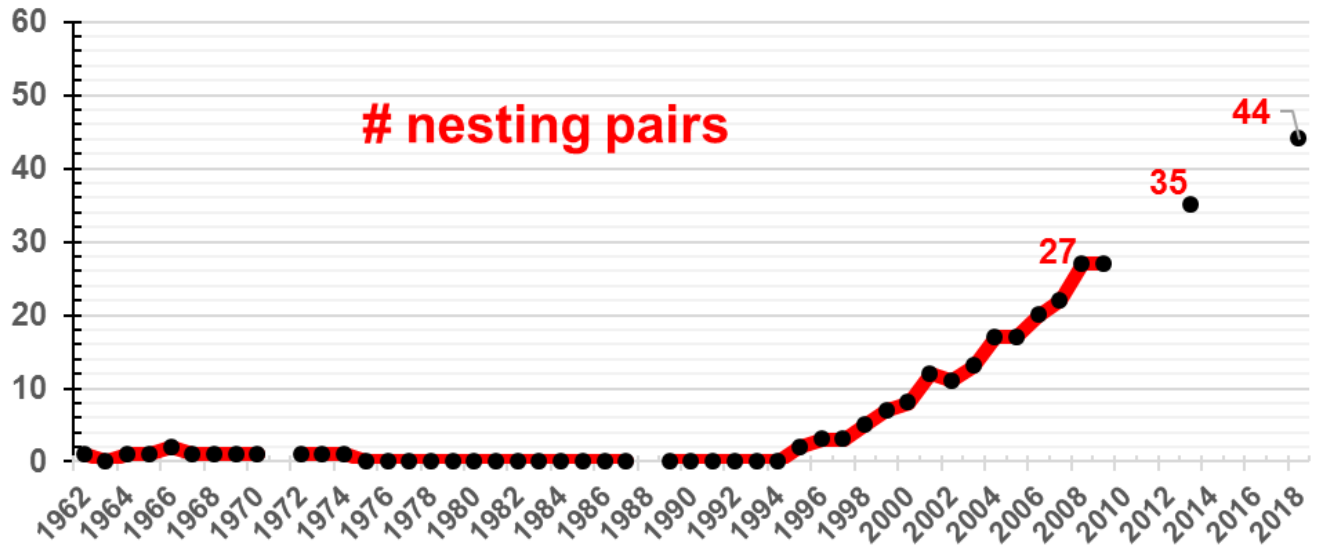


Figure 10. Abundance of bald eagles nesting in Kennebec County, 1962 - 2018.

Survey summary statistics for Kennebec County, 2018:

- Sample size =
 - 49 intact nests found at
 - 110 traditional nest locations monitored in
 - 50 distinct nesting territories
- Territory residency =
 - 44 territories occupied by nesting pairs
 - 1 territory occupied by an apparently single adult
 - 4 unoccupied territories (excludes 1 territory where eagles moved to an alternate nest in adjacent Franklin County)
- Territory occupancy = 91.8%

Totals (by township) of bald eagles nesting in Kennebec County, 2018:

- 5 nesting pairs = Winslow.
- 3 nesting pairs = Vassalboro, Wayne, Winthrop.
- 2 nesting pairs = Augusta, China, Gardiner, Litchfield, Monmouth, Oakland, Pittston, Rome, Sidney, West Gardiner.
- 1 nesting pair = Albion, Belgrade, Benton, Chelsea, Clinton, Hallowell, Manchester, Mount Vernon, Smithfield, Windsor.

One or two eagle pairs nested in Kennebec County during 1962 - 1974 in Belgrade, Chelsea, Gardiner, or Pittston. No eagles nested here for the next twenty years, 1975 - 1994. In 1995, eagles resumed nesting in two Kennebec County towns: Belgrade and Gardiner. Steady growth and range expansion began in Kennebec County after 1998

and has not yet slowed. Cobbosseecontee Lake in Kennebec County is one of only two lakes in Maine to support four or more pairs of nesting bald eagles.

5.8 Knox County status and changes

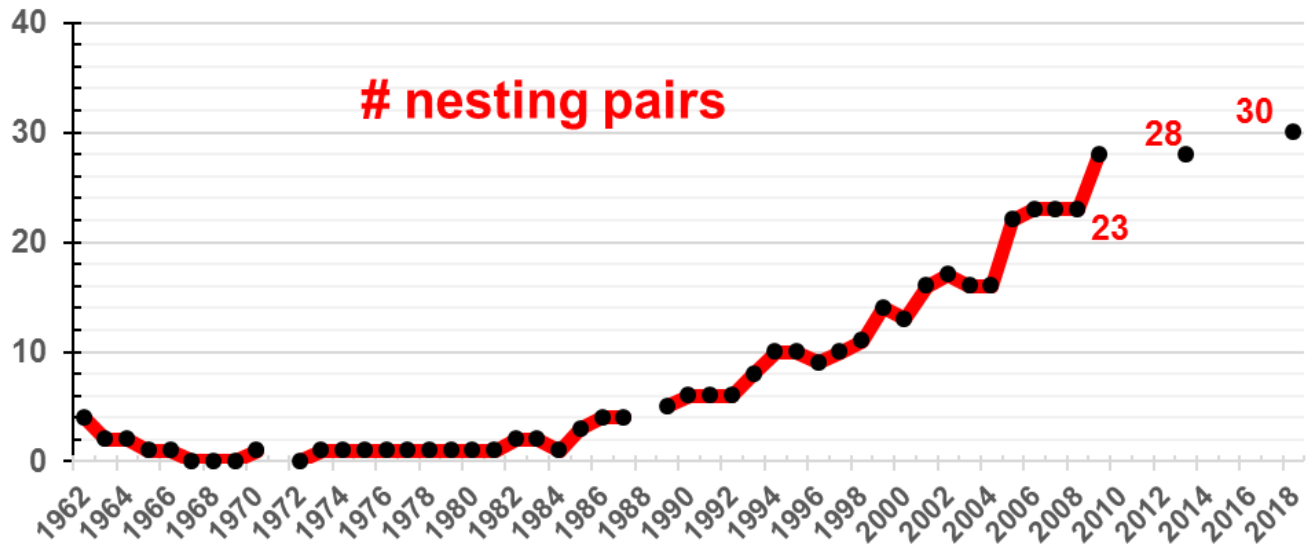


Figure 11. Abundance of bald eagles nesting in Knox County, 1962 - 2018.

Survey summary statistics for Knox County, 2018:

- Sample size =
 - 32 intact nests found at
 - 111 traditional nest locations monitored in
 - 38 distinct nesting territories
- Territory residency =
 - 30 territories occupied by nesting pairs
 - 3 territories occupied by apparently single adults
 - 5 unoccupied territories
- Territory occupancy = 86.8%

Totals (by township) of bald eagles nesting in Knox County, 2018:

- 6 nesting pairs = Vinalhaven.
- 5 nesting pairs = North Haven.
- 3 nesting pairs = Saint George.
- 2 nesting pairs = Camden, Friendship, Isle au Haut, Warren.
- 1 nesting pair = Appleton, Cushing, Hope, Matinicus Isle Plantation, Muscle Ridge Shoals Township, Owls Head, Rockport, Union.

The inaugural inventory of bald eagles nesting in Maine located four nesting pairs in the Knox County towns of North Haven, Vinalhaven, and Warren. However, that remnant

population declined further in the ensuing years. No more than a single nesting pair resided in Knox County from 1965 through 1981. Numbers rebounded quite slowly and remained at ten nesting pairs or fewer until 1998. Most Knox County nests were in coastal waters in and adjacent to Penobscot Bay.

The Knox County population tripled in the last 21 years like accelerated growth patterns across Maine. The increase might have been even greater except the count of eagle pairs in the town of Isle au Haut fell from six to two between 2009 and 2018: again possibly related to the harsh storms in March 2018. Severely damaged nests were most prevalent in settings with high exposure such as the outermost island communities of Isle au Haut and Criehaven Township. Increases in Muscongus Bay towns elsewhere in Knox County during that time interval compensated for that setback.

Two Penobscot Bay islands in North Haven supported eagles in one territory for at least 41 years during the period 1970 - 2018 and are now managed by MDIFW as part of the Alan Hutchinson Wildlife Management Area which provides an array of protected eagle nesting habitat stretching across the coast from Casco Bay to Cobscook Bay.

5.9 Lincoln County status and changes

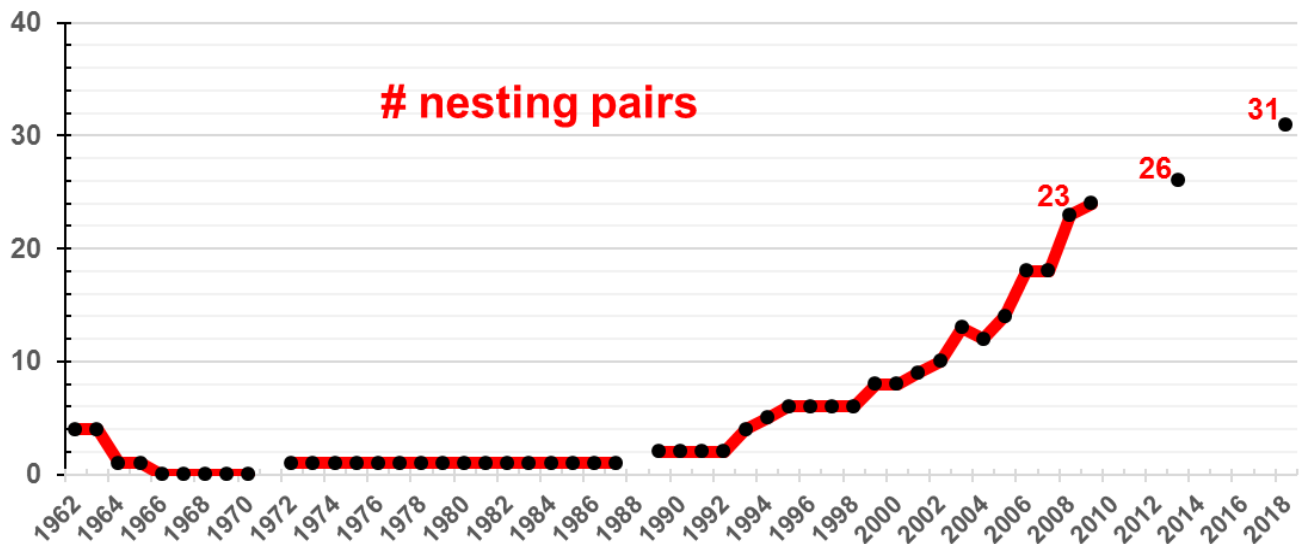


Figure 12. Abundance of bald eagles nesting in Lincoln County, 1962 - 2018.

Survey summary statistics for Lincoln County, 2018:

- Sample size =
 - 32 intact nests found at
 - 78 traditional nest locations monitored in
 - 42 distinct nesting territories

- Territory residency =
 - 31 territories occupied by nesting pairs
 - 0 territories occupied by apparently single adults
 - 8 unoccupied territories (excludes 3 territories where eagles moved to alternate nests in neighboring jurisdictions = 1 territory in adjacent Knox County and 2 territories in adjacent Sagadahoc County)
- Territory occupancy = 79.5%

Totals (by township) of bald eagles nesting in Lincoln County, 2018:

- 7 nesting pairs = Dresden.
- 4 nesting pairs = Bremen.
- 3 nesting pairs = Newcastle.
- 2 nesting pairs = Boothbay, Bristol, Edgecomb, Nobleboro, South Bristol.
- 1 nesting pair = Alna, Damariscotta, Southport, Waldoboro, Washington, Whitefield, Wiscasset.

When monitoring of Maine's eagle population began in 1962, four nesting pairs resided in Lincoln County: one each in the towns of Bremen, Bristol, Dresden, and Newcastle. All disappeared by 1966. There was no further documentation of nesting eagles again in the county until one was found in Newcastle during 1972.

Residents reported that eagle nesting at Damariscotta Lake in Newcastle dated back at least to 1947. We are inclined to agree since eagles at that location have had a stellar history. Eagles nested here forty of the past 44 years that MDIFW monitored it during 1972 - 2018. More importantly, eagles at this nest regularly hatched their eggs while others in the region did not. During the 1970s, more than 80% of all the young eagles fledged in Lincoln County hatched here. The prolific alewife run at Damariscotta Mills yields an abundant food supply which undoubtedly was a contributing factor.

No more than a single nesting pair resided in Lincoln County from 1965 to 1986. New eagle pairs arrived gradually and totaled ten or less until 2003 settling in Bremen (1987), Alna and South Bristol (1993), Boothbay and Bristol (1994), Boothbay Harbor (1995), and Southport (1996). Most resided at nests offshore in the Midcoast region or along the Damariscotta River, Sheepscott River, or Medomak River.

Eagle numbers more than tripled in Lincoln County over the last fifteen years like the dramatic increases seen over much of Maine in that period. Eagles established new nests in inland waters of these Midcoast river systems. The most rapid growth in Lincoln County is in the town of Dresden along the Kennebec River and Eastern River, a tributary of Merrymeeting Bay which has long attracted many visiting eagles in the fall, winter, and early-spring. As implied historically (Palmer 1949), it now again supports an exceptional concentration of nesting bald eagles.

5.10 Oxford County status and changes

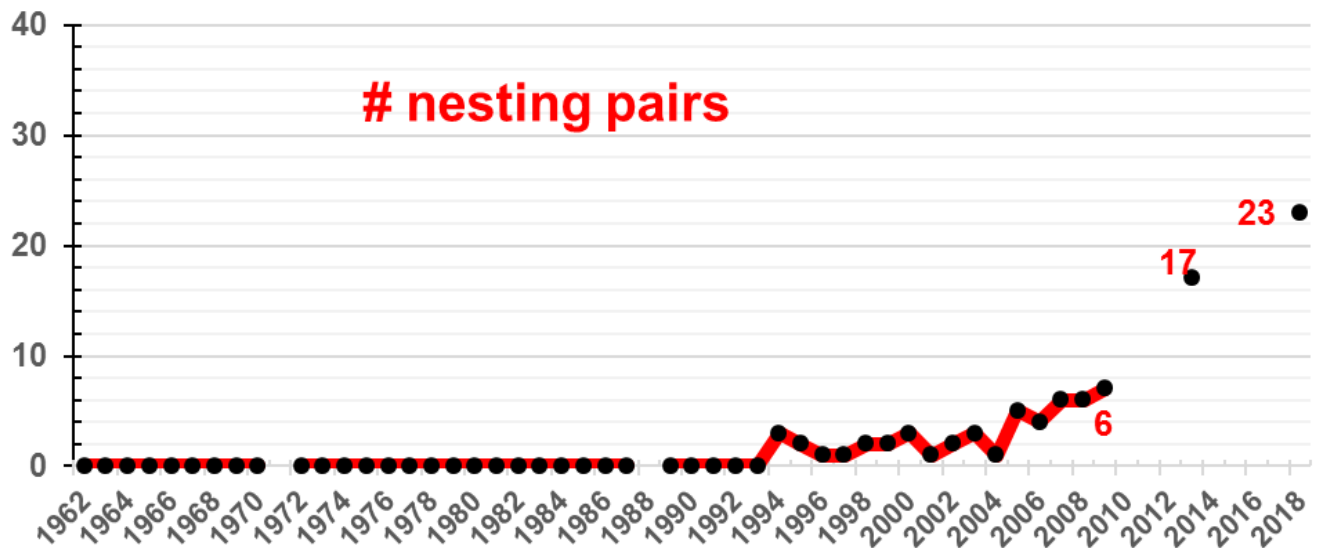


Figure 13. Abundance of bald eagles nesting in Oxford County, 1962 - 2018.

Survey summary statistics for Oxford County, 2018:

- Sample size:
 - 25 intact nests found at
 - 40 traditional nest locations monitored in
 - 26 distinct nesting territories
- Territory residency:
 - 23 territories occupied by nesting pairs
 - 1 territory occupied by an apparently single adult
 - 2 unoccupied territories
- Territory occupancy = 92.3 %

Totals (by township) of bald eagles nesting in Oxford County, 2018:

- 2 nesting pairs = Bethel, Fryeburg, Otisfield, Richardsontown Township.
- 1 nesting pair = Adamstown Township, Canton, Denmark, Lovell, Lynchtown Township, Magalloway Plantation, Mexico, Norway, Parkertown Township, Parmachenee Township, Peru, Roxbury, Rumford, Township C, Woodstock.

Bald eagles resumed nesting at three Oxford County locations in Adamstown Township, Lovell and Magalloway Plantation during 1994 after an absence dating back at least to 1962. One pair intermittently resided at an alternate nest in New Hampshire. Minimal growth followed with new pairs in Roxbury (1998), Upton (2000), Township C (2002), Canton (2005), Lynchtown Township (2005), Bethel (2007), and Mexico (2008). The 2018 survey located six nesting pairs in Oxford County. Low nesting density prevails thus far during this relatively early stage of eagle recovery in western Maine.

5.11 Penobscot County status and changes

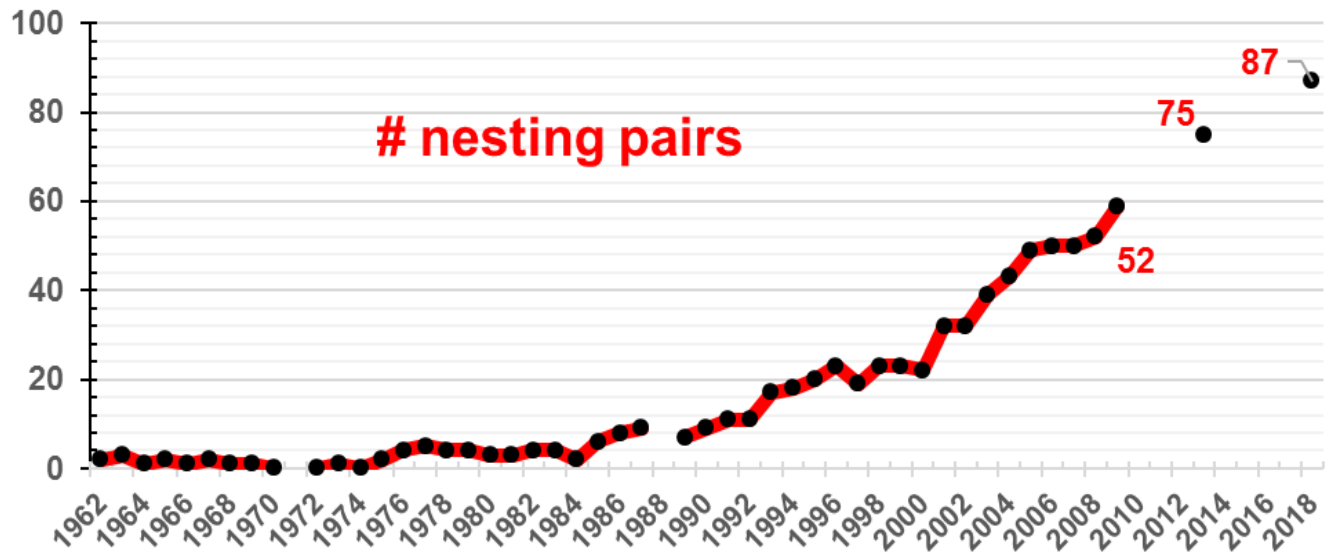


Figure 14. Abundance of bald eagles nesting in Penobscot County, 1962 - 2018.

Survey summary statistics for Penobscot County, 2018:

- Sample size =
 - 92 intact nests found at
 - 187 traditional nest locations monitored in
 - 95 distinct nesting territories
- Territory residency =
 - 87 territories occupied by nesting pairs
 - 4 territory occupied by an apparently single adult
 - 4 unoccupied territories
- Territory occupancy = 95.8%

Totals (by township) of bald eagles nesting in Penobscot County, 2018:

- 5 nesting pairs = Argyle Township, Lincoln.
- 4 nesting pairs = Medway.
- 3 nesting pairs = Bangor, Hampden, Millinocket, Old Town, T3 Indian Purchase, Winn.
- 2 nesting pairs = Bradley, Eddington, Edinburg, Enfield, Howland, Hudson, Lowell, Mattamiscontis Township, Orrington, Passadumkeag, Pukakon Township, T8 R7 WELS, Woodville.
- 1 nesting pair = Chester, Corina, Corinth, Dexter, Drew Plantation, East Millinocket, Garland, Hermon, Lakeville, Mattawamkeag, Milford, Mount Chase, Newport, Orono, Plymouth, Stetson, T1 R6 WELS, T1 R8 WELS, T1 R9 WELS, T2 R8 NWP,

T3 R1 NBPP, T3 R7 WELS, T3 R9 NWP, T4 Indian Purchase, T6 R8 WELS, T7 R6 WELS, T7 R8 WELS, TA R7 WELS, Veazie.

Small numbers of bald eagles nesting in Penobscot County varied between 0 - 5 nesting pairs during 1962 - 1984. Nesting eagles resided in various water bodies of the main stem of the Penobscot River watershed in the towns of Edinburg, Howland, Medway, Millinocket, and T2 R8 WELS as well as one pair in the Saint Croix River watershed in T6 R1 NBPP in that period.

Recovery rates in Penobscot County remained slow as the local population slowly advanced to 22 nesting pairs in 2000. Since that year the number of bald eagle nesting pairs quadrupled by 2018. Most reside in waters along the Penobscot River corridor or the West Branch of the Penobscot River.

Dam removals in the Penobscot River Restoration project began in 2012 to improve fish passage in more than 1,000 square miles of the watershed. That change was for the benefit of anadromous fish like alewives, blueback herring and shad as potential food resources for bald eagles in much of the Penobscot River basin. More than a million fish now pass via a fish lift in Costigan.

Immigration of new eagles into Penobscot County also accelerated by virtue of its adjacency to the ever-expanding numbers from the Downeast stronghold in neighboring Washington County and Hancock County. We anticipate further increases but perhaps at a reduced rate in waters not influenced by the Penobscot River Restoration.

5.12 Piscataquis County status and changes

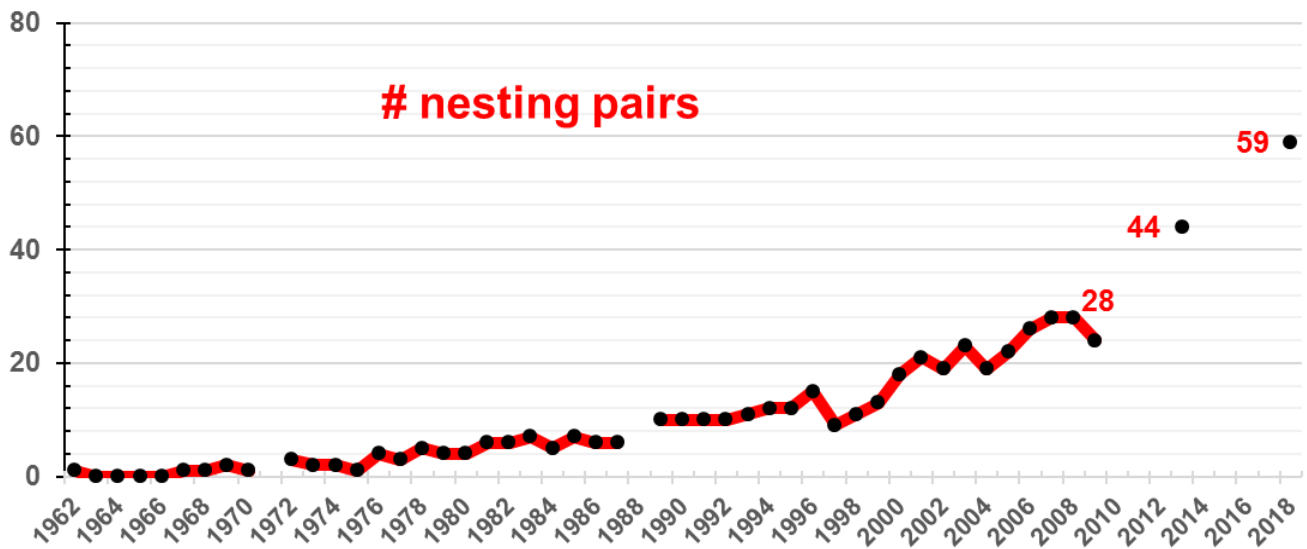


Figure 15. Abundance of bald eagles nesting in Piscataquis County, 1962 - 2018.

Survey summary statistics for Piscataquis County, 2018:

- Sample size =
 - 72 intact nests found at
 - 153 traditional nest locations monitored in
 - 74 distinct nesting territories
- Territory residency =
 - 59 territories occupied by nesting pairs
 - 4 territories occupied by apparently single adults
 - 9 unoccupied territories (excludes 2 territories in adjacent Aroostook County)
- Territory occupancy = 87.5%

Totals (by township) of bald eagles nesting in Piscataquis County, 2018:

- 3 nesting pairs = T7 R14 WELS.
- 2 nesting pairs = Big Moose Township, Chesuncook Township, Dover-Foxcroft, Milo, Soper Mountain Township, Spencer Bay Township, T1 R9 WELS, T6 R15 WELS, Trout Brook Township.
- 1 nesting pair = Abbot, Beaver Cove, Bowdoin College Grant West Township, Eagle Lake Township, Ebeemee Township, Elliottsville Township, Frenchtown Township, Guilford, Harfords Point Township, Lake View Plantation, Lobster Township, Medford, Monson, Orneville Township, Parkman, Sangerville, T1 R11 WELS, T2 R10 WELS, T2 R13 WELS, T3 R11 WELS, T3 R12 WELS, T4 R11 WELS, T4 R9 NWP, T6 R10 WELS, T6 R11 WELS, T7 R9 WELS, T7 R10 WELS, T7 R15 WELS, T8 R10 WELS, T9 R11 WELS, T9 R12 WELS, T9 R13 WELS, T9 R15 WELS, T10 R9 WELS, T10 R11 WELS, T10 R15 WELS, TA R10 WELS, Willimantic.

A remnant breeding population of bald eagles in Piscataquis County fluctuated between 0 - 4 nesting pairs between 1962 and 1977. Nesting eagles resided in various water bodies of the West Branch of the Penobscot River watershed in the towns of T2 R10 WELS, T3 R10 WELS, and T6 R15 WELS as well as one pair in the Allagash River lakes in T7 R10 WELS during these early years of monitoring Maine's bald eagles. A nest at Eagle Lake has been intact for a record 51 years since 1967, although the resident eagles have sometimes used an alternate nest during that period.

Very modest growth rates prevailed in the Piscataquis County eagle population until 1999. New pairs arrived primarily in these same two watersheds in waters of either the Allagash River or the Penobscot River's West Branch. Only three eagle nests appeared in the Piscataquis River sub-drainage during this period. This trend of gradual expansion continued across Piscataquis County through the year 2009.

A growth spurt was evident during the last ten years comparable to patterns in many other regions of central, western, southern, and northern Maine. The number of nesting eagles in Piscataquis County rose by 146% over the past nine years. This dramatic rise was most pronounced in the Piscataquis River watershed. During this period, removals of two hydroelectric dams on downriver sections of the Penobscot River corridor in

combination with a dam bypass channel for access into the Piscataquis River tributary enabled passage of anadromous fish like alewives, blueback herring, and shad. The greatest expansion of nesting eagles in the Piscataquis River basin occurred in the last five years, apparently correlated with the dam bypass project allowing fish passage that was completed in 2016.

5.13 Sagadahoc County status and changes

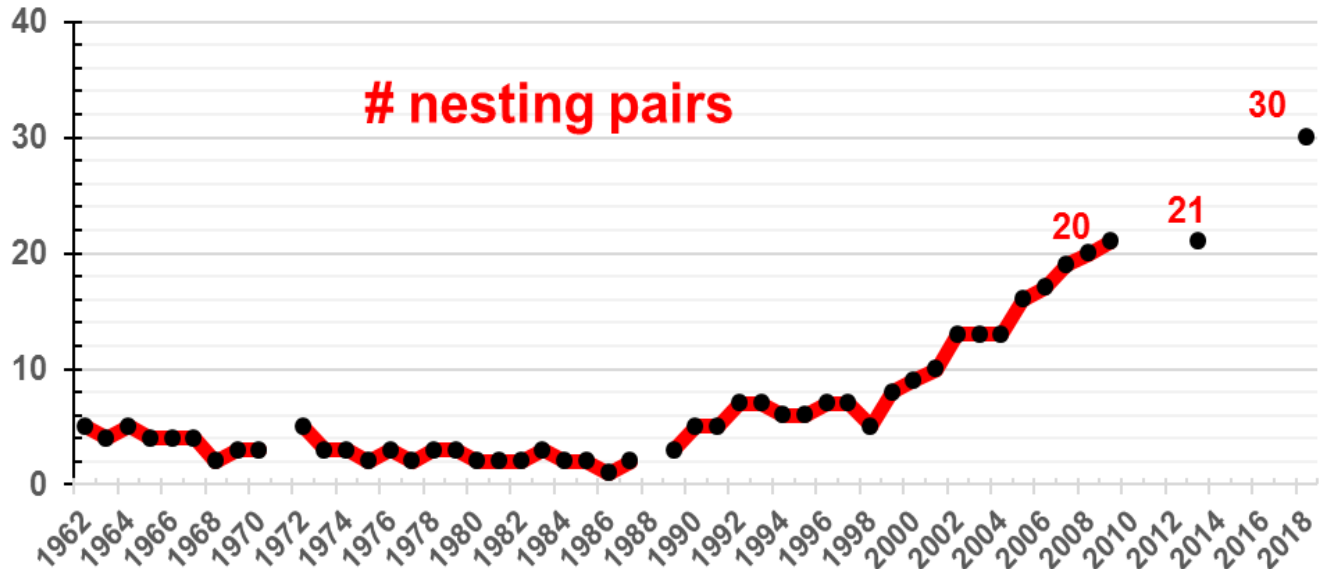


Figure 16. Abundance of bald eagles nesting in Sagadahoc County, 1962 - 2018.

Survey summary statistics for Sagadahoc County, 2018:

- Sample size =
 - 31 intact nests found at
 - 98 traditional nest locations monitored in
 - 39 distinct nesting territories
- Territory residency =
 - 30 territories occupied by nesting pairs
 - 1 territory occupied by apparently single adult
 - 4 unoccupied territories (excludes 4 territories where eagles moved to alternate nests in neighboring jurisdictions = 1 territory in adjacent Cumberland County and 3 territories in adjacent Lincoln County)
- Territory occupancy = 87.5%

Totals (by township) of bald eagles nesting in Sagadahoc County, 2018:

- 7 nesting pairs = Phippsburg.
- 6 nesting pairs = Woolwich.
- 4 nesting pairs = Topsham.
- 3 nesting pairs = Bath, Bowdoinham.

- 2 nesting pairs = Arrowsic, Georgetown, Perkins Township.
- 1 nesting pair = Richmond.

A remnant population in Sagadahoc County between 1 - 5 pairs during 1962 - 1991. Early eagle nesting here was confined to the towns of Bath, Bowdoinham, Perkins Township, and Woolwich. Nesting eagles tripled in overall number between 2000 and 2018 in Sagadahoc County. Most inhabited Merrymeeting Bay or the lower Kennebec River estuary, and that area again rivals its noteworthy density of nesting bald eagles.

5.14 Somerset County status and changes

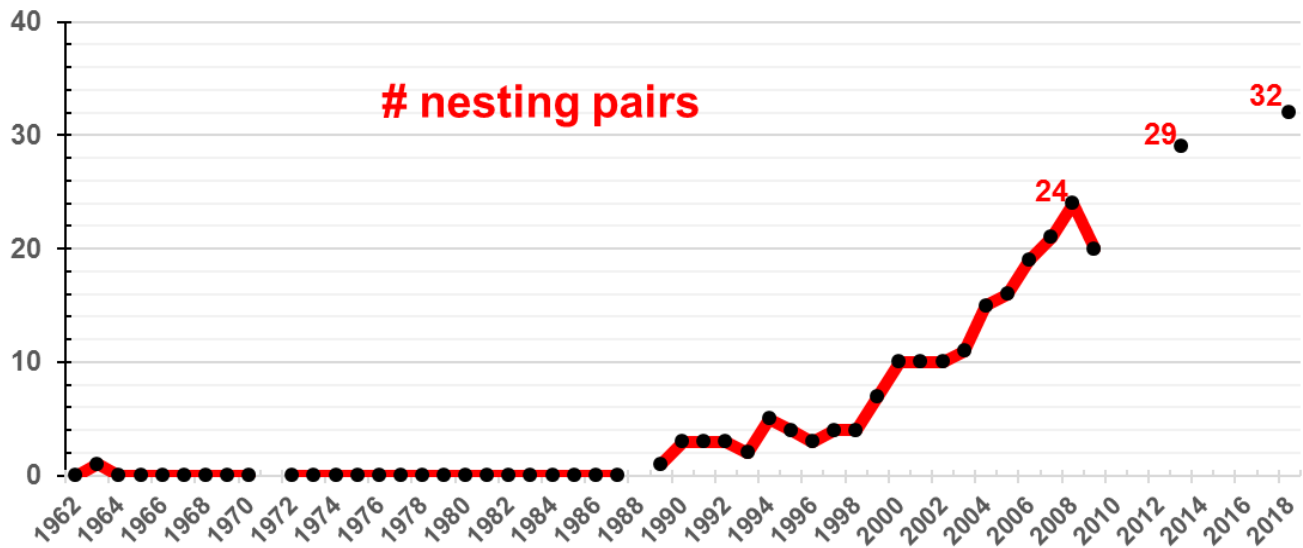


Figure 17. Abundance of bald eagles nesting in Somerset County, 1962 - 2018.

Survey summary statistics for Somerset County, 2018:

- Sample size =
 - 41 intact nests found at
 - 72 traditional nest locations monitored in
 - 40 distinct nesting territories
- Territory residency =
 - 32 territories occupied by nesting pairs
 - 3 territories occupied by apparently single adults
 - 5 unoccupied territories
- Territory occupancy = 87.5%

Totals (by township) of bald eagles nesting in Somerset County, 2018:

- 4 nesting pairs = Flagstaff Township.
- 2 nesting pairs = Attean Township, Dead River Township, Madison, Skowhegan.
- 1 nesting pair = Bingham, Canaan, Carratunk, Carrying Place Township, Concord Township, Dole Brook Township, East Moxie Township, Fairfield, Hartland,

Hobbstown Township, Holeb Township, Jackman, Lexington Township, Norridgewock, Palmyra, Plymouth Township, Sandwich Academy Grant, Sapling Township, Solon, T4 R5 NBKP.

Nesting bald eagles left Somerset County for 25 years after the demise of a pair in Concord Township in 1963. By 1998, four nesting pairs had returned to the county in Flagstaff Township, Plymouth Township, Sandwich Academy Grant and Sapling Township. Recovery escalated in Somerset County steadily over the last twenty years. Flagstaff Lake’s six nesting pairs of eagles is the highest tally for any lake in Maine.

5.15 Waldo County status and changes

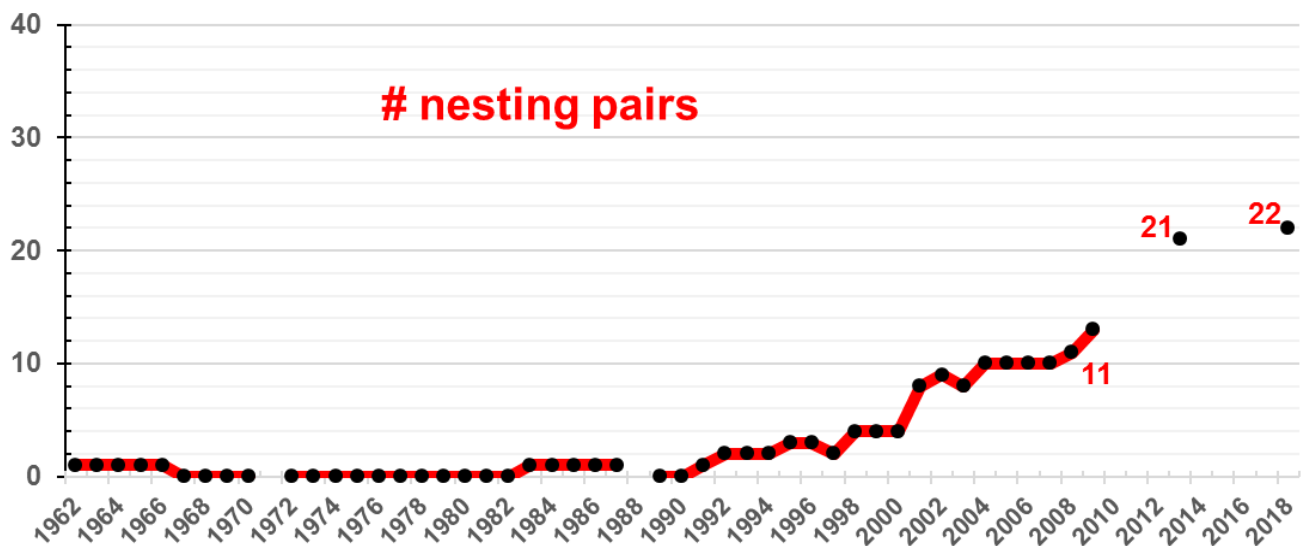


Figure 18. Abundance of bald eagles nesting in Waldo County, 1962 - 2018.

Survey summary statistics for Waldo County, 2018:

- Sample size =
 - 22 intact nests found at
 - 50 traditional nest locations monitored in
 - 25 distinct nesting territories
- Territory residency =
 - 22 territories occupied by nesting pairs
 - 0 territories occupied by apparently single adults
 - 2 unoccupied territories (excludes 1 territory where eagles moved to an alternate nest in adjacent Knox County)
- Territory occupancy = 91.7%

Totals (by township) of bald eagles nesting in Waldo County, 2018:

- 4 nesting pairs / township = Islesboro.

- 2 nesting pairs / township = Palermo, Stockton Springs.
- 1 nesting pair / township = Belfast, Belmont, Burnham, Frankfort, Freedom, Liberty, Morrill, Northport, Searsmont, Searsport, Swanville, Troy, Unity, Winterport.

A single pair in Prospect was the only eagle nesting activity in Waldo County when eagle surveys began in 1962. It was abandoned after 1966, and Waldo County supported no breeding eagles until 1982 when an eagle pair returned to the exact same nest used sixteen years earlier. It fell and was rebuilt several times since, but a remnant nest was still there in 2018. Only four new eagle pairs arrived over the next eighteen years: in Islesboro, Burnham, Swansville, and Unity. Steady increases followed after 2000. The population doubled between the 2009 and 2018 statewide nesting surveys.

5.16 Washington County status and changes

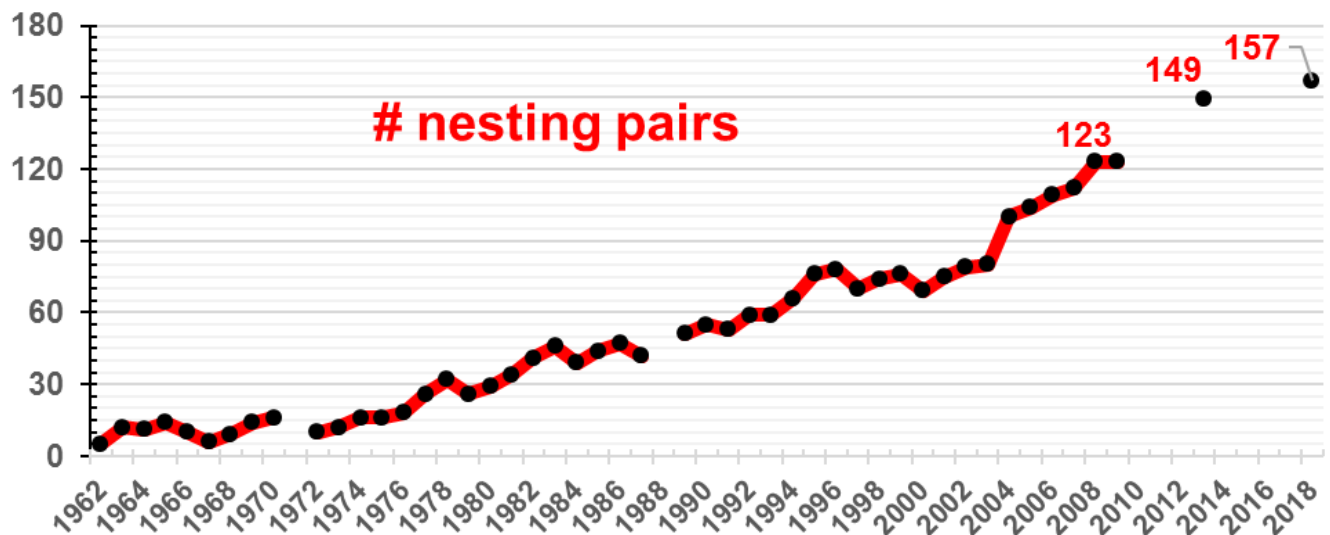


Figure 19. Abundance of bald eagles nesting in Washington County, 1962 - 2018.

Survey summary statistics for Washington County, 2018:

- Sample size =
 - 181 intact nests found at
 - 538 traditional nest locations monitored in
 - 201 distinct nesting territories
- Territory residency =
 - 157 territories occupied by nesting pairs
 - 22 territories occupied by apparently single adults
 - 19 unoccupied territories (excludes 3 territories where eagles moved to alternate nests in neighboring jurisdictions = 1 territory in adjacent Penobscot County and 2 territories in adjacent New Brunswick)
- Territory occupancy = 90.4%

Totals (by township) of bald eagles nesting in Washington County, 2018:

- 12 nesting pairs = Addison.
- 11 nesting pairs = Jonesport, Lubec, Pembroke.
- 7 nesting pairs = Harrington, Perry, Steuben.
- 6 nesting pairs = Beals, Edmunds Township, Milbridge.
- 5 nesting pairs = Cutler, Indian Township, Trescott Township.
- 4 nesting pairs = Calais, Machiasport.
- 3 nesting pairs = Berry Township, East Machias, Roque Bluffs, T6 R1 NBPP.
- 2 nesting pairs = Baileyville, Charlotte, Dennysville, Eastport, Grand Lake Stream Plantation, Princeton, Sakom Township, T19 ED, T26 ED.
- 1 nesting pair = Alexander, Beddington, Big Lake Township, Brookton Township, Cathance Township, Cherryfield, Columbia Falls, Crawford, Danforth, Deblois, Forest Township, Greenlaw Chopping Township, Jonesboro, Machias, Marion Township, T6 ND BPP, T19 MD BPP, T43 MD BPP, Topsfield, Whiting.

Nesting bald eagles never disappeared from the “sunrise” county. Early surveys during the 1960s probably missed many nests in remote areas of Washington County and similar rural areas. Washington County was the only sector of Maine with favorable reproduction and early hints of population recovery starting in the late-1970s.

By 1978 (when bald eagles were first designated as Endangered in Maine), 32 nesting pairs (52% of the statewide total) lived in Washington County. The Cobscook Bay region emerged as Maine’s premiere stronghold with levels of healthy reproduction exceeding all other areas in the State. Eagles nesting here were the source for eventual recovery of the species across Maine and much of neighboring New Brunswick.

The 2018 census identified a record 157 nesting pairs of bald eagles in Washington County. However, the net increase of eight pairs since the last statewide inventory five years ago represents only 5.4% growth since 2013. In the 2013 survey, we measured a 23.6% increase (= 26 new nesting pairs) over the previous five-year interval. The slowed growth of eagle numbers in Washington County is now well below the rate of overall expansion across Maine.

Our surveys this year identified an unusually large number of nesting territories (N = 22) in Washington County that seemingly were occupied by a single adult eagle in 2018. It is quite likely that some were actually resident pairs missed during surveys. Even that assumption cannot account for the diminished growth rate observed here in recent years and the likelihood that the Washington County population has started to level off. Unless there are changes in food abundance (e.g., restoration of depleted alewife runs or other abundant foods), the regional population may be approaching local carrying capacity, a natural limitation based on available resources.

Downeast Maine received more than three feet of snow in the first half of March when most eagles were already incubating or about to lay eggs. Many nest failures occurred

early in the season as monitoring efforts were just beginning. If pairs are not tending nests, it is challenging to document both adult eagles at a nest via aerial monitoring.

Nevertheless, if Washington County eagle totals were compared against states, it would still rank in the the top twenty nationwide for eagle abundance. Nesting bald eagles are distributed widely, and several Washington County communities now boast exceptional numbers of nesting eagles. The density of nesting eagles in coastal Washington County is unrivalled anywhere else in the Northeast between the Chesapeake Bay region and Cape Breton Island in Nova Scotia. The roster of Washington County towns where eagles reside is now very long! Ten of the top twenty towns in Maine that support the highest eagle counts were in Washington County. Addison, Harrington, Jonesport, Lubec, Pembroke, Perry, Steuben, Beals, Edmunds Township, and Milbridge all had counts in the range of 6 - 12 nesting pairs in 2018.

5.17 York County status and changes

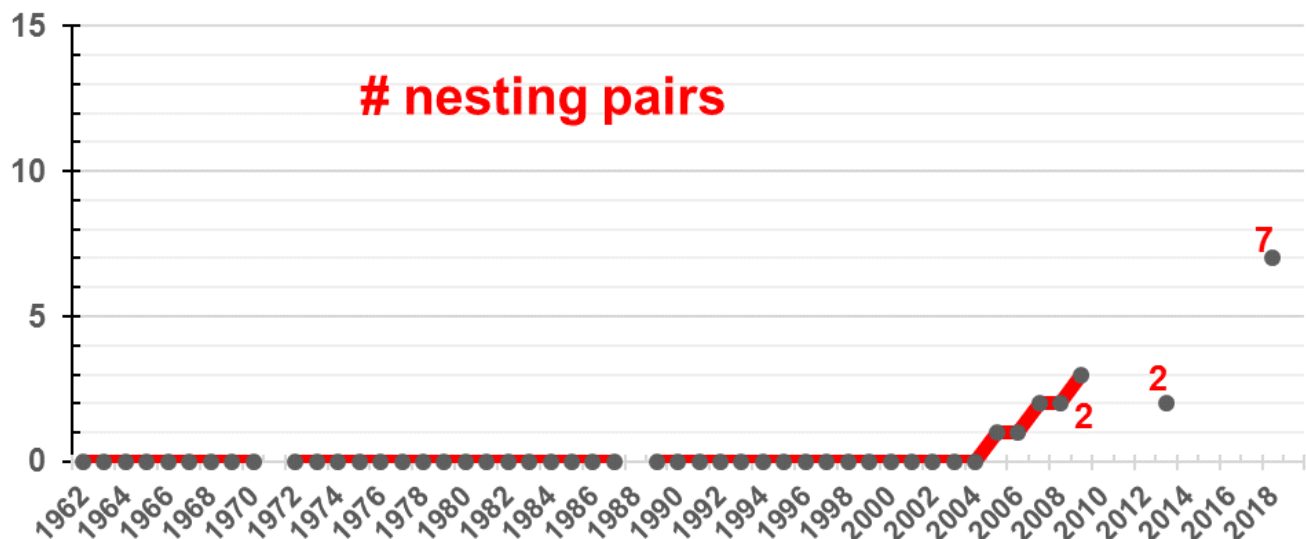


Figure 20. Abundance of bald eagles nesting in York County, 1962 - 2018.

Survey summary statistics for York County, 2018:

- Sample size =
 - 8 intact nests found at
 - 11 traditional nest locations monitored in
 - 9 distinct nesting territories
- Territory residency =
 - 7 territories occupied by nesting pairs
 - 0 territories occupied by apparently single adults
 - 1 unoccupied territories (excludes 1 territory where eagles moved to an alternate nest in adjacent New Hampshire)
- Territory occupancy = 87.5%

Totals (by township) of bald eagles nesting in York County, 2018:

- 1 nesting pair = Dayton, Lebanon, Limerick, Saco, Sanford, Shapleigh, York.

Nesting bald eagles were not found in Maine's southernmost county for the first 43 years of surveys until a breeding pair settled in Shapleigh (2005). The next nest discoveries soon followed in Dayton (2007) and Kittery (2009). The recent arrival of nesting eagles in York County reflects the long distance separating it from a robust source population. The 2018 survey located an additional five nesting pairs. This is the greatest percentage growth of any county in Maine since the last statewide survey in 2013. At present, there are no areas with remarkable density of nesting eagles in York County. The Saco River watershed now hosts six pairs of breeding eagles (including four in nearby southern Oxford County). Although only a modest population resides in York County, further increases of nesting bald eagles are likely in upcoming years.

6.0 Summary and Recommendations

MDIFW fulfilled its commitment to complete a statewide inventory of nesting bald eagles in 2018. Decades of annual monitoring and intensive management shifted to a periodic survey conducted once every five years after the species was "delisted" under Maine ESA in 2009. The 2018 inventory was the follow-up to similar efforts previously conducted in 2008 and in 2013.

The very first survey flights in 2018 detected widespread breeding failures and an unusually high incidence of damaged nests after two major snowstorms in March. There was definitive evidence of only a single eagle pair re-nesting in 2018. Other eagle pairs functionally "took the year off" after losing their first clutch of eggs. This inventory is much more difficult if fidelity to nests is diminished by breeding failures. Rechecks every 7 - 10 days at nests that appeared unoccupied partly repaired the census, but as many as forty nesting pairs may have been missed.

A record high total, 734 nesting pairs of bald eagles in Maine, resulted despite these difficulties. This outcome was well beyond the target population objective of 600 nesting pairs established for the year 2019 (Todd 2004). The 16.1% increase since 2013 represented a 50% drop-off in the rates of statewide population growth compared to the 32.5% increase in the previous five-year interval. The potential undercount of forty nesting pairs did not explain that slowdown. We found rates of population expansion were slowest in Washington County and Hancock County where, respectively, 115 and 156 pairs of nesting bald eagles resided in 2018. This traditional Downeast stronghold of Maine's population may have nearly reached the limits for those counties support.

Dramatic declines among bald eagles during the mid-20th century were erased in Maine after sustained population recovery began in the late-1980s. An equilibrium with food resources was expected as eagle populations increased. Patterns of expansion originated from the eastern Maine stronghold. The increase of eagle numbers in central, southern, western, and northern Maine exceeded the statewide average growth of

16.1% during 2013 - 2018. Five of those counties (Aroostook, Oxford, Piscataquis, Sagadahoc, and York) had expansion rates exceeding 34% over the last five years.

The life history of bald eagles dictated a prolonged recovery would be necessary to rebuild sizeable, dispersed populations. We predict continued increases of nesting pairs in areas of Maine with moderate or low nesting density at present. Models of habitat suitability for nesting eagles customized to Maine (Livingston *et al.* 1990) can identify optimal areas for that growth. However, nesting eagles have since demonstrated some adaptive tendencies and are less reliant on locations with a minimal human presence. Some areas of Maine that appear less suitable because of residential and industrial developments are likely the next instances of exceptional tolerance by nesting eagles.

MDIFW did not rely solely on eagle population abundance, trends, and distribution to delist bald eagles (Todd and Matula 2008). As insurance for safeguarding the comeback of eagles, thresholds for conservation of nesting habitat became a formal recovery criterion in Maine. Those levels have been greatly surpassed. In view of these findings, we offer the following recommendations:

1. Monitoring the statewide population of bald eagles nesting in Maine should be considered a discretionary effort in the future. Overall abundance will remain an intriguing metric but its measure may not merit the costs, personnel time, and risks inherent to this survey. Five-year intervals do not appear necessary.
2. A survey framework to sample regional populations across Maine may prove to be a more feasible and cost-effective alternative to this statewide inventory. Watersheds provide the most meaningful matrix to design such an effort. Samples should be stratified by patterns of eagle nesting density across Maine.
3. Resumption of a statewide monitoring effort or re-evaluating the new sampling strategy would be justifiable if future statewide population estimates fall below the count achieved in 2018.
4. Bald eagles will remain a very sensitive indicator of environmental quality because of their position as a top-level predator in complex aquatic food webs. Accordingly, researchers may justify tissue sampling from bald eagles in monitoring programs approved by agencies. Environmental contaminants played a major role in jeopardizing bald eagle populations in the 20th century.
5. Public esteem for bald eagles and appreciation for this remarkable comeback of an endangered species will likely not diminish in the coming years. MDIFW and conservation partners must balance their attention to other species that are still designated as Endangered or Threatened under Maine ESA as well as “Species of Greatest Conservation Need” identified in Maine’s Wildlife Action Plan (2015). Those labels no longer apply to bald eagles in Maine, but the successful story of bald eagle conservation should help garner more support for other at-risk wildlife.

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8.0 Acknowledgements

A survey of this scope and magnitude is a major undertaking only possible with a team effort of experienced pilots and biologists. Maine's beautiful blend of waters and forests as seen from the air is breathtaking. Sustained low-level flying inherent in this survey is both tedious and risky. If observers look away for five seconds, they just missed viewing an 800-foot swath below. In the event of lost power in the aircraft, there are less than 60 seconds available to make an emergency landing.

Personnel conducting the statewide inventory of bald eagle nests during 2018 accepted these challenges and gathered data that sets a record-setting population benchmark.

MDIFW observers: Sarah Boyden, Judy Camuso, Mark Caron, Bob Cordes, Danielle D'Auria, Henry Jones, Scott Lindsay, Kendall Marden, Amy Meehan, Tom Schaeffer, Andrew Smart, Sarah Spencer, Allen Starr, Charlie Todd, Chandler Woodcock, Derek Yorks, and Brad Zitske.

Guest observers:

- Bob Duchesne (Maine Legislature, House of Representatives, 2006 - 2018)
- Ray "Bucky" Owen (University of Maine emeritus & former Commissioner - MDIFW)

MDIFW Warden Service pilots: The tireless labors and invaluable skills of the four pilots on duty in 2018 are gratefully acknowledged. They are all also keen observers!



Figure 21. Chris Hilton, Jeff Spencer, and Jeff Beach (pictured left-to-right) along with veteran pilot Gary Dumond piloted the full 240 hours of flight time during the 2018 aerial nesting inventory of bald eagles in Maine. Thank you!



Figure 22. MDIFW Biologist Tom Schaeffer is ready to go “one more time.” He retired in August after 45 years in the agency and 29 years of flying surveys in the bald eagle population stronghold of eastern Maine. Congratulations!

Additional personnel participating in surveys prior to 2018: Most of our 2018 observers have many years of prior involvement. In addition, we thank other observers and pilots who assisted these efforts during the period 1962 - 2013.

Observers: Brad Allen, Linda Alverson, Dick Anderson, John Anderson, Jordan Bailey, Rich Bard, Sarah Boucher, Phil Bozenhard, Charles Brookfield, Barry Burgason, Patrick Burke, Erynn Call, Laura Callnan, Buster Carter, Sean Casto, Jim Connolly, Pat Corr, Cheryl Daigle, Chris DeSorbo, Noel Dodge, Eric Doucette, Marty Drutt, Charles Dyke, Bryan Emerson, Stuart Fefer, Paul Fournier, Marty Gilroy, Rick Gray, Bill Hanson, Betty Hayes, Derek Hengstenberg, Alan Hutchinson, Chuck Hulse, Charlie Jacobi, John Kenney, Ian Johnson, Michael Johnson, Keel Kemper, Dale Knapp, Chuck Knoder, Karl Korschgen, William Krantz, Frank Ligas, Susan Livingston, Arlen Lovewell, Mike Lychwala, Dan Macauley, George Matula, Jonathan Mays, Lincoln Mazzei, Mark McCollough, Kathleen McGee, Slade Moore, David Morrill, Kyle Murphy, Bill Noble, Gil Paquette, Deborah Palman, Steve Pelletier, Chris Persico, Sandy Ritchie, Brad Richard, Jim Schoultz, Mike Smith, Cory Stearns, Kevin Stevens, Tim Stone, Kelsey Sullivan, Tom Tetreau, Barbara Todd, Chris Todd, Jeremy Todd, Wendall Tremblay, Lindsay Tudor, Dana Valleau, Andy Weik, Dwight Welch, Linda Welch, Susan Woodward.

Pilots: Scott Bates, Steve Bean, John Bidwell, Randy Billings, Chris Blackie, Clyde Bolin, Karen Bollenger, Jason Bouchard, Frank Craig, John Crowley, Roger Currier, Dan Dufault, John Fetterman, Ray Fogg, Max Folsom, Sarah Folsom, Ed Friedman, Daryl Gordon, Otis Gray, Tim Hodgkins, Durward Humphrey, Steve Ingram, John Knight, Mark Koneff, Charlie Later, Jack McPhee, Dave Meehan, Jim Rea, Shawn Rogers, Alan Ryder, Bill Snow, Dana Toothaker, Russ Treadwell, Roger Wolverton.