

ANNUAL REPORT

Avian Research Subsection Wildlife Research Section Fish and Wildlife Research Institute

Project: **9291-250-2596 -Annual Bald Eagle Surveys in Florida**

Contract: Bald Eagle Population Monitoring #06150

FWC\FWRI CODE: 2596-06-A1

Fiscal Year Covered: FY 2007-2008

Principal Investigator: Janell M. Brush, Assistant Research Scientist, FWC, Fish and Wildlife Research Institute, 4005 South Main Street, Gainesville, FL 32601

Contractor: Stephen A. Nesbitt, Biological Administrator, FWC, Fish and Wildlife Research Institute, (retired), 5407 SW 86th Drive, Gainesville, FL 32608

Participants: John H. White, Biological Scientist III (retired), Florida Fish and Wildlife Conservation Commission, P.O. Box 1903, Eustis, FL 32727

Prepared By: Janell M. Brush and Stephen A. Nesbitt

Date Prepared: November 13, 2008

Abstract: An annual statewide survey of all known bald eagle nesting territories in Florida is conducted between November and March. Surveys are flown by fixed or rotary winged aircraft. All nesting and productivity data for bald eagles in Florida are compiled and analyzed to generate annual population estimates that are used to determine the Florida eagle population trend. The number of active bald eagle nesting territories documented in 2008 was 1,280. The number of young produced this year was estimated at 1,495, similar to the number estimated for 2007 (1,263). The productivity rates for 2008 (based on 403 nests for which results were determined) were, 1.17 per active territory and 1.60 per successful nest. The numbers for the 2007/2008 nesting survey represent an estimated population of between 3,400 (breeding adults, non-breeders, and subadults) and 4,900 (breeding adults, non-breeder, subadults, and young produced in 2008). The continuation of this survey is critical for the conservation and management of the bald eagle in Florida. This will enable us to monitor the population of this recently delisted species.



INTRODUCTION

The bald eagle (*Haliaeetus leucocephalus*) is one of the most thoroughly studied birds, with perhaps more than 2,500 articles published on its biology or management (Buehler 2000). There is much information available concerning the life history and habitat requirements of the bald eagle in Florida. This includes: nesting requirements (Broley 1947, McEwan and Hirth 1979, Wood *et al.* 1989); effects of habitat protection (Nesbitt *et al.* 1993); analyses of setback distances and disturbance levels (Nesbitt *et al.* 1993, Millsap *et al.* 2004); and habitat use and movements (Wood 1992, Wood *et al.* 1998, Mojica 2006). Despite the wealth of information gathered previously, additional research is needed to ensure the long-term conservation and management of bald eagles in Florida.

Historically, Florida's bald eagle population "must have been well in excess of 1000 nesting pairs," and numbers around Tampa Bay and Merritt Island were thought to be "among the densest breeding concentrations of a large raptor known anywhere on earth" (Peterson and Robertson 1978). Following severe decreases in population size, several federal and state regulations were put in place to protect the bald eagle. The bald eagle was first protected nationally in 1918 under the Migratory Bird Treaty Act (16 U.S.C. 703–711), which protected nearly all native birds and their nests. The Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668–668c) offered additional protection against the take and disturbance of bald eagles and their nests. In 1972, the U.S. Environmental Protection Agency banned all domestic use of DDT. The following year, the Endangered Species Act of 1973 (16 U.S.C. 1531–1544) was passed, and the bald eagle was added to the list of federally endangered and threatened species in 1978.

The elimination of DDT and the increased protection for the eagle led to the species recovery. The increase of bald eagle population in Florida occurred during a time of accelerated human occupancy throughout the state. The conclusion that can be drawn is that bald eagle populations can flourish even when faced with development pressures if appropriate habitat

protections and development monitoring guidelines are in place. There is speculation based on the population trend leveling off that Florida may have reached its carrying capacity for the bald eagle (Figure 1). Despite this population plateau, the eagle population in Florida has remarkably recovered.

In June 2007 the bald eagle was removed from the USFWS endangered species list. Although the bald eagle is no longer protected under the Endangered Species Act, it is still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The USFWS (2007) has redefined some of the terminology included in the Bald and Golden Eagle Protection Act, which prohibits the “take” of bald eagles, including their nests or eggs. The act defines take as meaning to “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb” an eagle. The new (USFWS 2007) definition of “disturb” is to “agitate or bother a bald or golden eagle to the degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.”

In April 2008, FWC approved the FWC Bald Eagle Management Plan and removed the species from the Imperiled Species List. A new FWC eagle website was developed at http://myfwc.com/eagle/Eagle_Index.htm. The new website includes information about the bald eagle management plan, permitting requirements, eagle biology, current research, and bald eagle nest locations. The FWC eagle nest locator website has also been updated at <http://myfwc.com/eagle/eaglenests/nestlocator.aspx>. The information in the site is current through the 2008 bald eagle nesting season. The new eagle nest locator website has many new features including:

- User-friendly nest territory search ability, including search by address
- Export query summary and maps to excel or word (including nest history)
- Google maps displaying all the nests in a single area
- View history feature

FWC staff and others have monitored bald eagle nests in Florida since 1972. The information gathered during the past 35 years includes the locations of over a thousand eagle nesting territories, breeding productivity, core nesting areas, reproductive success, and population trends. The current survey represents a minimum estimate of the state’s population (Nesbitt et al. 1990). To expand the survey, additional surveys were initiated during the 06-07 breeding season and will continue through the next breeding seasons. This additional survey expands the current survey by increasing the effort of locating previously undiscovered nests by focusing on potential bald eagle habitat in areas where there are currently no known nests. Historically, fewer eagle nests have been located in the Florida panhandle west of the Suwannee River compared to the peninsula. The panhandle region and other identified areas in the state will be surveyed with either more transects or increased flight time in suitable habitat to determine if there are undetected nests. All nesting and productivity data gathered during the surveys are compiled and analyzed to generate annual population estimates that are used to determine the Florida eagle population trend.

METHODS

A statewide survey of eagles was conducted during their nesting seasons (October through May). Surveys were flown by fixed or rotary winged aircraft. Replication of the survey methodology ensures that effort is comparable among years. Some nests were surveyed from the ground. The U.S. National Park Service (NPS) surveys Everglades National Park, and the Commission is responsible for the remainder of the state. All previously known bald eagle nests were checked for activity. All reported new nests were checked and any areas inadequately surveyed in the past were more thoroughly checked for nests.

The survey protocol followed Nesbitt et al. (1990) and include the following methods: reduce airspeed to 60-80 knots (111-120 kph), at an altitude of 300-500 feet (90-150 m), at a distance >300 m from the nest to avoid disturbance, no flights will take place during inclement weather or winds >20 knots (37 kph), and nests that are impossible to approach from the air because of FAA or military restrictions (i.e., too near an airport or military base) will be observed from the ground.

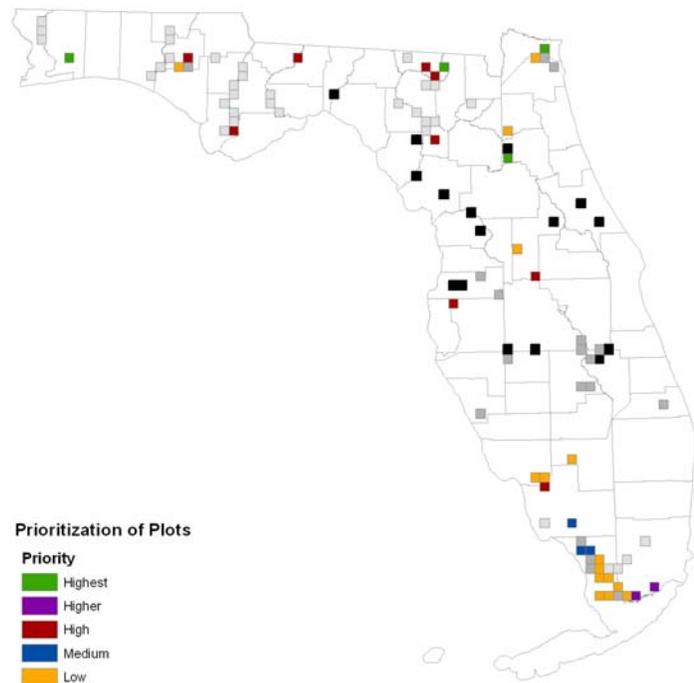
Nest locations were determined with the use of WAAS Global Positioning System (WGPS) unit with an accuracy of ± 10 m of the true location. Locations were recorded in longitude and latitude to hundredths of a minute and stored and displayed in NAD83 datum. The township, range, and section of each nest location also will be provided. A system called "X Marks the Spot" developed by Paul Kubilis of the FWC will be employed to record the location of new nest sites. This method consists of flying over the nest from two separate directions at an angle >60 degrees and making a waypoint over the nest with each pass. This technique provides three separate points (two waypoints and the crossing point of the two over-flights). This method necessitates that the GPS be capable of recording a flight log and each flight must be downloaded before the next flight. Otherwise, with current memory limitation of these hand held GPS units, the flight log will over-fill and data will be lost.

In addition to the traditional survey described above, a proportion of plots of suitable eagle nesting habitat was surveyed using a modified "dual frame method" (Haines and Pollock 1998). The dual frame method combines the efficiency and cost effective advantages of a list sampling frame (i.e., the current list of all known nest locations based on the previous 5 nesting seasons from the traditional survey database; this is a low cost survey method albeit often found to be incomplete) and area frame sampling (i.e., designates randomly selected plots to be surveyed for nests for geographic boundaries or regions of interest; this has been shown to be very efficient for sampling albeit more costly to cover a large area as on a statewide basis). The area frame sampling implements a double-observer procedure for estimating number of nests missed during the traditional or list sampling frame survey method. The dual frame method of analysis uses the sample information from both the list frame and the area frame to arrive at a more precise estimate of nest density across the entire study area. To conduct the analysis, nests identified in the area frame sampling are separated into the two categories: the overlap (nests in the plots that also occur in the list frame or traditional survey) and non-overlap (nests that are newly found in the plots) domains. The non-overlap nests are identified, and are used to estimate the total number of nests not in the list frame. Because these reconciled nests are only the ones not in the list sample, the list and area estimates are independent, so the variances from the list and area samples can be

added. The cost of obtaining an estimate of the total number of nests with the same standard error can be halved. The sum of the estimates from the area frame and the list frame are used to determine a total number of occupied eagle nests statewide. This methodology has been demonstrated to identify essentially 100% of the nests in the area surveyed (Mark Otto, USFWS unpublished report). Results from this sampling will be analyzed next year.

To implement this methodology for our modified dual frame survey, a map was generated showing all potential eagle habitat in Florida using GIS landscape information from the Closing the Gaps Program and the Bald Eagle Potential Habitat Model analysis. In addition to potential habitat, a selection criterion was developed based on scientific knowledge of bald eagle habitat selection in Florida and historical nesting location preferences. A grid of 6x6-mile (9.66x9.66-km) plots was overlain on the state. A subset of plots (n=101) was identified whose boundaries contained at least 50% coverage of potential eagle habitat (i.e., plots that have a greater likelihood of having nests) but contained no known nests (Figure 1). Plot locations (latitude/longitude locations of corners) were provided by the FWC staff and surveyed by two scientists. Each plot was surveyed along transect lines spaced at quarter-mile (0.4-km) intervals employing the double observer protocol (both observers in the rear seats and one observer on each side of the aircraft). A random sample of 16 plots was selected from this subset for implementation of the modified dual frame method this year. We are hoping to sample more plots over the next two years (at least 30 per year). New nests discovered during the modified dual frame survey will be incorporated into the master nest list and will be surveyed in the future with the annual statewide survey.

Figure 1. Prioritization of grid cell plots containing potential eagle nesting habitat and no known nests.



RESULTS

The 2007/2008 statewide survey began on 7 December 2007 and the last regular survey flight was flown on 14 April 2008. We flew many flights the last two seasons as part of the modified dual frame survey. We have sampled 29 plots in previously under surveyed areas that held potential eagle nesting habitat. A total of 14 confirmed new nesting territories were located during those surveys resulting in over half of the surveyed plots yielding new nests to add to our statewide survey effort. The number of active bald eagle nesting territories documented in 2008 was 1,280 (Table 1). The number of young produced this year was estimated at 1,495, this was close to the number estimated for 2007 (1,263). The productivity rates for 2008 (based on 403 nests for which results were determined) were, 1.17 per active territory and 1.60 per successful nest. The number of young per active territory and the number of young per successful nest were in line with the preceding 10 year and 5 year means (Table 2). This survey does not include eagles that nest in Everglades National Park (traditionally 30 to 50 pairs) and if those numbers were included the estimated population would be increased by 112 to 187 eagles. The numbers for the 2007/2008 nesting survey represent an estimated population of between 3,400 (breeding adults, non-breeders, and subadults) and 4,900 (breeding adults, non-breeder, subadults, and young produced in 2008). This survey did not include eagles nesting in Everglades National Park (traditionally 30 to 50 pairs) and if those numbers were included the estimated population would be increased by 115 to 190 eagles.

DISCUSSION

The population of nesting bald eagles in Florida in 2008 increased by 4.9% over the number of active territories reported in 2007 (Figure 1). This was greater than the mean increase of 1.5% for the preceding 5 years; however that 5 year span included 1 year of no growth and 1 year of negative growth. The current percent of annual growth in nesting population, though positive, is below the rate of 9% a year for the 5 years from 1991 through 1995. The year over year growth rate of the nesting bald eagle population in Florida has been declining in recent years (Figure 2). One reason why the growth rate for Florida's nesting bald eagle population is approaching zero is perhaps because numbers are approaching carry capacity.

Geographic distribution of bald eagle nesting territories in Florida continues to increase as the overall nesting population grows. Sixty-one of Florida's 67 counties supported nesting bald eagles in 2008 (Table 3); another 3 counties that had nesting in previous years were not surveyed this year (see above), so the actual total number of counties with nesting bald eagles may have been 64. Nine counties were represented by just 1 nesting pair, while 16 were represented by >25 nesting pairs, and 2 (Osceola and Polk) supported 116 and 119 nesting pairs respectively.

In 2008 live pine trees were used for 72.1% of the active nest site, dead pines were used for 13.3% of active nest sites. Live cypress trees were used for 7.1% of the active sites and dead cypress accounted for 0.9% of the active nest sites. In all living substrate accounted for 82.6% of all the active nest sites in 2008. The use of artificial or manmade structures increased slightly in 2008 with 28 (1 more than in 2007). The use of artificial nest sites has not increased that dramatically over the last 5 years; however the use of artificial nest sites was non-existent during the first 10 to 20 years of the survey. Artificial sites used by nesting bald eagles in Florida in 2008 included cell phone towers and power transmission poles.

It is important that the population in Florida be monitored as the new post-delisting management paradigm begins. There is no reason that with effective habitat management the species cannot be sustained at or above the current population level. During 2008/2009 we should continue to refine the selection criterion for survey plots potential eagle nesting habitat and survey 20 more plots if possible.

ACKNOWLEDGMENTS

We wish to thank the following agencies: The Wildlife Foundation of Florida, United States Fish and Wildlife Service, USDA Forest Service - Ocala National Forest, Everglades National Park, and Ocala Aviation Services. Funding was provided through the Bald Eagle Conservation Fund and USDA Forest Service. Thank you to the many individuals who continue to contribute to the success of this project, in particular thanks to: Will Bradford, Stuart Cumberbatch, Jake Gipson, Georgia Kratimenos, Paul Kubilis, Candice Martino, Alice Mason, Steve Nesbitt, Rosanna Rivero, Jim Rodgers, Kristin Rogers, Deborah Schimmel, Linda Torres, Ron Towater, John White. Photo acknowledgement: Arpat Ozgul.

REFERENCES

- Broley, C.L. 1947. Migration and nesting of Florida bald eagles. *Wilson Bulletin* 59:3–20.
- Buehler, D.A. 2000. Bald eagle (*Haliaeetus leucocephalus*). Number 506 in *The Birds of North America* (A. Poole, P. Stettenheim, and F. Gill, editors). The Academy of Natural Sciences, Philadelphia, PA, and the American Ornithologists' Union, Washington, D.C.
- McEwan, L.C., and D.H. Hirth. 1980. Food habits of the bald eagle in north-central Florida. *Condor* 82: 229–231.
- Millsap, B., T. Breen, E. McConnell, T. Steffer, L. Phillips, N. Douglass, and S. Taylor. 2004. Comparative fecundity and survival of bald eagles fledged from suburban and rural natal areas in Florida. *Journal of Wildlife Management* 68: 1018–1031.
- Mojica, E.K. 2006. Migration, home range, and important use areas of Florida sub-adult bald eagles. Master's thesis, University of Georgia. Athens, GA.
- Nesbitt, S.A., G.L. Holder, D.A. Mager, and S.T. Schwikert. 1990. Use of aerial surveys to evaluate bald eagle nesting in Florida. Pages 207–210 in *Proceedings of the Southeast Management Symposium and Workshop*. National Wildlife Federation. Washington, D.C.
- Nesbitt, S.A., M.J. Folk, and D.A. Wood. 1993. Effectiveness of bald eagle habitat protection guidelines in Florida. *Proceedings of the Annual Conference of Southeastern Associated Fish and Wildlife Agencies* 333–338.
- Sullivan, D., T.H. Logan, C.M. Martino, S.[A.] Nesbitt, and T. Steffer. 2006. Biological Status Report for the Bald Eagle. Florida Fish and Wildlife Conservation Commission.

Tallahassee, FL.

USFWS. 2007. National bald eagle management guidelines. Washington, D.C.

Wood, P.B., T.C. Edwards, and M.W. Collopy. 1989. Characteristics of bald eagle nesting habitat in Florida. *Journal of Wildlife Management* 53: 441–449.

Wood, P.B. 1992. Habitat use, movements, migration patterns, and survival rates of sub-adult bald eagles in north Florida. Ph.D. dissertation, University of Florida. Gainesville, FL.

Wood, P.B., M.W. Collopy, and C.M. Sekerak. 1998. Postfledging nest dependence period for bald eagles in Florida. *Journal of Wildlife Management* 62: 333–339.

LIST OF TABLES

Table 1. Results of bald eagle nesting activity in Florida 2002–2008 (excluding ENP).

	#			
Year	Active	# Not Active	# Gone	# Unknown
2002	1098	251	463	32
2003	1116	352	355	21
2004	1077	237	469	61
2005	1158	171	453	61
2006	1166	174	499	89
2007	1218	228	491	79
2008	1280	225	457	75

Table 2. Productivity results for bald eagles nesting in 1998–2007 and 2008.

Year	# Active Nests	# Young Produced	Young / Active Nest	Young / Successful Nest
1998	980	1120	1.14	1.31
1999	1,043	1220	1.17	1.50
2000	1,069	1,165	1.09	1.62
2001	1,102	1,311	1.19	1.60
2002	1,133	1,280	1.13	1.52

2003	1,133	1,280	1.14	1.54
2004	1,092	1,318	1.14	1.54
2005	1,133	1,473	1.30	1.59
2006	1,166	1,527	1.31	1.52
2007	1,218	1,303	1.07	1.46
Mean preceding 10 years (SD)	1,106.9 (66.5)	1,299.7 (124.6)	1.17 (0.08)	1.52 (0.09)
Mean preceding 5 years (SD)	1,148.4 (46.9)	1,380.2 (111.8)	1.19 (0.11)	1.53 (0.05)
2008	1,280	1,495	1.17	1.60

Table 3. Number of active bald eagle nests by county in Florida 2003–2008.

COUNTY	YEAR					
	2008	2007	2006	2005	2004	2003
Alachua	51	42	43	40	33	40
Baker	1	1	0	0	0	0
Bay	11	12	9	12	7	6
Bradford	4	3	3	3	2	3
Brevard	39	42	43	42	41	42
Broward	1	0	0	0	0	0
Charlotte	38	29	26	26	25	26
Citrus	21	23	17	19	19	16
Clay	11	9	7	10	10	10
Collier	23	21	24	15	18	21
Columbia	2	2	2	2	1	2
Dade	1	1	1	1	1	0
De Soto	4	3	4	1	6	6
Dixie	7	9	6	8	8	8
Duval	10	7	7	10	6	7
Escambia	1	1	1	1	0	0
Flagler	10	9	9	8	6	6
Franklin	28	40	25	34	20	23
Gadsden	3	3	3	3	1	3
Gilchrist	1	1	1	0	0	1
Glades	14	17	15	16	12	14
Gulf	10	11	6	6	5	3
Hamilton	3	1	1	2	1	1
Hardee	5	5	2	3	3	3
Hendry	5	5	6	4	2	6
Hernando	12	13	16	14	10	12

Highlands	37	32	37	30	25	30
Hillsborough	20	19	17	16	20	19
Indian River	7	9	7	10	5	8
Jackson	5	4	4	4	3	6
Jefferson	2	3	4	4	4	3
Lake	70	69	75	65	68	65
Lee	51	50	47	42	43	42
Leon	7	9	9	9	8	6
Levy	24	27	28	26	22	18
Liberty	3	2	2	2	1	2
Manatee	21	21	18	18	15	17
Marion	51	46	38	36	34	34
Martin	15	13	16	10	11	9
Monroe	7	6	6	1	1	1
Nassau	1	0	0	0	0	0
Okaloosa	U	1	2	1	2	2
Okeechobee	16	19	15	16	18	17
Orange	38	35	34	29	30	35
Osceola	116	112	107	118	116	116
Palm Beach	7	9	7	10	9	11
Pasco	18	16	16	16	14	17
Pinellas	17	16	16	16	20	19
Polk	119	113	121	122	118	122
Putnam	67	50	41	57	46	52
Santa Rosa	U	3	3	2	0	0
Sarasota	41	37	33	34	31	33
Seminole	49	51	52	47	46	48
St. Johns	25	19	18	15	14	10
St. Lucie	8	8	10	11	9	8
Sumter	15	15	12	16	14	15
Suwannee	2	2	1	2	1	1
Taylor	16	10	10	9	6	7
Union	1	1	1	1	0	1
Volusia	73	60	66	70	67	70
Wakulla	11	18	14	11	15	10
Walton	U	2	1	1	3	2
Washington	1	1	1	1	1	1

Table 4. Nesting substrate used by bald eagle nesting in Florida 2003–2007.

Year	Australian Pine		Other		Oak		Sand Pine		Cypress		Pine		Artificial
	<i>Live</i>	<i>Dead</i>	<i>Live</i>	<i>Dead</i>	<i>Live</i>	<i>Dead</i>	<i>Live</i>	<i>Dead</i>	<i>Live</i>	<i>Dead</i>	<i>Live</i>	<i>Dead</i>	
2003	10	3	3	2	8	1	12	0	79	13	839	120	21
2004	11	1	6	3	13	2	8	0	84	13	807	100	23
2005	12	0	5	2	12	2	6	1	86	8	918	80	20
2006	14	5	6	1	12	7	10	0	89	13	865	117	21
2007	17	6	7	3	14	1	8	1	84	12	862	165	27
2008	19	7	8	3	16	3	4	2	90	12	914	167	28

Figure 2. Number of bald eagle nesting pairs in Florida 1998 – 2008.

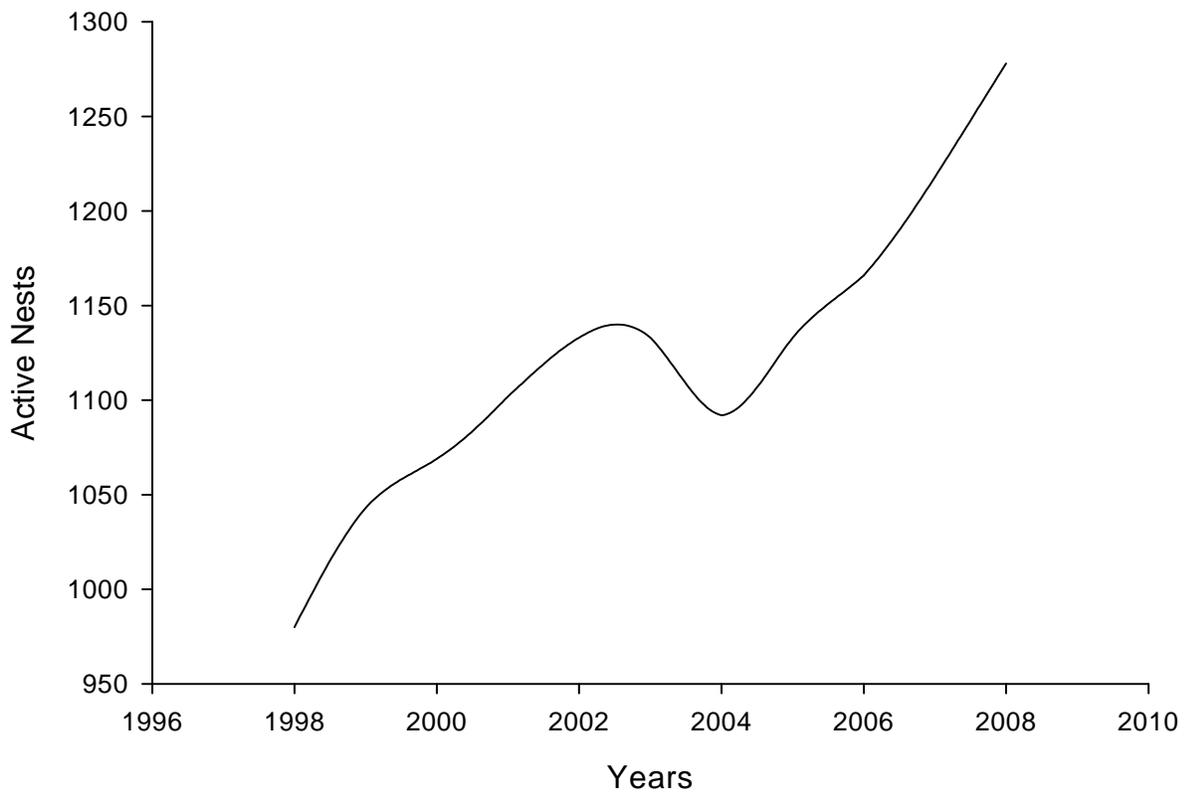
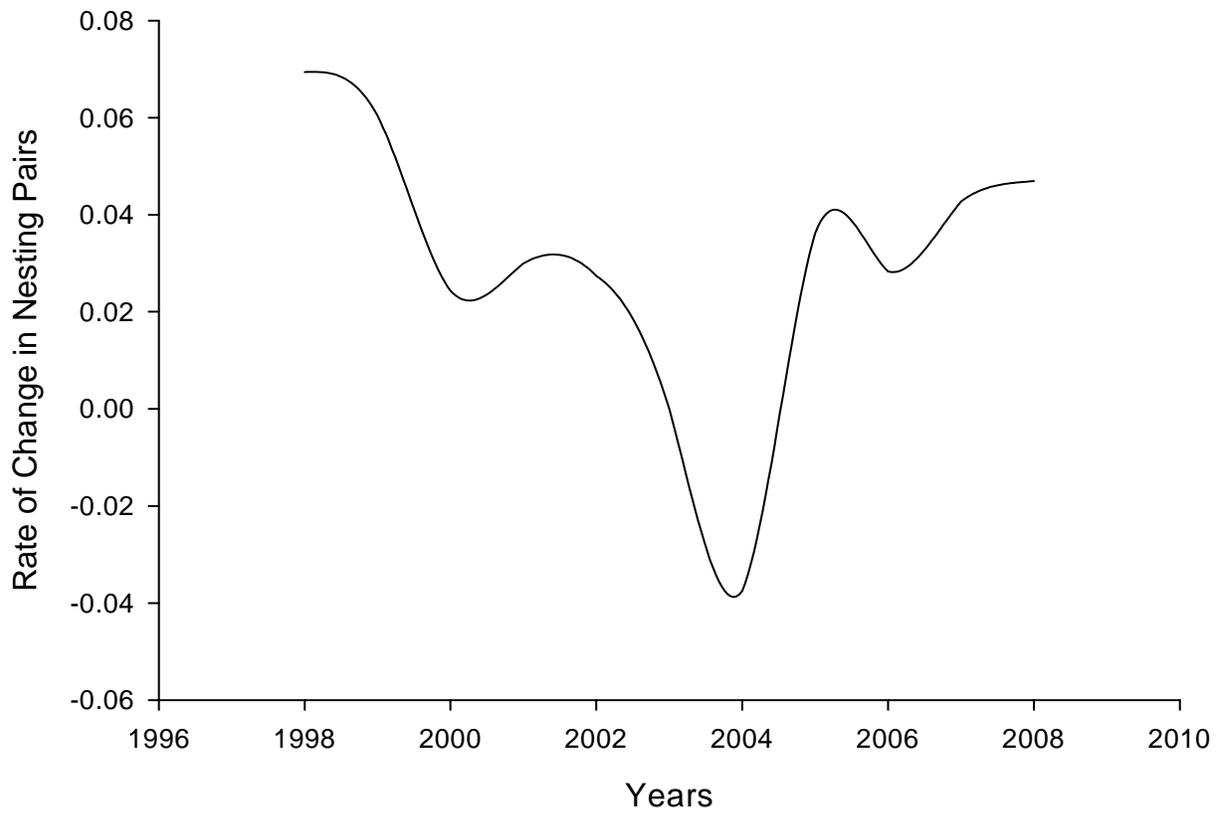


Figure 3. Rate of annual increase in number of bald eagles nesting in Florida 1998 – 2008.



APPENDIX

Manuscript – In preparation

CONCENTRATED BALD EAGLE NESTING IN FLORIDA

STEPHEN A. NESBITT,¹ MARK A. BARRETT,¹ JANELL M. BRUSH,¹ JOHN H. WHITE,² JAMES L. HATCHITT,³ AND RICHARD A. KILTIE¹

ABSTRACT. – *We used Geographic Information System (GIS) to analyze nearest neighbor distances among nesting bald eagles in Florida during 1998 to 2007. We identified an increase from 10 to 21 clusters of nesting eagles during the period. Five clusters that were identified in the 1970s were present in 2007. The cumulative average linear nest density was 0.29 nests / km, with a density of 0.43 nests / km in the areas of greatest concentration. Statewide density in 2007 was 5.51 nests / 100 km². Using these data, an interpolated average territory size in Florida would be 317.1 hectares. In the best nesting habitat where nesting concentration is greatest, the average nesting territory size would be 279.5 hectares. In 2007 only 40.7% of the eagle nests in Florida were on protected, i.e. public-owned, lands; 44.9% of the clusters fell on 15 public-owned lands. The challenge will be to protect the integrity of these core nesting areas as the human population continues to encroach on Florida's remaining natural habitat.*