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Trends in Midwinter Counts of Bald Eagles in the Conterminous United States, 1986-2005

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Introduction

Each January, several hundred individuals count eagles along standard, non-overlapping survey routes as part of a nationwide Midwinter Bald Eagle survey. Nationwide counts of eagles were coordinated by the National Wildlife Federation from 1979 until 1992, when the Bureau of Land Management's Raptor Research and Technical Assistance Center assumed responsibility for overseeing the count. Responsibility for count coordination shifted to the National Biological Survey (1993-1996) and later to the U.S. Geological Survey (USGS), Forest and Rangeland Ecosystem Science Center, Snake River Field Station.

Initial objectives of the survey were to establish an index to the total wintering Bald Eagle population in the lower 48 states, to determine eagle distribution during a standardized survey period, and to identify previously unrecognized areas of important winter habitat. Millsap (1986) reported results of the midwinter survey from 1979 through 1986. Beginning in 1984, National Wildlife Federation officials asked participants to count eagles along standard routes to provide data on count trends. Steenhof et al. (2002) published an analysis of count trends from 1986-2000. This report presents results of a follow-up evaluation of using data from 5 additional years. This 20-year analysis used the same methods used in the 15-year trend analysis (Steenhof et al. 2002).

Methods

Observers conduct surveys of Bald Eagles on standard routes during the first 2 weeks of January each year, usually on 1 of 2 target days. Standard survey routes are defined as clearly described areas where eagles had been observed in the past. Federation guidelines stipulated that standard surveys be conducted by the same number of experienced observers using the same method (e.g., fixed-wing, helicopter, boat, vehicle) at approximately the same time of day each year. Most survey participants are employees of state or federal conservation agencies, but private volunteers also participate in the survey. Coordinators from each state are responsible for organizing local counts, enlisting survey participants, and compiling data to eliminate duplicate sightings and overlapping routes. Sizes of survey routes vary from single fixed points to 150 miles. Approximately 44% of the surveys are conducted from vehicles. 18% are conducted from fixed wing aircraft; 8% are collected from boats; and 7% are conducted by helicopter. Due to weather and staffing limitations, not all standard routes are surveyed every year. Twenty-five states identified and began surveying standard routes in 1986; other states did not begin standard surveys until the mid-1990s. Some states stopped participating in the count in the 1990s. The number of states participating each year has ranged from 25 to 41, and the number of standard survey routes per state ranges from 1 to 84.

The analysis was based on 178,896 observations of eagles during 8,674 surveys of 746 routes in 43 states. Data from routes that were not surveyed consistently for at least four years and routes that never had more than three eagle observations in a single year during the 20-year sampling period were not used in the trend analysis. We estimated trends using procedures described by Steenhof et al. (2002).

Results

Counts of Bald Eagles increased 1.7% per year across all regions from 1986-2005 (95% CI = 1.1-2.4%; Table 1). Of the 746 routes, 63% exhibited positive trends. The estimated rate of increase and the percent of routes with increasing trends were slightly lower than for 1986-2000 (Steenhof et al. 2002).

Trends varied by region (Table 1). Model-based estimates of total counts in the Northeast increased 6% per year (95% CI = 4.4-7.6%), whereas those in the Southwest and Southeast showed no change (Table 1). Increasing trends were statistically significant in the northern and eastern portions of the country, but not in the West and South. Trends were positive on 92% of routes in the Northeast, but only 30% of routes in the southeast had positive trends.

Trends for ecoregions also showed a general Northeast-Southwest gradient, with significant ($P < 0.05$) increases in 6 of 9 ecoregions (Table 2). The Great Lakes region continued to show the greatest estimated annual increase (6.8%); the Gulf, the Rockies, and the Southwest Desert showed non-significant decreases (Table 2).

Trends were positive in 32 states and negative in 11 states (Table 3). Increases were significantly different from zero in 17 states; decreases were significant only in Arizona and Colorado. Most of the significant increases were in the northeastern and Midwestern states; the highest significant increases occurred in Ohio (10.1%), Michigan (9.4%), Vermont (8.8%), and New York (8.2%; Table 3).

Conclusions

Our analysis confirms that wintering Bald Eagle populations in the U.S. continue to increase. The estimated rate of increase for 1986-2005 is slightly lower than the estimated increase for 1986-2000. Increases continued to be higher in the northern and eastern part of the U.S. than in the West and South.

As a large-scale volunteer effort that developed over many years, the Midwinter Bald Eagle survey has inherent problems. Many reports we received could not be used because of incomplete documentation or inconsistent survey methods. Because survey routes were not randomly selected, we do not know if the standard routes used in this analysis are representative of the contiguous 48 states. Our findings are likely biased towards states and portions of states where agencies and individuals were committed to long-term, consistent data collection. We have assumed that winter counts are a reasonable index to eagle abundance at the areas surveyed during the January sampling period. Trend analyses based on counts as indexes are valid only if the proportion of the population sampled is constant from year to year. The ability to detect eagles on survey routes may vary with many factors, including weather, topography, and vegetation, and we are assuming that errors in detectability are consistent from year to year on a given survey route. We have controlled for variation in detectability by including only those surveys

that covered the same area, using the same transportation method each year. The count has become a tradition that will likely continue in many states. In addition to providing information on eagle trends, distribution, and habitat, the count has helped to create public interest in Bald Eagles and their conservation. Unlike nesting surveys, it provides information on both breeding and nonbreeding segments of the population at a potentially limiting time of year. It also provides an opportunity to monitor modifications or threats to habitat at important wintering areas.

Literature Cited

Millsap, B.A. 1986. Status of wintering Bald Eagles in the conterminous 48 states. *Wildlife Society Bulletin* 14:433-440.

Steenhof, K., L. Bond, K.K. Bates and L.L. Leppert. 2002. Trends in midwinter counts of Bald eagles in the contiguous United States, 1986-2000. *Bird Populations* 6:21-32.

Table 1. Estimates of trends in the Midwinter Bald Eagle count and proportion of survey routes with increasing trends, by region, 2986-2005. Asterisks indicate trends significantly different from zero. Regions are defined in relation to 40 degrees N and 100 degrees W.

Region	No. Routes	Trend estimate	95% Confidence Interval		% of routes with increasing counts
Overall	746	1.70%	(1.1%, 2.4%)	*	63%
North	360	3.60%	(2.6%, 4.5%)	*	76%
South	386	-0.10%	(-1.0%, 0.8%)		50%
East	355	3.50%	(2.5%, 4.4%)	*	75%
West	391	0.00%	(-0.9%, 0.9%)		52%
Northeast	131	6.00%	(4.4%, 7.6%)	*	92%
Southeast	224	1.00%	(-0.1%, 2.1%)		64%
Northwest	229	1.20%	(0.2%, 2.3%)	*	67%
Southwest	162	-1.20%	(-2.6%, 0.3%)		30%

Table 2. Estimates of percent annual change in midwinter Bald Eagle counts **by ecoregion**, 2986-2005 (n=746). Asterisks indicate trends significantly different from zero.

Ecoregion	% Annual Change	95% Confidence Interval	
East Coast[a]	2.50%	(1.4%, 3.6%)	*
Eastern Woodland[b]	1.70%	(0.7%, 2.6%)	*
Great Basin[c]	0.90%	(0.1%, 1.7%)	*
Great Lakes[d]	6.80%	(4.8%, 8.7%)	*
Gulf[e]	-0.10%	(-1.3%, 1.1%)	
Pacific Coast[f]	2.30%	(1.2%, 3.5%)	*
Prairie[g]	3.20%	(2.3%, 4.1%)	*
Rockies[h]	-0.10%	(-0.9%, 0.8%)	
Southwest Desert[i]	-1.10%	(-2.4%, 0.2%)	

[a] Southeastern Coastal Plan (27) and New England/Mid-Atlantic Coast (30)

[b] Atlantic Northern Forest (14), Central Hardwoods (24), Appalachian Mountains (28), and Piedmont (29)

[c] Great Basin (9) and Sierra Nevada (15)

[d] Boreal Hardwood Transition (12), Lower Great Lakes (13), and Prairie Hardwood Transition (23)

[e] Oaks and Prairies (21), West Gulf Coastal Plain (25), Mississippi Alluvial Valley (26), and Gulf Coastal Prairie (37)

[f] Northern Pacific Rainforest (5) and Coastal California (32)

[g] Prairie Potholes (11), Badlands and Prairie (17), Shortgrass Prairie (18)

[h] Northern Rockies (10) and Southern Rockies (16)

[i] Sonora and Mohave Deserts (33), Sierra Madre Occidental (34), and Chihuahua Desert (35)

Table 3. Number of survey routes and surveys used in the analysis, with estimated trends in the eagles counted, midwinter, by state, 1986-2005. Asterisks indicate trends significantly different from zero.

State	Routes	Surveys	Years	% Annual Change	95% Confidence Interval	
Alabama	3	57	(1986-2005)	0.20%	(-2.9%, 3.2%)	
Arizona	65	721	(1992-2005)	-1.30%	(-2.6%,-0.1%)	*
Arkansas	20	163	(1986-2005)	-0.40%	(-2.4%, 1.6%)	
California	7	78	(1986-2005)	1.20%	(-1.4%, 3.9%)	
Colorado	34	444	(1986-2005)	-2.30%	(-3.7%,-1.0%)	*
Connecticut	10	136	(1986-2005)	2.70%	(0.5%, 5.0%)	*
Delaware	1	13	(1989-2004)	3.30%	(-3.4%,10.5%)	
Georgia	9	61	(1989-2005)	0.10%	(-3.1%, 3.4%)	
Idaho	77	1176	(1986-2005)	1.70%	(0.9%, 2.5%)	*
Illinois	43	317	(1988-2005)	3.80%	(2.1%, 5.5%)	*
Indiana	25	346	(1986-2005)	3.40%	(1.8%, 5.0%)	*
Iowa	48	505	(1986-2005)	6.80%	(5.1%, 8.5%)	*
Kansas	15	210	(1986-2005)	2.50%	(0.4%, 4.6%)	*
Kentucky	17	163	(1986-2005)	1.10%	(-1.1%, 3.3%)	
Louisiana	6	53	(1986-2004)	-1.00%	(-4.6%, 2.7%)	
Maryland	3	53	(1986-2005)	4.90%	(1.7%, 8.1%)	*
Massachusetts	4	62	(1986-2005)	2.50%	(-1.1%, 6.3%)	
Michigan	3	31	(1987-1998)	9.40%	(4.2%,15.0%)	*
Minnesota	4	65	(1986-2005)	6.40%	(3.0%, 9.9%)	*
Mississippi	2	12	(1997-2005)	0.40%	(-6.4%, 7.8%)	
Montana	37	300	(1986-2005)	1.40%	(-0.3%, 3.2%)	
Nebraska	6	79	(1986-2005)	1.80%	(-1.3%, 5.1%)	
Nevada	10	72	(1992-2005)	-1.60%	(-4.6%, 1.5%)	
New Hampshire	6	63	(1991-2005)	6.30%	(2.7%,10.2%)	*
New Jersey	21	285	(1988-2005)	5.00%	(3.2%, 6.7%)	*
New Mexico	41	284	(1990-1996)	-1.20%	(-3.2%, 0.9%)	
New York	2	40	(1986-2005)	8.20%	(4.3%,12.1%)	*
North Carolina	4	33	(1987-2005)	0.30%	(-3.9%, 4.8%)	
North Dakota	1	20	(1986-2005)	0.40%	(-4.5%, 5.6%)	
Ohio	1	10	(1996-2005)	10.10%	(0.4%,20.8%)	*
Oklahoma	33	384	(1986-2005)	-0.50%	(-1.8%, 0.9%)	
Oregon	84	1234	(1988-2005)	1.70%	(0.8%, 2.6%)	*
Pennsylvania	8	77	(1986-2005)	4.90%	(1.8%, 8.1%)	*
South Carolina	24	223	(1993-2005)	1.10%	(-0.9%, 3.1%)	
South Dakota	4	71	(1986-2005)	-1.50%	(-4.2%, 1.3%)	

Tennessee	8	122	(1986-2005)	0.10%	(-2.3%, 2.5%)	
Texas	20	254	(1986-2005)	-0.20%	(-1.9%, 1.5%)	
Utah	19	262	(1986-2005)	-0.80%	(-2.5%, 1.0%)	
Vermont	3	39	(1989-2005)	8.80%	(4.3%,13.5%)	*
Virginia	4	27	(1997-2005)	2.70%	(-2.4%, 8.0%)	
Washington	5	60	(1986-2005)	3.30%	(-0.5%, 7.2%)	
West Virginia	1	8	(1995-2004)	-0.60%	(-9.4%, 9.0%)	
Wisconsin	8	61	(1991-2005)	4.70%	(1.2%, 8.2%)	*
TOTAL	746	8674				