



Growth and recovery of the bald eagle population in Oklahoma

M. Alan Jenkins and Steve K. Sherrod

Abstract We conducted surveys twice annually from 1990–2003 to determine the occupancy and reproductive success of known and newly reported bald eagle (*Haliaeetus leucocephalus*) nests in Oklahoma. During the study period, the number of nesting pairs of eagles increased from 0 to 41, and the number of young fledged per nest has remained between 1 and 2. The population and productivity level of bald eagles appear sufficient to declassify the species from its current listing as a federally threatened and state endangered species in Oklahoma.

Key words aerial surveys, bald eagle, *Haliaeetus leucocephalus*, Oklahoma, nests, population

The bald eagle (*Haliaeetus leucocephalus*) was among the first species to be placed on the federal list of endangered and threatened wildlife and plants. In 1995 the species' federal status was changed from endangered to threatened because of its increased population size and improved reproduction following the ban on dichloro-diphenyl-trichloroethane (DDT) in 1972 (United States Fish and Wildlife Survey [USFWS] 1995). Although many bald eagles occur in Oklahoma during the winter months, it was not a common nesting species in recent years, with no more than 1 known occupied nest/year from 1950–1990 (Sutton 1967, Lish and Sherrod 1986). It was determined that a population of 10 occupied nests, with an annual productivity of at least 1.0 young fledged per nest by 2002, would meet the recovery goal for Oklahoma (USFWS 1983). From 1984–1990, 90 nestling bald eagles originating from Florida were released by hacking in Oklahoma as part of a project to re-establish eagles as a breeding species in the southeastern United States (Jenkins and Sherrod 2002). Hacking is a release method in which young raptors are placed in a shelter in the release area and provided with food until they fledge and are independent (Sherrod et al. 1982).

Study area and methods

The study area encompassed all of Oklahoma. We received reports of nesting bald eagles and verified them as soon as possible. Reports came from state and federal agencies, private individuals (especially landowners), and the public media. Some nests were found while conducting aerial surveys to check known eagle breeding areas. A special additional helicopter survey for bald eagles was made for the Grand River Dam Authority's Lake Hudson (Mayes Co.) project and environs for relicensing purposes. We followed the Northern States Bald Eagle Recovery Plan recommendation of 2 annual surveys, 1 each early and late in the nesting season (USFWS 1983).

We conducted early season surveys near the average date of clutch completion and late surveys after adults had ceased continual brooding (i.e., from 5–9 weeks of age to fledging at ca. 11–12 weeks of age). There can be a month or more difference in timing of reproductive stages among breeding pairs. In the beginning of each survey period, we made an effort to visit those nests that were consistently early. In Oklahoma annual surveys began in mid-January.

Authors' address: G. M. Sutton Avian Research Center, University of Oklahoma, Oklahoma Biological Survey, P. O. Box 2007, Bartlesville, OK 74005; e-mail for Jenkins: alanjenkins@ou.edu.



A banded female bald eagle, previously released by the G. M. Sutton Avian Research Center, returns to her nest on the Arkansas River in Oklahoma.

We surveyed most known breeding areas from a Partenavia Observer (Vulcanair S.p.A., Naples, Italy) flown by USFWS. The Observer was specifically designed for wildlife counts and observation; it has a high-wing, low-minimum-air-speed operating limit and a plastic observation nose cone to facilitate passenger visibility. We flew the aircraft over nests at 33 m above ground level at an airspeed of 100 knots. We made supplemental flights in a Cessna 210 Centurion turboprop (Cessna, Wichita, Kans.) to check breeding areas of some outlying and late nests in February. We checked the remainder of the breeding areas on foot or by kayak. Additional historical occupancy and productivity data came from members of the public, usually landowners, who reported nests to us.

We adopted terminology used by Postupalsky (1974) to describe nest occupancy and reproduction. An occupied nest was one with a pair of eagles present. Usually this was 2 eagles in adult plumage, but bald eagles can breed as young as 3 years old (Mulhern et al. 1994); thus, we also counted nests with 2 subadults as occupied. An active nest was one in which eggs were laid. A successful nest was one where at least 1 young eagle fledged, and productivity was described as the number of young eagles fledged per nest.

A few occupied nests reported to us were attended by a pair of adults that failed to lay eggs and left the nest area about the time migrant eagles leave Oklahoma (Sutton 1967). On one occasion, we observed copulation on such a nest, but no eggs were laid, and we did not see the pair at the nest again. We believe these pairs were migrants from breeding areas to the north. We termed these “win-

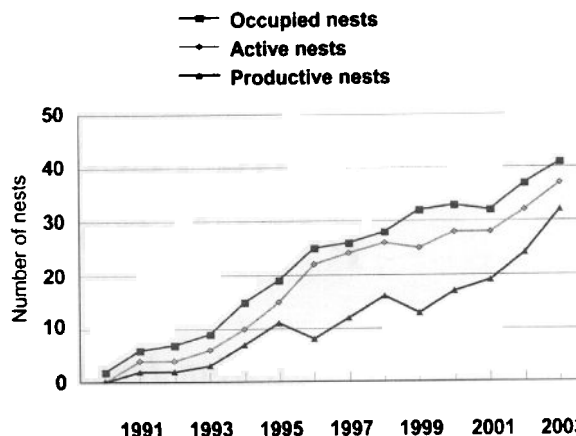


Figure 1. Annual numbers of occupied, active, and productive Oklahoma bald eagle nests, 1990-2003.

ter nests” (Jenkins and Sherrod 1993). We did not observe any winter nest being reoccupied in subsequent years. We did not include data from 2 winter nests in the results.

Results

The bald eagle's population has increased steadily in Oklahoma since 1990 (Figure 1). In slightly more than a decade, the number of occupied nests has increased 20-fold, and the number of nests has increased concomitantly. Productivity was highly positively correlated to nesting effort (Figure 2), and the number of fledglings per productive nest has remained steady (Table 1).

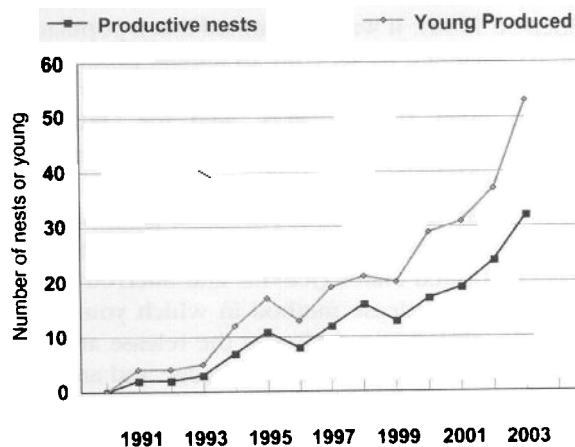


Figure 2. Annual numbers of productive Oklahoma bald eagle nests and young produced, 1990-2003.

Table 1. Annual mean number of young for occupied, active, and productive bald eagle nests in Oklahoma 1990-2003.

Year	Occupied	Active	Productive
1990	0.00	0.00	0.00
1991	0.67	1.00	2.00
1992	0.57	1.00	2.00
1993	0.55	0.83	1.67
1994	0.80	1.20	1.71
1995	0.89	1.13	1.55
1996	0.52	0.59	1.63
1997	0.73	0.79	1.58
1998	0.75	0.81	1.31
1999	0.63	0.80	1.54
2000	0.88	1.04	1.71
2001	0.97	1.11	1.63
2002	1.00	1.16	1.54
2003	1.29	1.43	1.67
Mean, all years	0.85	1.02	1.60

Discussion

From 1950 through 1990, only a few bald eagles were known to have bred successfully in Oklahoma. Bald eagle reproduction was intermittent at best; no more than 1 young was fledged statewide in any 1 year before 1991 (Lish and Sherrod 1986). After 1990 and the introduction over a 6-year period of 90 translocated bald eagles, the number of breeding pairs and young fledged increased during the next 14 years (Figure 1). All released eagles were banded with USFWS (the Bird Banding Laboratory is now a unit of the United States Geological Survey) aluminum bands and larger plastic auxiliary marker leg bands. Where it could be determined, fortuitous sightings of banded eagles showed that most, if not all, of the breed-



U.S. Fish and Wildlife Service's Partenavia Observer aircraft used for low level bald eagle nest surveys in Oklahoma.

ing eagles after 1990 were birds that we had released. Some of these birds may still be in the breeding population. For example, in May 2002 an injured banded eagle was captured near Muskogee, Oklahoma. The bird was derived from Florida as an egg, hatched, reared, and hatched in Oklahoma, and had lived in the wild for 16 years following its release. Another bird found injured in October 2003 had been banded and hatched in 1990. However, although some of the original released eagles were still a part of the population in 2003, most current breeders probably are progeny from several generations of released birds.

We believe that recent increases in the bald eagle nesting population in Oklahoma are due to the increase in favorable habitat, namely the impoundment of rivers to create reservoirs; to the decrease in chlorinated hydrocarbon pesticides in the environment that occurred after legislation limiting their use in the United States was enacted; and to the reintroduction of the species by hatching from 1985-1990.

As of 2003 the population of Oklahoma's nesting eagles was 4 times greater than the number suggested as the recovery goal by the Northern States Bald Eagle Recovery Team (USFWS 1983) (Figure 1). The population surpassed the recommended recovery level of 10 occupied nests in 1994 (Figure 1), and the annual productivity goal of at least 1.0 young fledged per nest has been reached every year since 1991 (Table 1). These increases in nesting and productivity within the state indicate a healthy and expanding population of bald eagles.

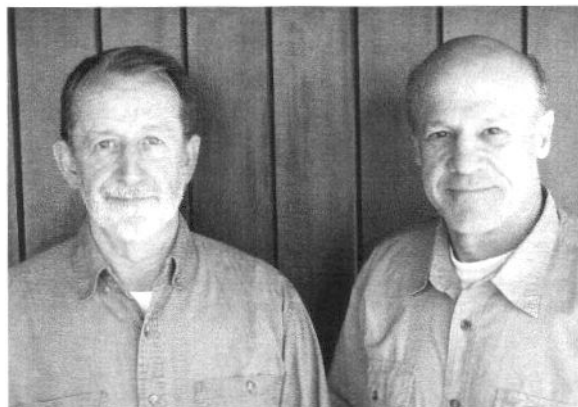
The threatened or endangered classification by Oklahoma is the same classification assigned by the federal government and automatically changes with it. Currently the bald eagle is classified as threatened by the state of Oklahoma and the federal government. Based on our data, the nesting population of the bald eagle in Oklahoma has increased from a few and intermittent nesting pairs and fledged young to the current level, which more than justifies removal of the species from endangered and threatened status in the state.

Acknowledgments. We thank the many cooperators and funders of this research: the United States Fish and Wildlife Service and Region 2 pilot J. Bredy, the Oklahoma Department of Wildlife Conservation, the United States Army Corps of Engineers, and *Tulsa World* pilot B. Guess. Funders of the eagle restoration project to whom we owe

extreme gratitude include: K. S. Adams Foundation, S. S. Adams, AEP/Public Service Company of Oklahoma, Alabama Department of Wildlife Conservation, American Airlines, L. J. Eaton and the Bank of Oklahoma, Bernsen Foundation, J. A. Brock, CITGO Corp., Conoco Petroleum Co., Florida Game and Freshwater Fish Commission, Founders & Associates, Inc., Dr. D. Fuller, Chapman Charitable Trust, D. Henley of "The Eagles," L. Johnson, Kerr Foundation, R. E. Lorton, Lyon Foundation, Mabee Foundation, McCune Charitable Trust, Dr. V. Mihailovic, Phillips Petroleum Co., H. C. Price, R. J. Reynolds Co., Sarkeys Foundation, the *Tulsa World*, United States Army Corps of Engineers, United States Fish and Wildlife Service, J. H. Williams and the Williams Cos., J. S. Zink and the John Steele Zink Foundation, and numerous other corporations, foundations, and private individuals. The manuscript was improved by the suggestions and corrections of Michael A. Patten, Sally Jenkins, J. Michael Meyers, and an anonymous reviewer.

Literature cited

- JENKINS, M. A., AND S. K. SHERROD. 1993. Recent bald eagle nest records in Oklahoma. *Bulletin of the Oklahoma Ornithological Society* 26: 25-28.
- JENKINS, M. A., AND S. K. SHERROD. 2002. Successful restoration of bald eagles in the southeastern United States. Pages 175-181 *in* R. Yosef, M. L. Miller, and D. Pepler, editors. *Raptors in the new millennium*. International Birding Research Center, Eilat, Israel.
- LISH, J. W., AND S. K. SHERROD. 1986. A history of bald eagle nesting activity in Oklahoma. *Proceedings of the Oklahoma Academy of Science* 66: 15-20.
- MULIERN, D. W., M. A. WATKINS, M. A. JENKINS, AND S. K. SHERROD. 1994. Successful nesting by a pair of bald eagles at ages three and four. *Journal of Raptor Research* 28: 113-114.
- POSTUPALSKY, S. 1974. Raptor reproductive success: some problems with methods, criteria and terminology. Pages 21-31 *in* F. N. Hamerstrom, Jr., B. E. Harrell, and R. R. Olendorf, editors. *Management of raptors, raptor research report 2*. Vermillion, South Dakota, USA.
- SHERROD, S. K., W. R. HEINRICH, W. A. BURNHAM, J. H. BARCLAY, AND T. J. CADE. 1982. *Hacking: a method for releasing peregrine falcons and other birds of prey*. The Peregrine Fund, Inc., Ithaca, New York, USA.
- SUTTON, G. M. 1967. *Oklahoma birds*. University of Oklahoma Press, Norman, Oklahoma, USA.
- UNITED STATES FISH AND WILDLIFE SERVICE. 1983. *Northern states bald eagle recovery plan*. Northern States Bald Eagle Recovery Team, Washington, D.C., USA.
- UNITED STATES FISH AND WILDLIFE SERVICE. 1995. *Endangered and threatened wildlife and plants: final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 states*. *Federal Register* 60(133): 36000-36010.



M. Alan Jenkins (left) is the Assistant Director for the G. M. Sutton Avian Research Center of the Oklahoma Biological Survey, University of Oklahoma. His major research interest is birds of prey, mainly falcons and eagles. He received his B.S. degree at Utah State University and his M.S. degree from Brigham Young University, both in zoology. He formerly worked for the United States Fish and Wildlife Service's Denver Wildlife Research Center as a raptor biologist from 1975-1984. He has served as a member on the American Peregrine Falcon (Rocky Mountain and Southwest Populations) and Northern States Bald Eagle Recovery Teams, as well an officer of the Oklahoma Chapter of The Wildlife Society. **Steve K. Sherrod** (right) has served for over 20 years as executive director of the George Miksch Sutton Avian Research Center of the Oklahoma Biological Survey, University of Oklahoma. His primary interest is in environmental conservation and using birds as indicator species for environmental health. He received his B.S. in zoology from the University of Oklahoma, his M.S. in biology from Brigham Young University, and his Ph.D. in biology from Cornell University. He is President of the North American Grouse Partnership and serves on the Attwater's Prairie-Chicken Recovery Team.

Associate editor: *Fuler*

