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RH: Florida bald eagle migration • *Mojica and Meyers*

**MIGRATION, HOME RANGE, AND IMPORTANT USE AREAS OF FLORIDA SUB-ADULT
BALD EAGLES**

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ABSTRACT

Long distance migration movements of bald eagles prevent a thorough study of their migration through traditional methods of banding and radio-telemetry. We used satellite telemetry to determine diurnal and nocturnal important use areas (IUAs), migration routes, stopover sites, and home ranges of 69 migratory and non-migratory Florida sub-adult bald eagles. We used CrimeStats III to identify IUAs with nearest neighbor analysis of daytime and nighttime satellite locations. We calculated home range with 95% kernel density estimation (KD) and minimum convex polygons. We measured the number of days traveled in migration, path of the migration, and the distance traveled from winter to summer areas. We found 151 daytime IUAs ($\bar{x} = 610 \text{ km}^2$; 95% CI: 515 – 706; 95% kernel density) in 20 states and provinces, and 50 nocturnal roosts in 8 states and provinces. We found no difference in home range size of migratory eagles between sexes in winter or summer. Home ranges of migratory eagles in winter ($\bar{x} = 29,843 \text{ km}^2$; 95% CI: 12,349 – 47,338) were larger than summer ($\bar{x} = 7,211 \text{ km}^2$; 95% CI: 1,154 – 13,268). Eagles made equal use of both Coastal Plain ($n = 24$) and Appalachian Mountain ($n = 26$) migratory routes on the first migration north. Mountain migrants traveled farther ($\bar{x} = 2,112 \text{ km}$; 95% CI: 1,815 – 2,410, 95% CI than coastal migrants ($\bar{x} = 1,397 \text{ km}$; 95% CI: 1,087 – 1,706). Forty-seven percent of migratory eagles ($n = 25$) used stopovers during migration staying 6 to 31 days ($\bar{x} = 14.8 \text{ days}$; 95% CI: 12.8 – 16.8). We recommend that locations of IUAs be added to GIS databases for future management and

conservation land purchases. Bald eagle nesting habitat receives federal protection, but habitat used by sub-adult eagles is mostly unprotected. Protecting and managing habitat used throughout the species lifecycle may be more beneficial for eagle survival. We recommend conserving and protecting nocturnal roosts and managing undeveloped shoreline forest within the IUAs identified in this study.

INTRODUCTION

Each spring, an estimated 2 to 3 thousand sub-adult bald eagles (Nesbitt et al. 2003) migrate north from Florida along the Atlantic Coastal Plain and Appalachian Mountains, presumably in search of food and milder climate (Wood and Collopy 1994). Band recoveries indicate that Florida eagles have migrated as far north as Prince Edward Island, Canada in summer and have returned to Florida in winter (Broley 1947). Little is known about the migratory pathways and locations of seasonal foraging sites of Florida bald eagles in eastern North America.

Migration ecology of the bald eagle has been studied extensively using band recoveries and VHF radio-transmitters (Harmata 1982, Harmata et al. 1985, Hunt et al. 1992, McClelland et al. 1994, Wood and Collopy 1994, Harmata 2002). Few studies have examined long-term movements of eagles, however, because of technological problems in tracking long-distance migration and the cost of equipment and person-hours to follow them. We used satellite telemetry

to collect data on long-distance movements which are not easily obtained with VHF transmitters and receivers.

From 1997-2004, Florida Fish and Wildlife Conservation Commission (FWC) biologists collected >14,000 satellite locations on 69 sub-adult bald eagles as part of a survival study (Millsap et al. 2004). We used these data to determine seasonal foraging and roosting areas, migration routes, migratory stopover sites, and home range sizes. Identification of foraging/roosting areas and descriptions of migration pathways are important to protect habitat used by non-breeding eagles (Wood and Collopy 1994). The U.S. Fish and Wildlife Service (USFWS) and FWC have protected nesting habitat for eagles since the 1970's (USFWS 1987), but conserving habitat used by breeding and non-breeding eagles throughout their range may be more appropriate for ensuring survival of the species (McClelland et al. 1994).

OBJECTIVES:

- 1) to determine daytime and nighttime locations important to Florida sub-adult eagles using nearest neighbor clustering analysis.
- 2) to determine home range size for migratory and non-migratory eagles and compare sizes between sexes and seasons.
- 3) to describe migratory routes and locate stopover sites.
- 4) to determine distance traveled during migration and compare by migration routes, by sexes, and by calendar year.
- 5) to determine the number of days eagles migrate and compare length of time between north and south movements.

METHODS

Important use areas

We identified diurnal and nocturnal areas used consistently by Florida eagles. We identified important use areas (IUAs) with nearest-neighbor clustering analysis in CrimeStats III (Levine 2004) by combining location data for all migratory individuals. The clustering technique describes natural groups or patterns within the data (Everitt 1980, Everitt et al. 2001) highlighting geographic areas used by several eagles or repeatedly by one eagle in multiple years.

Initially, we selected satellite location data using criteria determined to be accurate within 1 km (Location Class (LC) ≥ 0 ; X > 3; Y > 2; Number Of Plausibility Checks ≥ 2 ; pass duration > 200) (Millsap et al. 2004). We generated separate data sets for day and night locations for use in determining diurnal foraging and nocturnal roosting IUAs for migratory eagles (spend summers north of Florida). We randomly selected locations collected for each eagle in the first 7 months after transmitter deployment from stratified sets (by months) to avoid weighting birds during more frequent bi-weekly transmission period. We selected 4 weekly locations per month. The most accurate location (> LC) for each day was selected for daytime (between the hours of sunrise and one hour before sunset) and nighttime (locations one hour after sunset to sunrise) (Luukkonen et al. 1989). We calculated sunrise and sunset times within each degree latitude and compiled locations for all eagles and years (1997-2004).

We determined daytime IUAs areas using ≥ 2 satellite locations within a 25 km radius. We estimated this radius from our average daily movements of

Florida sub-adult eagles summering along the Chesapeake Bay. We classified nighttime locations as roosting areas with a minimum of 2 locations in ≤ 1 km radius (the satellite accuracy error rate). Daytime locations within each IUA ellipse were then combined and a kernel density area (km^2) was calculated. IUAs identified in Florida were classified as winter IUAs and those outside Florida as summer IUAs. IUA were ranked by bird-year, which we calculated as the sum of the number of seasons each individual eagle used a site. IUAs were ranked overall and for each state by bird-year. We assumed protection of IUAs with the highest bird-year value would have the greatest impact on bald eagle conservation since it would conserve an area used repeatedly or by multiple eagles. Bodies of water (U.S. Geological Survey 2003) within 5 km and conservation lands (Conservation Biology Institute 2006) within 1 km were determined and reported for each IUA. Roosts reported by other studies were mostly located within 0.75 km of water bodies (Steenhof et al. 1980, Chester et al. 1990, Buehler et al. 1991b) and we chose 5 km distance to water to allow for satellite location error and variation in habitat structure.

Migratory eagle seasonal home ranges

Out of 61 migratory eagles, only 40 had sufficient movement data to generate a home range. We did not define areas used by migratory eagles in winter and summer with traditional definitions of home range because our sampling technique did not provide enough locations to generate a complete home range. Instead, we used the term coarse home range (CHR). CHR area (km^2) uses standard home range analysis techniques, but should be compared

cautiously to other studies because it may underestimate home range size. For migratory eagles ($n = 40$) summer and winter seasons began at cessation of directional migratory movement for >31 days or 4 weekly locations in our study. If eagle locations were concentrated chronologically in multiple sites >100 km apart, we calculated areas separately for each site and summed areas by season. We based the 100 km distance on minimum daily migration movements of sub-adult eagles (McClelland et al. 1994, Wood and Collopy 1994), assuming that eagles traveling >100 km were making a permanent change in their location.

A fixed kernel density (KD) and minimum convex polygon (MCP) CHR were calculated for summer and winter seasons when ≥ 10 locations were available (using 1 location per day). MCP areas are provided for comparison to previous studies (Appendix D). We used Animal Movement Extension (Hooge and Eichenlaub 2000) in ArcView (Environmental Systems Research Institute 1999) to batch process KD and MCP areas. To maintain sample independence for ANOVA, we used first year of data only for each eagle in our comparisons of seasonal CHR areas. We tested differences of home range size (KD only) by sexes using a one-way ANOVA (SAS Institute Inc 2003). We also tested home range size between winter and summer seasons using a paired t-test. We used $\alpha = 0.05$ for all statistical tests.

Non-migratory eagle home ranges

We analyzed location data for non-migratory eagles to determine seasonal differences (winter and summer) in home range size. For non-migratory eagles, we defined seasons by the average Florida departure (May 14, $n = 123$,

beginning of summer) and arrival dates (October 14, $n = 103$, beginning of winter) of migratory eagles. Fixed KD using least-squares cross-validation (Worton 1989) and MCP were calculated only for eagles with home ranges that achieved an asymptotic value (Harris et al. 1990) using a MCP bootstrapping script in Animal Movement. Unlike migratory eagles, we considered non-migratory eagles to have traditionally defined home ranges because they reached an asymptotic value in the bootstrapping procedure and can be compared to home range sizes reported in other studies. We summarized data for winter and summer home range sizes (using paired data, $n = 3$ eagles), but a low sample size limited further analysis for sex or season.

Migration

Migration initiation and completion dates were used to estimate the number of days traveled in migration. We calculated departure date by averaging satellite transmission dates during the week of departure when an eagle made continuous directional movement north or south. We did not use data if the interval between transmissions was >2.5 weeks, to avoid inaccurate departure date estimates from missing values. The arrival date was determined by the first day the eagle stopped migration, and began a period of localized movements (<100 km radius) for >31 days. We analyzed data for first north and south migrations for each eagle ($n = 40$). We defined a stopover site as an area where an eagle made localized movements 6 to 31 days during the migration period. Satellite transmissions were received for eagles every 7 days. If the

eagle remained in an area >6 days, we had at least 2 locations confirming use of the area.

We determined first-year migration routes using satellite data accurate >1 km (Location Class = A, B, 0-3) to define routes taken by migrating eagles (Millsap et al. 2004). During the migration period, satellite locations were plotted and connected on a map of eastern North America. Routes were categorized with proximity to the Appalachian Mountains, i.e., any northward movement within the mountain boundary (Sure!Maps Raster 1995) was classified as mountain and travel east of the mountains was classified as coastal. We calculated distance traveled by adding the linear distances for each eagle between winter and summer areas. We compared bald eagle migration distances between routes, sexes, and calendar year using 3-way ANOVA (SAS Institute Inc 2003).

RESULTS

Important use areas

We found 151 IUAs using daytime locations (Figure 1). Kernel density within the IUAs ranged from 0 km² to 3,637 km² (mean = 610 km², 95% CI: 515 – 706, Appendix A). The highest ranked IUAs on the wintering grounds were in southwest Florida (Table 1). In summer, the highest ranked IUAs were on the Chesapeake Bay (Figure 2) and northern North Carolina. We identified conservation lands which overlapped each IUA ($n = 267$, Appendix B), and found 35 of 151 IUAs on private lands.

Fifty nocturnal roosts were identified in Florida, Maryland, North Carolina, New York, Pennsylvania, Virginia, Vermont, and Nova Scotia (Appendix C). The winter roost on the South Prong Alafia River in Hillsborough County, Florida had the highest bird-year rank (bird-year = 19, Figure 3). The highest ranking summer roost was on the Potomac River (bird-year = 15) in Charles County, Maryland, 4 km south of the Indian Head Naval Station. Sixty-eight percent of roosts were used by more than one eagle.

Migratory eagle seasonal home ranges

We found no difference in CHR size between sexes (95% KD, $F_{1,28} = 1.25$, $P = 0.27$) during the eagles' first winter (female: 95% KD $\bar{x} = 16,765 \text{ km}^2$ [95% CI: 9,501-24,028] and male: 95% KD $\bar{x} = 10,205 \text{ km}^2$ [95% CI: 659-19,751]). Eagles visited several areas within Florida >100 km apart and returned to each area several times during the winter season.

We estimated 54 summer CHRs for 37 migratory eagles, for which 16 were divided into multiple chronological movements >100 km. Again, we found no difference between CHR size by sexes (one-way ANOVA, $F_{1,30} = 0.67$, $P = 0.42$) during eagles' first summer (female: 95% kernel $\bar{x} = 4,299 \text{ km}^2$ [95% CI: 2,596-6,003]; and male: 95% kernel $\bar{x} = 3,182 \text{ km}^2$ [95% CI: 983-5,381]).

CHR sizes in winter were larger than in summer (95% KD, paired t-test, \bar{x} difference = +22,632 km^2 , SE = 8,352 km^2 , df = 18, $t = 4.31$, $P < 0.001$) (Figure 4). Mean 95% KD CHR sizes were 29,843 km^2 (95% CI: 12,349 – 47,338) in winter and 7,211 km^2 (95% CI: 1,154 – 13,268) in summer.

Non-migratory eagle home ranges

Small non-migratory eagle home range sample sizes did not permit statistical analysis between seasons. Winter 95% KDs ranged from 1,461 to 26,619 km² and in summer ranged from 4,634 to 32,443 km² for ages 1-3 years (Figure 5 and Appendix D).

Migration

During their first year, migratory eagles flew north in summer along the Coastal Plain ($n = 24$) and Appalachian Mountains ($n = 26$, Figure 6). The lower Mississippi River Valley was also used by eagles to migrate into Mississippi and Missouri ($n = 2$). We found no difference for distance traveled in main effects (sex, year) or interaction terms; however, route distances did differ. Coastal migrants traveled less ($\bar{x} = 1,397$ km) than mountain migrants ($\bar{x} = 2,112$ km; $F_{1,31} = 9.11$, $P = 0.005$). One eagle spent the summer 4,146 km north of Florida in coastal Labrador, Canada (51°N), but the northern most latitude visited was 55°N in NW Labrador. Another eagle traveled only 340 km north of Florida to Lake Marion, South Carolina (33°N) and spent the summer.

We documented 25 of 53 migratory eagles using stopovers (Appendix F). Eagles visited stopovers 1-3 times during migration, staying 6-31 days ($\bar{x} = 14.8$ days, 95% CI: 12.8 – 16.8, $n = 54$, Figure 7). Number of days traveled on migration was longer southward than for northward movements (paired t-test, \bar{x} difference = +11 days, SE = 5, df = 38, $t = 2.2$, $P = 0.03$). Most stopover durations were ≤ 31 days, but one female (PTT 22988) spent the summer in New York, then migrated south and remained at a West Virginia stopover for 54 days

before continuing south to Florida (removed from the analysis because it did not meet migration criteria).

DISCUSSION

Important use areas

A limited number of Florida eagle foraging and roosting sites are described in previous studies (Broley 1947, Buehler et al. 1991*b*, Wood and Collopy 1994). Our study, however, is the first to report the significance of these sites using a large sample size and unbiased sampling technique (satellite telemetry). Bird-year ranking allows evaluation of IUAs by number of eagles using the site or by repeated use by one eagle. Studies in the Chesapeake Bay noted locations favored by migrant Florida eagles (Buehler et al. 1991*a*). We found these and additional areas throughout eastern North America. We suspect 15% of IUAs identified in this study have been reported previously for migratory bald eagles (Stocek 1985, Luukkonen et al. 1989, Buehler et al. 1991*a*, Bryan et al. 1996, Laing et al. 2005) including areas of the Chesapeake Bay, B. Everett Jordan Lake, Gulf of St. Lawrence, St. John's River, and coastal South Carolina.

Most IUAs overlap protected conservation lands, but 23% are unprotected on private lands and may warrant future conservation. Large IUAs highlight a need to continue cooperative agreements with private landowners to protect eagles using broadly distributed natural resources outside of established conservation areas.

We found nocturnal roosts in 11 states and provinces. Bald eagles use both communal and solitary nocturnal roosts near large water bodies (Buehler et

al. 1991*b*). We found all of our roosts located within 5 km of water. Other researchers found roosts within 10 km of water bodies (Steenhof et al. 1980, Chester et al. 1990, Buehler et al. 1991*b*). Habitat protection of communal eagle roosts is an important management guideline (USFWS 1987); therefore, the 50 roosts reported herein should be of interest to local agencies for consideration and protection.

Migratory eagle seasonal home ranges

Wide ranging movements confound traditional home range estimation of bald eagles during migration and on their summering and wintering grounds. Radio-tagged eagles can range outside a VHF receiver 51% of the time; therefore, many of their movements were previously unknown (Grubb et al. 1994) and home range sizes were imprecise. We provide home range estimates using data unbiased by the researcher's ability to locate the animal and suggest that they are a more concise estimate of the true area used seasonally by sub-adult eagles.

Our estimates of CHR were considerably larger than those reported in VHF studies of sub-adult eagles, which ranged from 102 to 593 km² (Grubb et al. 1989, McClelland et al. 1994). Our CHRs were comparable, however, to a satellite telemetry study of two Canadian sub-adult eagles where MCP estimates in winter ranged from 11,106 to 26,431 km² and in summer from 47,280 to 53,946 km² (Grubb et al. 1994). Our winter CHR was similar, but our estimation of summer CHR was considerably less than eagles in Canada. Contrary to the Canadian sub-adult study, we found that Florida sub-adults have a larger winter

CHR compared to summer. Winter CHR may be greater because of a concentration of conspecifics in Florida during winter months, which would increase competition for prey. Additionally, resident adult eagles in Florida may compete with migratory sub-adults for more productive foraging sites since they used these areas year-round. Given that winter CHRs are similar in size to non-migratory home ranges, it is possible that both sub-adult groups may compete for foraging areas with territorial adults during the winter breeding season, which results in larger movements to access food resources.

During summer months, we found that some eagles exhibited nomadic behavior, visiting multiple foraging sites >100 km apart. Other biologists also reported this phenomenon in bald eagles (Gerrard et al. 1978, McClelland et al. 1994, Laing et al. 2005). Sub-adults may roam more than older birds, presumably to gain foraging and migration experience (Wood and Collopy 1994). Migrant eagles may stay in an area only while food resources are abundant. Their non-breeding status allows flexibility to explore new foraging sites (Buehler et al. 1991a). Previously reported sub-adult home ranges (Grubb et al. 1989, McClelland et al. 1994) may be underestimated as a result of difficulties in accurately tracking nomadic eagle movements.

Bald eagles are sexually dimorphic with adult females weighing >20% more than males (Dunning 1993). We might expect females to have a larger home range than males, similar to other raptors (Newton 1979). We found no differences in CHR size between migratory male and female eagles in either summer or winter seasons. We suggest that the eagles' non-breeding status may

account for these results, but our findings support an earlier VHF study on adult bald eagles ($n = 11$) that found no home range size difference between sexes (Harmata 1982).

Non-migratory eagle home ranges

Prior to this study, all sub-adult eagles were thought to migrate north of Florida with breeding adults remaining during summer months (Wood and Collopy 1994). A roost in Everglades National Park was visited by sub-adults in summer months (Curnutt 1992), but without telemetry, it is unknown if these eagles were non-migratory. We found conclusive evidence, however, that sub-adults can be non-migratory in Florida. There could be a variety of reasons why sub-adult eagles do not migrate but we were not able to determine this.

Sub-adult eagle home ranges sometimes covered both Florida coasts. They visited several foraging areas repeatedly during a season and throughout their first 3 years. Their non-migratory home ranges were also larger than those previously reported (Grubb et al. 1989, McClelland et al. 1994). Home ranges sizes were comparable to winter MCPs in another sub-adult eagle satellite study where estimates ranged 11,000 to 26,000 km² (Grubb et al. 1994).

The seasonal presence of migratory eagles can affect the distribution of resident non-breeding eagles (Buehler et al. 1991a). We could not determine if Florida sub-adult non-migratory eagles were affected by the departure and arrival of the migrant eagle population because of our small sample.

Migration

This study was the first to describe bald eagle migratory routes along the Appalachian Mountains and Mississippi Valley. Earlier studies indicated that eagles used coastal routes predominantly (Broley 1947, Wood and Collopy 1994), but we found equal use of coastal and mountain migratory routes. Eagles of both sexes and all sub-adult age classes used both migratory routes. We suggest choice of route may depend on prevailing winds at the time of migration or genetic pre-programming (Broley 1947, Hunt et al. 1992). In the 1940's, biologists hypothesized that Florida eagles found summering in midwestern states used the Mississippi Valley during migration (Broley 1947). Only 2 (4%) eagles in this study used the Mississippi Valley flyway, but only the lower portion of that flyway. One female (PTT 24979) spent two consecutive summers in southern Illinois on the Mississippi River and wintered on the Florida panhandle. Another female (PTT 13498) summered 4 years in northeastern Alabama and southern Tennessee, and spent winters in west-central Florida (Appendix G). In addition, one male (PTT 24981) migrated north through the mountains before moving west to summer on Lake Erie. The Atlantic Coast, Appalachian Mountain, and Mississippi River migratory routes we describe may be specific to Florida bald eagles. Other eagle populations in the southeast may use variations of these routes (Gill 1990).

We recorded migration distances >1,000 km more than those reported in previous studies for adults and sub-adults (range: 1,450 to 3,032 km) from summering and nesting grounds to wintering grounds (Grubb et al. 1994,

McClelland et al. 1994, Wood and Collopy 1994). Two eagles stopped their northerly migration in Georgia and South Carolina, while the remaining 35 traveled several thousand additional kilometers. Migration route used may explain some difference in distance traveled, since we found coastal migrants traveled less distance overall than mountain migrants. Mountain migrants may be able to travel farther by soaring or gliding on more abundant updrafts than are found in the Coastal Plain (Heintzelman 1975, Hunt et al. 1992).

Stopover sites are important areas along the migration route where most eagles spent 1 to 4 weeks replacing fat reserves before continuing on to their destination. Our estimated time spent at stopovers was consistent with previous studies of hatch-year sub-adults ($\bar{x} = 14.5$, range 1-25 days; Restani 2000, Laing et al. 2005). Over half the eagles were not detected using stopovers, but this could be related to our sampling interval (1 transmission/week). Eagles may have used stopovers ≤ 6 days and therefore were undetected by the satellite transmissions.

MANAGEMENT IMPLICATIONS

Successful reintroduction and restoration efforts initiated the proposed removal of the bald eagle from the endangered species list (USFWS 1999). Continual bald eagle population increases may cause increased competition between humans and eagles for shoreline habitat (Buehler et al. 1991*b*). Disturbance from human activities was identified as a concern, for which current regulations provide a protective buffer surrounding nests (USFWS 1987). Little habitat protection, however, is accorded to non-breeding eagles. Protecting non-

breeding habitat may increase sub-adult eagle survival and ensure successful recruitment into the breeding population (Simons et al. 1988).

We identified IUAs, important for foraging and roosting sub-adult eagles, for use in successful management of the species. IUAs we discovered in the eastern United States and Canada will be added to state and federal GIS databases for management and possible future conservation purchases. We provide a list of public lands with IUAs located (Appendix B) and recommend managers consider potential effects that recreation or land management practices may have on their eagle population.

The *Management Guidelines for the Bald Eagle in the Southeast Region* emphasized conservation of communal roosts and protection from human disturbances (USFWS 1987). Luukkonen et al. (1989) recommended conserving nocturnal roosts as a high priority for eagle management because they believed that daytime foraging and perch habitat was not limiting. Conservation of nocturnal roost sites is a viable management option because roosts were usually small in size (< 1 km) and easily defined. Actual roosts locations provided herein should be verified on the ground. Daytime IUAs are harder to define in terms of specific tracts of land to protect, but in general maintaining undeveloped shoreline forest would protect a majority of nocturnal roosting and daytime perching habitat for eagles (Buehler et al. 1991b).

We recommend conservation and protection of communal nocturnal roost locations (IUAs) we identified (Appendix C) along with general conservation of shoreline habitat in IUAs (Appendix A) proposed previously by Buehler et al

(1991*b*). We encourage continued regional and national habitat protection of bald eagle habitat and coordination among wildlife agencies, non-governmental organizations, and private landowners for eagle conservation. We believe a bald eagle working group will accomplish most of the coordination needed for successful coordination of our national symbol.

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LITERATURE CITED

- Broley, C. L. 1947. Migration and nesting of Florida bald eagles. *Wilson Bulletin* 59:3-20.
- Bryan, A. L., T. M. Murphy, K. L. Bildstein, I. L. Brisbin, and J. J. Mayer. 1996. Use of reservoirs and other artificial impoundments by bald eagles in South Carolina. Pages 285-297 *in* D. Bird, D. Varland, and J. Negro, editors. *Raptors in human landscapes: adaptations to built and cultivated environments*. Academic Press. San Diego, California, USA.
- Buehler, D. A., T. J. Mersmann, J. D. Fraser, and J. K. D. Seegar. 1991*a*. Differences in distribution of breeding, non-breeding, and migrant bald eagles on the northern Chesapeake Bay. *Condor* 93:399-408.
- Buehler, D. A., T. J. Mersmann, J. D. Fraser, and J. K. D. Seegar. 1991*b*. Nonbreeding bald eagle communal and solitary roosting behavior and roost habitat on the northern Chesapeake Bay. *Journal of Wildlife Management* 55:273-281.
- Chester, D. N., D. F. Stauffer, T. J. Smith, D. R. Luukkonen, and J. D. Fraser. 1990. Habitat use by non-breeding bald eagles in North Carolina. *Journal of Wildlife Management* 54:223-234.

- Conservation Biology Institute. 2006. Protected Areas Database version 4. Corvallis, Oregon, USA.
- Curnutt, J. L. 1992. Dynamics of a year-round communal roost of bald eagles. *Wilson Bulletin* 104:536-540.
- Dunning, J. B. 1993. CRC handbook of avian body masses. CRC Press. Boca Raton, Florida, USA.
- Environmental Systems Research Institute. 1999. ArcView version 3.2. Redlands, California, USA.
- Everitt, B. 1980. Cluster analysis. Halsted Press. London, England.
- Everitt, B., S. Landau, and M. Leese. 2001. Cluster analysis. Oxford University Press. London, England.
- Gerrard, J. M., D. W. A. Whitfield, P. Gerrard, P. N. Gerrard, and W. J. Maher. 1978. Migratory movements and plumage of subadult Saskatchewan bald eagles. *Canadian Field Naturalist* 92:375-382.
- Gill, F. B. 1990. Ornithology. W.H. Freeman and Co. New York, New York, USA.
- Grubb, T. G., S. J. Nagiller, W. L. Eakle, and G. A. Goodwin. 1989. Winter roosting patterns of bald eagles (*Haliaeetus leucocephalus*) in north-central Arizona. *Southwestern Naturalist* 34:453-459.
- Grubb, T. G., W. W. Bowerman, and P. H. Howey. 1994. Tracking local and seasonal movements of wintering bald eagles *Haliaeetus leucocephalus* from Arizona and Michigan with satellite telemetry. Pages 347-358 in B.-U. Meyburg and R. D. Chancellor, editors. Proceedings of the IV World Conference on Birds of Prey and Owls. The Pica Press. Berlin, Germany.
- Harmata, A. R. 1982. Statewide endangered species research: behavior and ecology of wintering and migrant bald eagles in the Rocky Mountains. Project Number MONT. SE-001-R /JOB 01/FIN. Montana Department of Fish Wildlife and Parks, Helena, Montana, USA. .
- Harmata, A. R., J. E. Toepfer, and J. M. Gerrard. 1985. Fall Migration of bald eagles produced in northern Saskatchewan. *Blue Jay* 43:232-237.
- Harmata, A. R. 2002. Vernal migration of bald eagles from a southern Colorado wintering area. *Journal of Raptor Research* 36:256-264.

- Harris, S., W. J. Cresswell, P. G. Forde, W. J. Trehwella, T. Woollard, and S. Wray. 1990. Home-range analysis using radio-tracking data--a review of problems and techniques particularly as applied to the study of mammals. *Mammal Review* 20:97-123.
- Heintzelman, D. S. 1975. Autumn hawk flights: the migrations in Eastern North America. Rutgers University Press. Rutgers, New Jersey, USA.
- Hooge, P. N., and B. Eichenlaub. 2000. Animal movement extension to Arcview version 2.04. Alaska Science Center - Biological Science Office, U.S. Geological Survey. Anchorage, Alaska, USA.
- Hunt, W. G., R. E. Jackman, J. M. Jenkins, C. G. Thelander, and R. N. Lehman. 1992. Northward post-fledging migration of California bald eagles. *Journal of Raptor Research* 26:19-23.
- Laing, D. K., D. M. Bird, and T. E. Chubbs. 2005. First complete migration cycles for juvenile bald eagles (*Haliaeetus leucocephalus*) from Labrador. *Journal of Raptor Research* 39:11-18.
- Levine, N. 2004. CrimeStat: a spatial statistics program for the analysis of crime incident locations, version 3.0. Ned Levine & Associates, Houston, TX, and the National Institute of Justice, Washington, DC, USA.
- Luukkonen, D. R., T. J. Smith, D. N. Chester, J. D. Fraser, and D. F. Stauffer. 1989. Ecology, habitat, and management of bald eagles at B. Everett Jordan Lake and Falls Lake, North Carolina, final report. U.S. Army Corps of Engineers, Wilmington, North Carolina, USA.
- McClelland, B. R., L. S. Young, P. T. McClelland, J. G. Crenshaw, H. L. Allen, and D. S. Shea. 1994. Migration ecology of bald eagles from autumn concentrations in Glacier National Park, Montana. *Wildlife Monographs* 125:1-61.
- 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.
- Nesbitt, S. A., J. A. Bozzo, N. J. Douglass, K. Lamonte, P. S. Kubilis, T. W. Regan, S. T. Schwikert, and J. H. White. 2003. Bald eagle population monitoring, annual report. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida, USA.
- Newton, I. 1979. Population ecology of raptors. Buteo Books. Vermillion, South Dakota, USA.

- Restani, M. 2000. Age-specific stopover behavior of migrant bald eagles. *Wilson Bulletin* 112:28-34.
- SAS Institute Inc. 2003. *JMP start statistics, version 5.1*. Thomson Learning. Belmont, California, USA.
- Simons, T., S. K. Sherrod, M. W. Collopy, and M. A. Jenkins. 1988. Restoring the bald eagle. *American Scientist* 76:253-268.
- Steenhof, K., S. S. Berlinger, and L. H. Fredrickson. 1980. Habitat use by wintering bald eagles in South Dakota. *Journal of Wildlife Management* 44:798-805.
- Stocek, R. F. 1985. The bald eagle in New Brunswick. Pages 44-47 *in* J. M. Gerrard and T. M. Ingram, editors. *Proceedings of the Bald Eagle Days*. White Horse Plains Publishers. Winnipeg, Canada.
- Sure!Maps Raster. 1995. Eastern U.S.: NH, VT, NY, MA, PA, RI, CT, NJ, DE, MD, DC, VA, WV, NC, SC, GA, FL, ME. Horizons Technologies, Inc., San Diego, California, USA.
- U.S. Geological Survey. 2003. U.S. National Atlas Water Feature Areas: aqueducts, canals, dams, intercoastal waterways, rivers, and streams version Reston, Virginia, USA.
- U.S. Fish and Wildlife Service. 1987. Management guidelines for the bald eagle in the southeast region. United States Fish and Wildlife Service. Atlanta, Georgia, USA.
- U.S. Fish and Wildlife Service. 1999. Proposed rule to remove the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. *Federal Register* 64:36454-36464.
- Wood, P. B., and M. W. Collopy. 1994. Population ecology of sub-adult southern bald eagles in Florida: post-fledging ecology, migration patterns, habitat use, and survival. Nongame wildlife program project NG87-026, final report. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, USA.
- Worton, B. J. 1989. Kernel methods for estimating the utilization distribution in home-range studies. *Ecology* 70:164-168.

Table 1. Highest ranked daytime important use areas (IUAs) of Florida sub-adult bald eagles on summer and winter grounds, 1997-2004. IUAs identified using nearest neighbor clustering (Crimestat III) and ranked by bird-year.

IUAs by waterbody	County	State	95% kernel (km ²) ¹	Bird-years ²
Winter				
S. Prong Alafia River	Hillsborough	FL	182	19
Peace River	Polk	FL	464	19
Braden River	Manatee	FL	666	19
Saddle Creek	Polk	FL	415	18
Summer				
Potomac River	Charles	MD	364	15
Susquehanna River	Cecil	MD	677	14
Seaforth Lake	Chatham	NC	307	13
Potomac River	Westmoreland	VA	279	12

¹ Kernel density estimates were performed on locations within each IUA.

² The sum of the number of seasons individual eagles used the site.

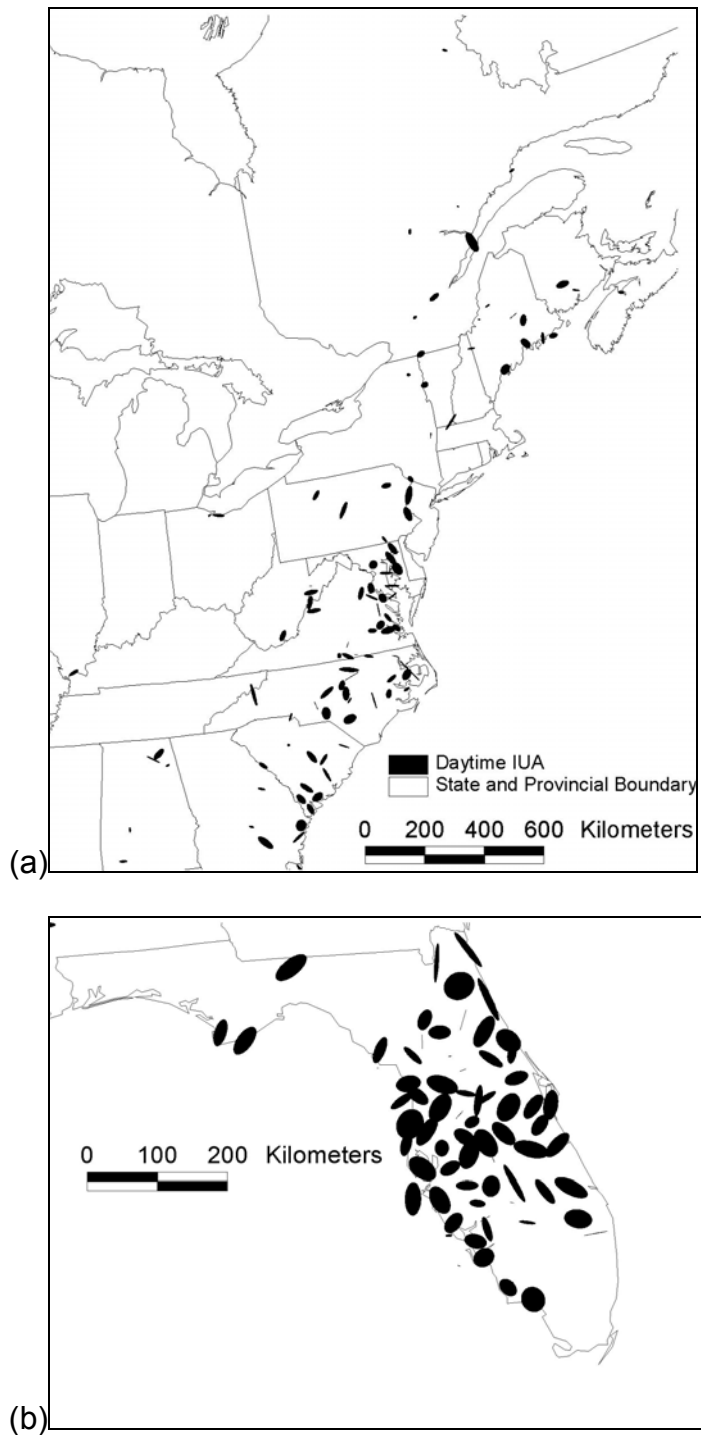


Figure 1. Daytime important use areas (IUAs) for migratory Florida sub-adult bald eagles. Summer months were spent north of Florida (a), and winter months within Florida (b). IUAs were visited by >1 eagle or 1 eagle >1 year.

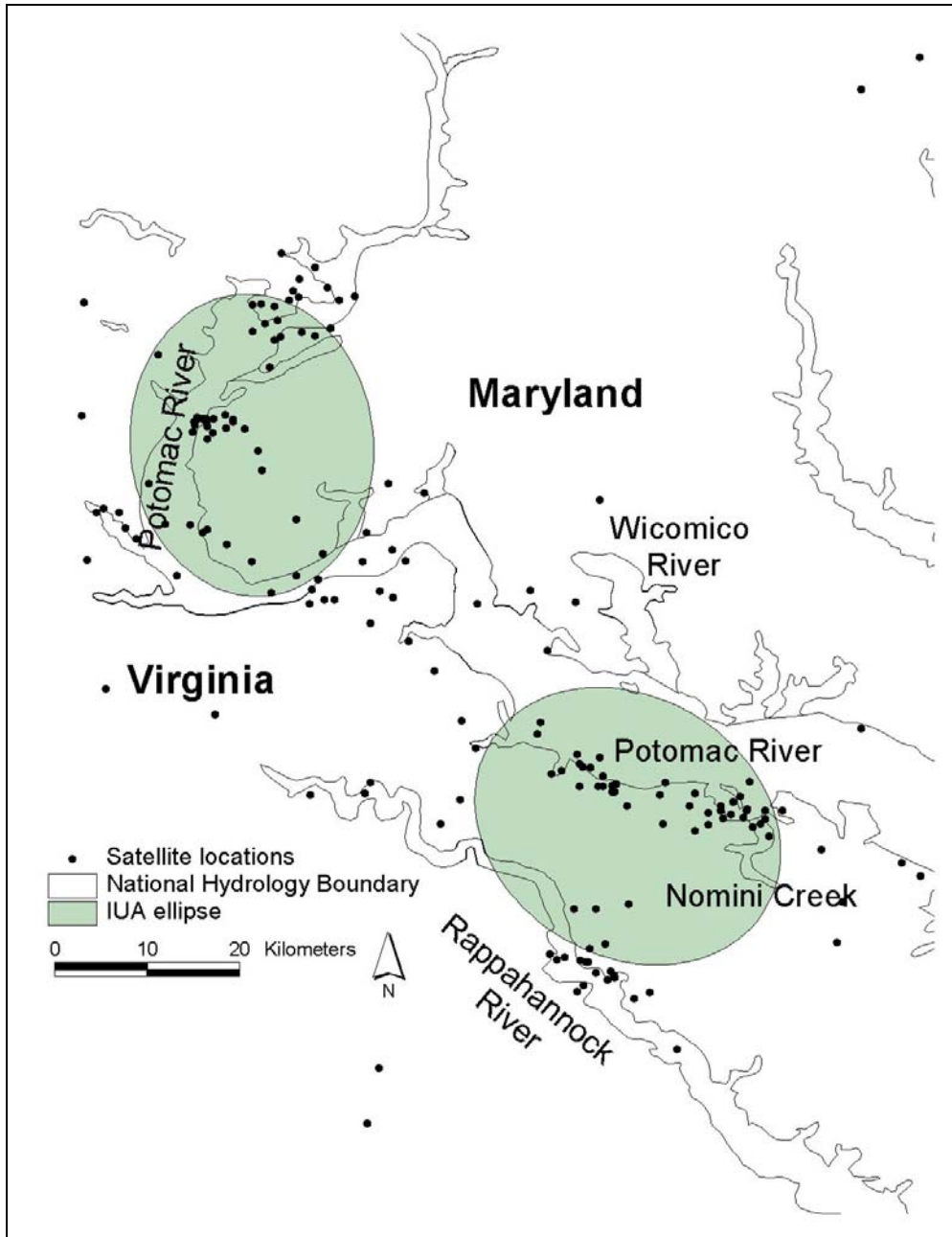


Figure 2. Two of the highest ranking bald eagle daytime summer important use areas (IUAs) on the Potomac River, Virginia and Maryland, 1997-2004. Ranking was based on number of repeated visits and by number of individual birds using the site. The upper Potomac IUA had the highest bird-year ranking of 15 and the lower Potomac IUA had a bird-year of 12.

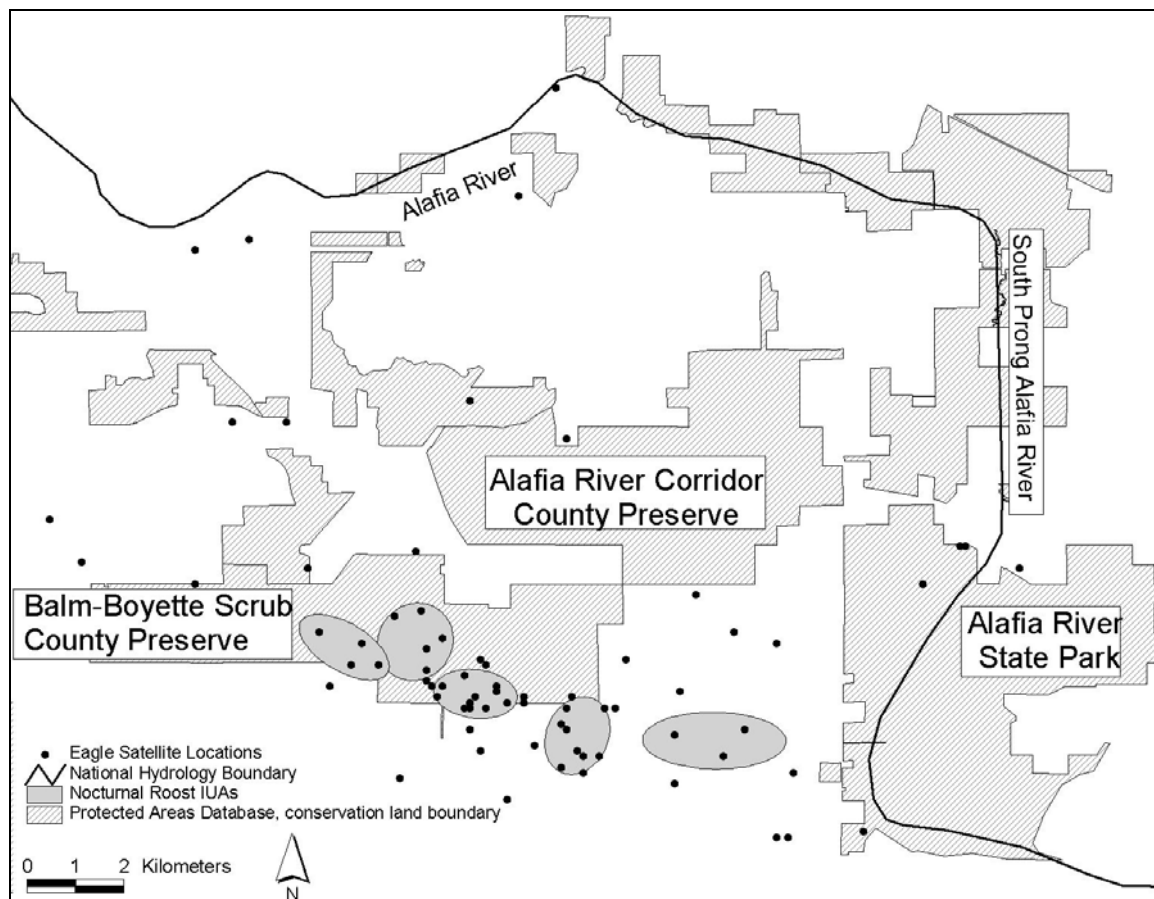


Figure 3. One of the highest ranked Florida sub-adult bald eagle nocturnal winter roost important use areas (IUA) on the South Prong Alafia River, Hillsborough County, Florida, 1997-2004. Bird-year ranking was based on number of repeated visits and by number of individual birds using the site. The bird-year for this roost was 19.

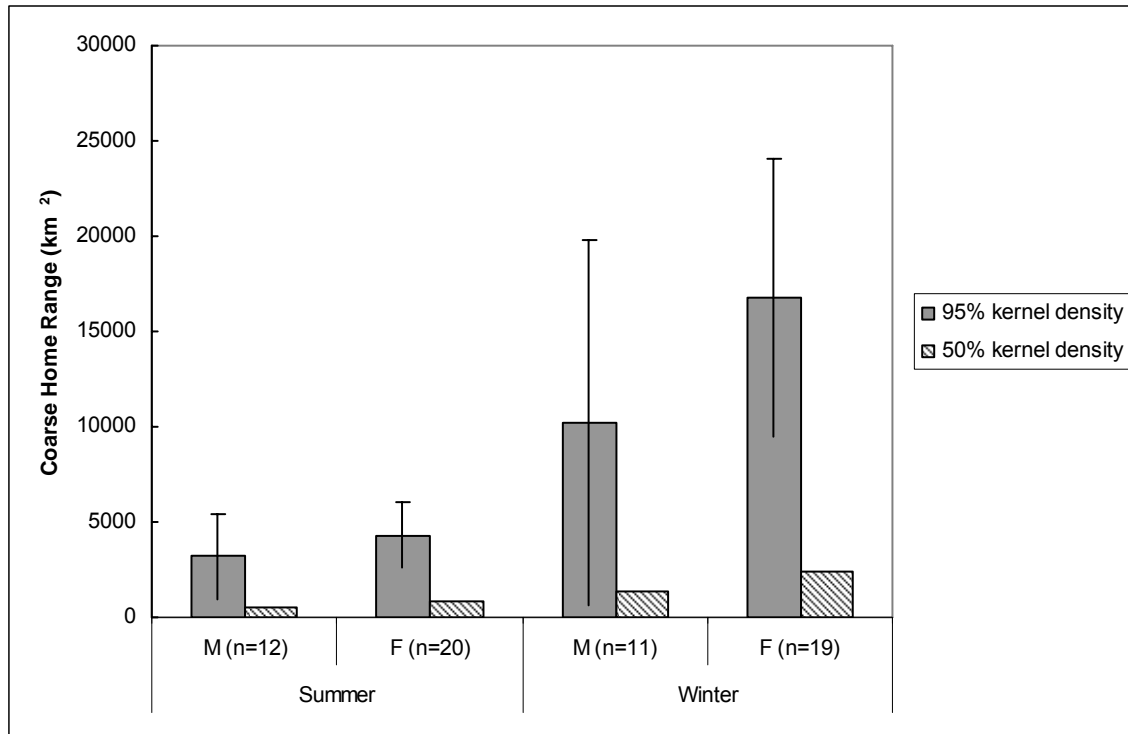


Figure 4. Mean first year seasonal coarse home ranges (CHRs \pm 95% CI) for male and female migratory Florida sub-adult bald eagles, 1997-2004. Summer months were spent north of Florida, while winter months were mostly within Florida.

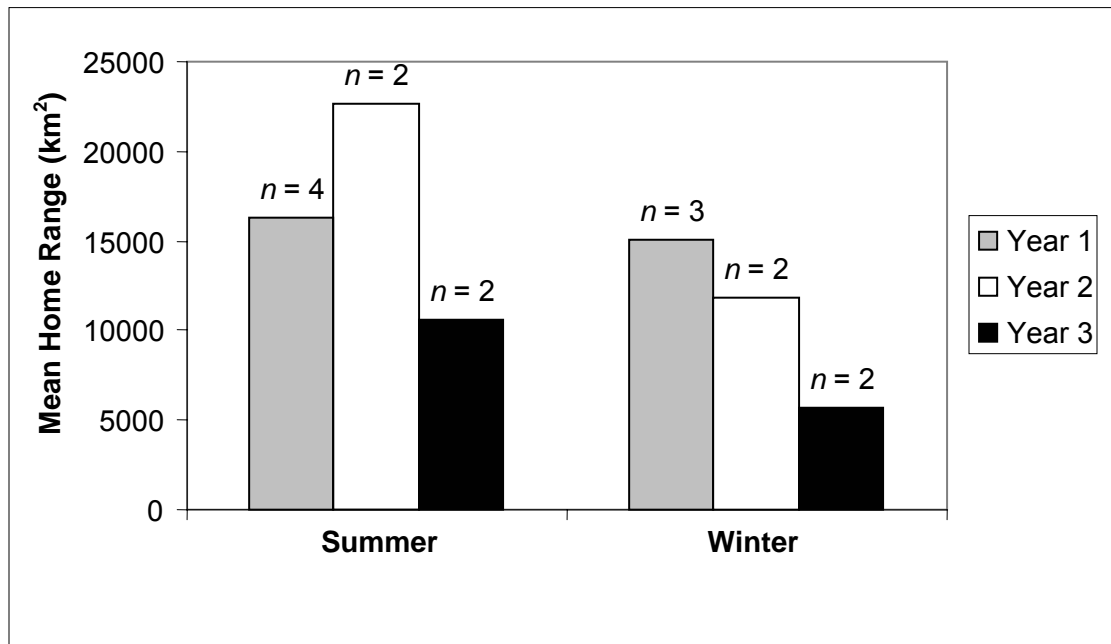


Figure 5. Mean non-migratory Florida sub-adult bald eagle 95% kernel density home ranges by season and age (years).

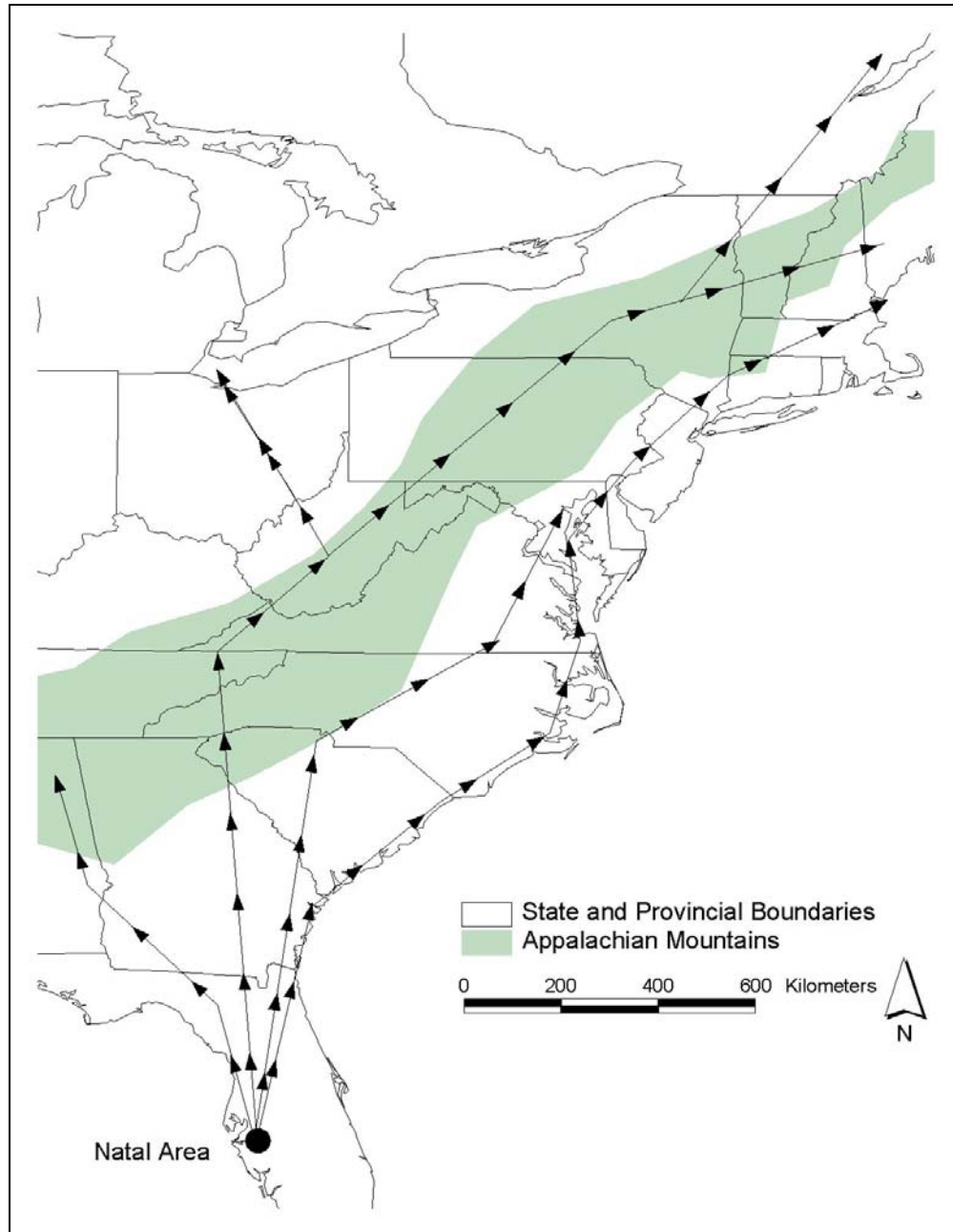


Figure 6. Migration routes followed by Florida sub-adult bald eagles ($n = 54$) ages 1-5, 1997-2004. Return routes south similar.

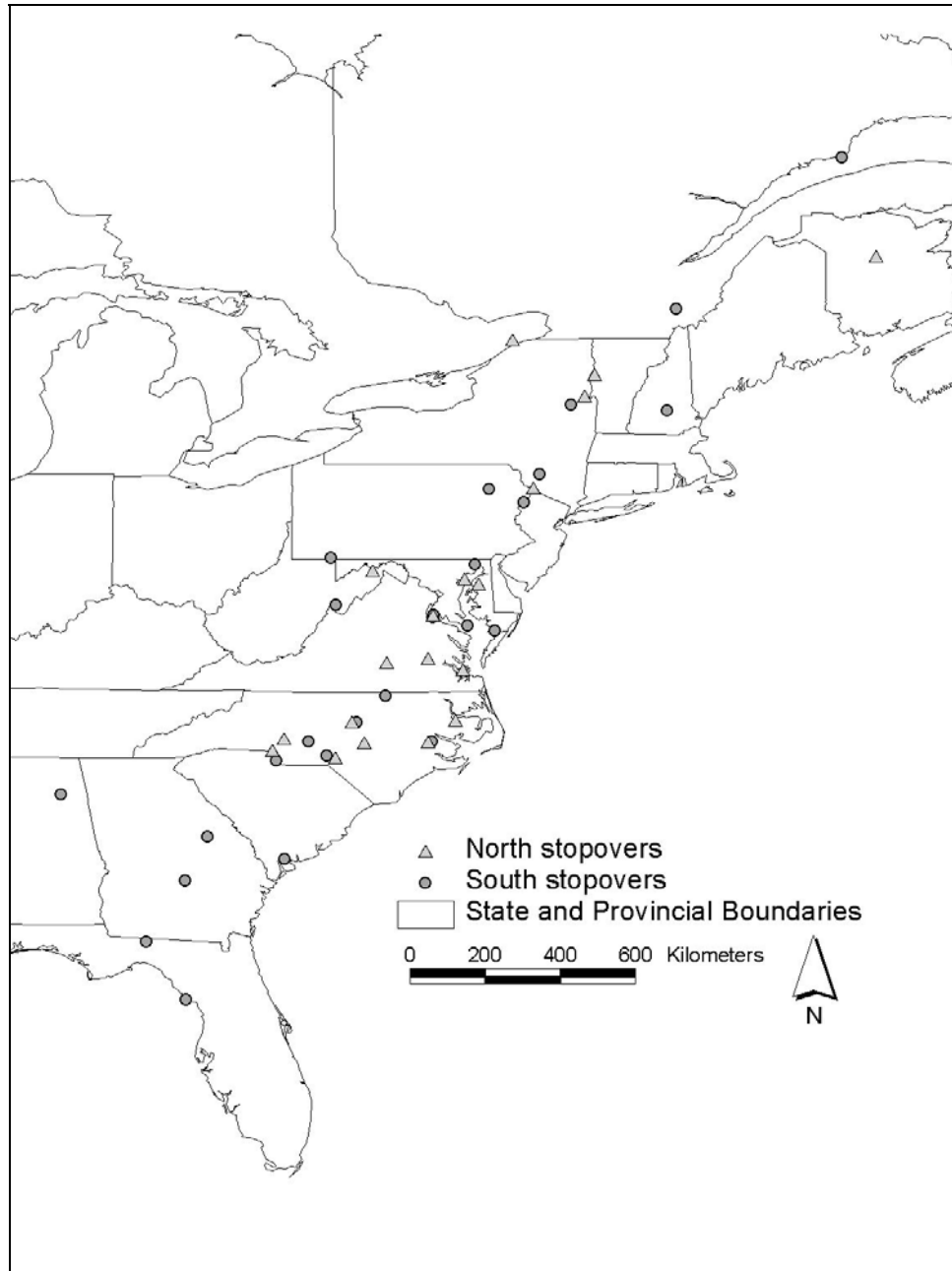


Figure 7. Stopover sites used by Florida sub-adult bald eagles ($n = 25$) ages 1-4 during northbound and southbound migration, 1997-2004. Eagles remained at sites 6-31 days ($\bar{x} = 14.8$ days; 95% CI: 12.8 – 16.8; $n = 54$).

APPENDIX A. Important use areas (IUAs) for migratory Florida bald eagles

identified using nearest-neighbor clustering of >1 eagles or >1 seasons for an individual eagle within a 25 km radius. Locations were collected from sunrise to one hour before sunset, 1997-2004. A 95% kernel density area (km²) was calculated on all points within each IUA cluster.

Waterbody	State	County or Province	Latitude	Longitude	No. individuals	95% kernel (km ²)
St. John River	CAN	New Brunswick	45.881	-66.533	2	1081
Avon River	CAN	Nova Scotia	45.204	-63.393	1	207
Bay of Fundy	CAN	Nova Scotia	45.090	-64.266	1	78
Lake Caniapiscan	CAN	Quebec	53.801	-68.511	1	48
St. Pierre Lake	CAN	Quebec	46.130	-73.050	1	52
St. Lawrence River	CAN	Quebec	47.892	-69.787	1	2138
St. Lawrence River	CAN	Quebec	46.582	-72.021	1	668
St. Lawrence River	CAN	Quebec	49.639	-67.147	2	188
Lake Guntersville	AL	Marshall	34.388	-86.282	1	812
Lake Guntersville	AL	Marshall	34.535	-86.059	1	1168
Lochloosa Lake	FL	Alachua	29.483	-82.104	4	155
Newnan's Lake	FL	Alachua	29.668	-82.294	4	585
Banana Creek	FL	Brevard	28.602	-80.635	2	0
Banana River	FL	Brevard	28.349	-80.668	2	1219
St John's River	FL	Brevard	28.363	-80.920	7	200
Lemon Bay	FL	Charlotte	26.898	-82.393	4	31
Peace River	FL	Charlotte	26.907	-81.840	4	490
Charlotte Harbor	FL	Charlotte	26.775	-82.030	7	273
Crystal Bay	FL	Citrus	28.719	-82.552	4	841
Crystal Bay	FL	Citrus	28.889	-82.663	4	1008
Homosassa Bay	FL	Citrus	28.686	-82.786	4	685
St John's River	FL	Clay	30.030	-81.720	4	1565
Tamiami Canal	FL	Collier	25.924	-81.347	2	318
Golden Gate Canal	FL	Collier	26.124	-81.671	7	203
Prairie Creek	FL	De Soto	27.043	-81.848	2	0
Peace River	FL	Desoto	27.254	-81.922	3	171
Apalachicola River	FL	Franklin	29.704	-84.952	2	1454
Fisheating Creek	FL	Glades	26.915	-81.263	3	216
Intercoastal Waterway	FL	Gulf	29.841	-85.295	1	804
Peace River	FL	Hardee	27.442	-81.694	5	745
Kissimmee River	FL	Highland	27.268	-80.945	2	627
Fisheating Creek	FL	Highlands	27.197	-81.435	2	0
Lake Istokpoga	FL	Highlands	27.433	-81.360	3	1416
Hillsborough River	FL	Hillsborough	28.014	-82.314	7	394

Appendix A. Continued.

Waterbody	State	County or Province	Latitude	Longitude	No. individuals	95% kernel (km ²)
South Prong Alafia River	FL	Hillsborough	27.744	-82.239	10	182
Blue Cypress Lake	FL	Indian River	27.828	-80.665	3	1024
Lake Apopka	FL	Lake	28.546	-81.694	3	166
St. John's River	FL	Lake	29.050	-81.422	4	834
Lake Apopka	FL	Lake	28.564	-81.583	1	92
Lake Harris	FL	Lake	28.663	-81.859	2	312
Caloosahatchee River	FL	Lee	26.552	-81.946	3	607
Gulf of Mexico	FL	Lee	26.497	-82.313	2	0
Lake Miccosukee	FL	Leon	30.557	-84.145	2	499
Gulf of Mexico	FL	Levy	29.143	-83.074	1	0
Suwannee River	FL	Levy	29.366	-83.004	1	176
Withlacoochee River	FL	Levy	29.240	-82.541	2	436
Gulf of Mexico	FL	Manatee	27.428	-82.824	4	1088
Braden River	FL	Manatee	27.365	-82.448	9	666
Ocklawaha River	FL	Marion	28.962	-81.850	2	0
Ocklawaha River	FL	Marion	29.161	-82.006	2	0
Lake Okeechobee	FL	Martin	26.856	-80.540	4	914
Nassau River	FL	Nassau	30.471	-81.509	4	1725
St. Mary's River	FL	Nassau	30.365	-82.000	3	1208
St. Lucie River	FL	Okeechobee	27.263	-80.568	5	1181
Econlockhatchee River	FL	Orange	28.402	-81.275	9	605
Lake Kissimmee	FL	Osceola	27.826	-81.049	6	1280
Tohopekaliga Lake	FL	Osceola	28.080	-81.404	7	559
St. John's River	FL	Osceola	28.114	-80.870	2	478
Everglades Swamp	FL	Palm Beach	26.635	-80.326	2	0
Anclote River	FL	Pasco	28.252	-82.493	9	582
Gulf of Mexico	FL	Pasco	28.374	-82.720	3	1495
Anclote River	FL	Pasco	28.126	-82.815	2	272
Tampa Bay	FL	Pinellas	27.789	-82.631	5	1142
Buffum Lake	FL	Polk	27.771	-81.607	2	0
Saddle Creek	FL	Polk	28.106	-81.963	9	415
Peace River	FL	Polk	27.881	-81.939	11	464
Withlacoochee River	FL	Polk	28.288	-81.829	3	396
Peace River	FL	Polk	27.994	-81.677	6	876
Withlacoochee River	FL	Putnam	28.525	-82.255	5	1288
Ocklawaha River	FL	Putnam	29.598	-81.736	2	0
Myakka River	FL	Sarasota	27.051	-82.301	11	483
St John's River	FL	Seminole	28.755	-81.097	6	301
Tolomato River	FL	St. John's	29.805	-81.325	4	2009
Withlacoochee River	FL	Sumter	28.816	-82.177	3	662
Withlacoochee River	FL	Sumter	28.403	-81.995	2	0

Appendix A. Continued.

Waterbody	State	County or Province	Latitude	Longitude	No. individuals	95% kernel (km ²)
Tomoka River	FL	Volusia	29.070	-81.108	8	178
Tomoka River	FL	Volusia	29.244	-81.127	8	361
Lake George	FL	Volusia	29.407	-81.458	3	1686
Weiss Lake	GA	Cherokee	34.166	-85.779	1	95
Alabaha River	GA	Coffee	31.500	-82.635	3	1340
Turnpike Creek	GA	Dodge	32.031	-83.054	3	126
Ogeechee River	GA	Liberty	31.856	-81.299	4	836
Lake Strom						
Thurmond	GA	Lincoln	33.800	-82.326	2	243
Sapelo River	GA	McIntosh	31.522	-81.442	4	1248
Ohio River	KY	McCracken	37.184	-88.958	1	9
Connecticut River	MA	Franklin	42.816	-72.647	3	1668
Patapsco River	MD	Anne Arundel	39.160	-76.545	2	0
Patuxent River	MD	Anne Arundel	38.845	-76.531	3	665
Patuxent River	MD	Calvert	38.431	-76.390	2	918
Susquehanna River	MD	Cecil	39.517	-76.075	9	677
Potomac River	MD	Charles	38.497	-77.211	12	364
Chesapeake Bay	MD	Kent	39.249	-76.226	3	616
Patuxent River	MD	Montgomery	39.165	-76.946	1	163
Wye East River	MD	Talbot	38.904	-76.061	2	871
Androscoggin River	ME	Cumberland	43.926	-69.906	3	982
Frenchman Bay	ME	Hancock	44.507	-68.019	3	411
Penobscot River	ME	Penobscot	45.193	-68.598	3	89
Seboeis Lake	ME	Piscataquis	45.404	-68.960	2	0
Pamlico River	NC	Beaufort	35.519	-76.872	2	0
Seaforth Lake	NC	Chatham	35.795	-78.993	9	307
Albemarle Sound	NC	Chowan	35.847	-76.406	3	3637
Core Creek	NC	Craven	35.289	-77.332	2	230
Neuse River	NC	Granville	36.220	-78.623	2	1882
Horse Creek	NC	Manatee	27.499	-82.032	3	491
Roanoke Rapids						
Lake	NC	Northampton	36.507	-77.804	2	180
Tranters Creek	NC	Pitt	35.716	-77.118	3	269
Deep River	NC	Randolph	35.665	-79.589	3	1364
Pee Dee River	NC	Richmond	35.056	-79.743	3	1303
Cape Fear River	NC	Robeson	34.761	-78.923	4	1580
LakeTillery	NC	Stanly	35.335	-80.066	2	0
Falls Lake						
Reservoir	NC	Wake	36.011	-78.571	2	953
Shearon Harris						
Reservoir	NC	Wake	35.531	-78.894	3	495
East Dismal						
Swamp	NC	Washington	35.747	-76.536	2	491
Neuse River	NC	Wayne	35.184	-77.918	4	1291
Cane River	NC	Yancy	35.942	-82.298	2	2413
Huron River	OH	Erie	41.403	-82.656	1	147
Delaware River	PA	Bucks	40.428	-75.197	2	1424
Susquehanna River	PA	Lancaster	39.837	-76.313	3	115
Delaware River	PA	Pike	41.434	-74.782	1	40

Appendix A. Continued.

Waterbody	State	County or Province	Latitude	Longitude	No. individuals	95% kernel (km ²)
Delaware River	PA	Pike	40.973	-74.999	4	2409
Susquehanna River	PA	Wyoming	41.399	-75.791	2	151
Lake Moultrie	SC	Berkeley	33.246	-80.102	2	618
Pocotaligo River	SC	Clarendon	33.702	-80.124	3	438
Combahee River	SC	Colleton	32.624	-80.561	6	651
Combahee River	SC	Colleton	32.942	-80.898	3	1218
Broad Run	SC	Fairfield	34.298	-81.303	2	53
Savannah River	SC	Hampton	32.636	-81.154	8	444
Broad River	SC	Jasper	32.302	-80.878	2	73
Little Pee Dee River	SC	Marion	34.000	-79.318	2	41
Wateree River	SC	Sumter	33.840	-80.531	3	923
Lake Wylie	SC	York	35.118	-81.071	2	290
Cowpasture River	VA	Bath	38.141	-79.536	3	551
Appomattox River	VA	Chesterfield	37.237	-77.479	4	571
Rappahannock River	VA	Culpepper	38.395	-77.634	3	471
Roanoke River	VA	Halifax	36.622	-78.573	3	539
Dan River	VA	Halifax	36.683	-78.887	2	228
James River	VA	James City	37.175	-76.556	4	154
Rappahannock River	VA	King George	38.218	-77.251	3	713
Mattaponi River	VA	King William	37.812	-77.091	3	785
Potomac River	VA	Loudoun	39.062	-77.373	2	255
Roanoke River	VA	Mecklenburg	36.626	-78.258	2	0
Pamunkey River	VA	New Kent	37.530	-76.799	2	424
James River	VA	Prince George	37.354	-77.132	7	305
James River	VA	Surry	37.158	-76.875	6	907
Potomac River	VA	Westmoreland	38.130	-76.467	4	576
Potomac River	VA	Westmoreland	38.128	-76.848	7	279
Lake Champlain	VT	Addison	44.089	-73.328	2	116
Lake Champlain	VT	Franklin	45.015	-73.180	3	171
South Fork Potomac River	WV	Pendleton	38.395	-79.637	2	911
North Fork South Branch Potomac River	WV	Randolph	38.696	-79.528	2	306
Knapp Creek	WV	Summers	37.557	-80.871	1	165

APPENDIX B. Protected areas used by migratory Florida sub-adult bald eagles, 1997-2004. Areas overlapped boundaries of important use areas (IUAs) identified by nearest neighbor clustering analysis of >1 eagles or >1 seasons for and individual eagle within a 25 km radius. Locations were collected from sunrise to one hour before sunset.

Protected Area	State	Owner	Managing Agency	Type
Monsanto State Park	AL	State	Alabama Department of Conservation & Natural Resources	State Park
Lake Guntersville State Park	AL	State	Alabama Department of Conservation & Natural Resources	State Park
Timucuan Ecological and Historic Preserve	FL	Federal	National Park Service	National Research Reserve
Marjory Stoneman Douglas Wilderness Area	FL	Federal	National Park Service	Wilderness Area
Cape Canaveral Air Station	FL	Federal	U.S. Department of Defense	Military Reservation
Mayport Naval Station	FL	Federal	U.S. Department of Defense	Military Reservation
Chassahowitzka NWR	FL	Federal	U.S. Fish and Wildlife Service	National Wildlife Refuge
Lower Suwannee NWR	FL	Federal	U.S. Fish and Wildlife Service	National Wildlife Refuge
St. Johns NWR	FL	Federal	U.S. Fish and Wildlife Service	National Wildlife Refuge
Alexander Springs Wilderness Area	FL	Federal	U.S. Fish and Wildlife Service	Wilderness Area
Chassahowitzka Wilderness Area	FL	Federal	U.S. Fish and Wildlife Service	Wilderness Area
Ocala NF	FL	Federal	U.S. Forest Service	National Forest
Micco Scrub Sanctuary	FL	Local	Brevard County Parks & Recreation Department	Natural Area
Charlotte Flatwoods	FL	Local	Charlotte County Parks & Recreation Department	Other
Port Orange City Forest	FL	Local	City of Port Orange	Other
Betz Tiger Point Park	FL	Local	Duval County/City of Jacksonville	City Park
Cypress Lakes Preserve	FL	Local	Hernando County Planning Department	Nature Preserve
Brooker Creek	FL	Local	Hillsborough County	Nature Preserve
Balm-Boyette Scrub	FL	Local	Hillsborough County	Nature Preserve
Fish Hawk	FL	Local	Hillsborough County	Other
Balm Scrub	FL	Local	Hillsborough County	Other
Alafia River Corridor	FL	Local	Hillsborough County Parks, Recreation & Conservation	Conservation Area
Lettuce Lake Regional Park	FL	Local	Hillsborough County Parks, Recreation & Conservation	County Park

Appendix B. Continued.

Protected Area	State	Owner	Managing Agency	Type
Triple Creek	FL	Local	Hillsborough County Parks, Recreation & Conservation	Natural Area
Cone Ranch	FL	Local	Hillsborough County Parks, Recreation & Conservation	Other
Yellow Fever Creek Preserve	FL	Local	Lee County Parks & Recreation	Natural Area
Prairie Pines Preserve	FL	Local	Lee County Parks & Recreation	Natural Area
San Carlos Bay - Bunche Beach Preserve	FL	Local	Lee County Parks & Recreation	Natural Area
Matanzas Pass Preserve	FL	Local	Lee County Parks & Recreation	Nature Preserve
Pine Island Preserve	FL	Local	Manatee County Conservation Lands Management Division	Natural Area
Duette Park	FL	Local	Manatee County Planning Department	County Park
Oakland Nature Preserve	FL	Local	Oakland Nature Preserve, Inc.	Natural Area
Brooker Creek Preserve	FL	Local	Pinellas County Department of Environmental Management	Nature Preserve
Cross Bar Ranch Wellfield	FL	Local	Pinellas County Utilities Department	Other
All-Bar Ranch	FL	Local	Pinellas County Utilities Department	Other
Lake Hancock Circle B Bar Reserve	FL	Local	Polk County Environmental Services Department	Natural Area
Saddle Creek County Park	FL	Local	Polk County Parks & Recreation Division	County Park
Pinelands Reserve	FL	Local	Sarasota County Natural Resources Department	Nature Preserve
Jelks Preserve	FL	Local	Sarasota County Natural Resources Department	Nature Preserve
T. Mabry Carlton, Jr. Memorial Reserve	FL	Local	Sarasota County Natural Resources Department	Nature Preserve
Abolay-Lykes Property	FL	Local	Sarasota County Natural Resources Department	Other
Indianola Mounds	FL	Local	Sarasota County Natural Resources Department	Other
Sarasota Ranch Lands	FL	Local	Sarasota County Natural Resources Department	Other
Blind Pass Park	FL	Local	Sarasota County Parks & Recreation Department	County Park
Lake Proctor Wilderness Area	FL	Local	Seminole County Planning & Development Department	Wilderness Area
C-23/C-24 Storage Reservoirs	FL	Local	South Florida Water Management District	Other
Pasco I	FL	Local	Southwest Florida Water Management District	Conservation Area
Deer Prairie Creek	FL	Local	Southwest Florida Water Management District	Conservation Area
St. Lucie Pinelands	FL	Local	St. Lucie County Public Works Department	Other

Appendix B. Continued.

Protected Area	State	Owner	Managing Agency	Type
Florida Coastal Islands Sanctuaries	FL	Private	Audubon of Florida	Private Conservation
Jahna Industries CE	FL	Private	Florida Department of Environmental Protection	Conservation Easement
GSLA Land Protection Agreement	FL	Private	Florida Department of Environmental Protection	Conservation Easement
Hines CE	FL	Private	Florida Department of Environmental Protection	Conservation Easement
Miami Corporation	FL	Private	Florida Fish and Wildlife Conservation Commission	Private
Lake Panasoffkee CE	FL	Private	Southwest Florida Water Management District	Conservation Easement
Myakkahatchee Creek	FL	Private	Southwest Florida Water Management District	Conservation Easement
Pasco I CE	FL	Private	Southwest Florida Water Management District	Conservation Easement
Timber Company CE	FL	Private	St. Johns River Water Management District	Conservation Easement
NATC Oak Hammock CE	FL	Private	Suwannee River Water Management District	Conservation Easement
NATC Suwannee Swamp CE	FL	Private	Suwannee River Water Management District	Conservation Easement
David and Sarah Meeks CE	FL	Private	Suwannee River Water Management District	Conservation Easement
Jack and Loy Ann Mann CE	FL	Private	Suwannee River Water Management District	Conservation Easement
Disney Wilderness Preserve	FL	Private	The Nature Conservancy	Private Conservation
Apalachicola NERR	FL	State	Florida Department of Environmental Protection	National Research Reserve
Clear Springs	FL	State	Florida Department of Environmental Protection	Other State
South Prong Alafia River	FL	State	Florida Department of Environmental Protection	Other State
Pinellas County Aquatic Preserve	FL	State	Florida Department of Environmental Protection	State Aquatic Reserve
Charlotte Harbor Aquatic Preserve	FL	State	Florida Department of Environmental Protection	State Aquatic Reserve
Big Bend Aquatic Preserve	FL	State	Florida Department of Environmental Protection	State Aquatic Reserve
Lemon Bay Aquatic Preserve	FL	State	Florida Department of Environmental Protection	State Aquatic Reserve
Estero Bay Aquatic Preserve	FL	State	Florida Department of Environmental Protection	State Aquatic Reserve
Charlotte Harbor State Buffer Preserve	FL	State	Florida Department of Environmental Protection	State Nature Reserve
Crystal River State Buffer Preserve	FL	State	Florida Department of Environmental Protection	State Nature Reserve

Appendix B. Continued.

Protected Area	State	Owner	Managing Agency	Type
Estero Bay State Buffer Preserve	FL	State	Florida Department of Environmental Protection	State Nature Reserve
Pumpkin Hill Creek State Buffer Preserve	FL	State	Florida Department of Environmental Protection	State Nature Reserve
St. Joseph Bay State Buffer Preserve	FL	State	Florida Department of Environmental Protection	State Nature Reserve
Hontoon Island State Park	FL	State	Florida Department of Environmental Protection	State Park
Crystal River Archaeological State Park	FL	State	Florida Department of Environmental Protection	State Park
Fakahatchee Strand Preserve State Park	FL	State	Florida Department of Environmental Protection	State Park
Faver-Dykes State Park	FL	State	Florida Department of Environmental Protection	State Park
Blue Spring State Park	FL	State	Florida Department of Environmental Protection	State Park
Hillsborough River State Park	FL	State	Florida Department of Environmental Protection	State Park
Lake Louisa State Park	FL	State	Florida Department of Environmental Protection	State Park
Myakka River State Park	FL	State	Florida Department of Environmental Protection	State Park
Paynes Prairie Preserve State Park	FL	State	Florida Department of Environmental Protection	State Park
William Beardall Tosohatchee State Reserve	FL	State	Florida Department of Environmental Protection	State Park
Withlacoochee Trail State Park	FL	State	Florida Department of Environmental Protection	State Park
Lake Kissimmee State Park	FL	State	Florida Department of Environmental Protection	State Park
General James A. Van Fleet Trail State Park	FL	State	Florida Department of Environmental Protection	State Park
Alafia River State Park	FL	State	Florida Department of Environmental Protection	State Recreation Area
Goethe SF	FL	State	Florida Division of Forestry	State Forest
Withlacoochee SF	FL	State	Florida Division of Forestry	State Forest
Tiger Bay SF	FL	State	Florida Division of Forestry	State Forest
Tate's Hell SF	FL	State	Florida Division of Forestry	State Forest
Picayune Strand SF	FL	State	Florida Division of Forestry	State Forest
Myakka SF	FL	State	Florida Division of Forestry	State Forest
Matanzas SF	FL	State	Florida Division of Forestry	State Forest
Lake George SF	FL	State	Florida Division of Forestry	State Forest
Little Big Econ SF	FL	State	Florida Division of Forestry	State Forest
Apalachicola River WEA	FL	State	Florida Fish and Wildlife Conservation Commission	Conservation Area
Paradise Island	FL	State	Florida Fish and Wildlife Conservation Commission	Other State

Appendix B. Continued.

Protected Area	State	Owner	Managing Agency	Type
Relay WMA	FL	State	Florida Fish and Wildlife Conservation Commission	Wildlife Management Area
J. W. Corbett WMA	FL	State	Florida Fish and Wildlife Conservation Commission	Wildlife Management Area
Half Moon WMA	FL	State	Florida Fish and Wildlife Conservation Commission	Wildlife Management Area
Fred C. Babcock-Cecil M. Webb WMA	FL	State	Florida Fish and Wildlife Conservation Commission	Wildlife Management Area
Fisheating Creek WMA	FL	State	Florida Fish and Wildlife Conservation Commission	Wildlife Management Area
Three Lakes WMA	FL	State	Florida Fish and Wildlife Conservation Commission	Wildlife Management Area
Bull Creek WMA	FL	State	Florida Fish and Wildlife Conservation Commission	Wildlife Management Area
Babcock-Webb WMA	FL	State	Florida Fish and Wildlife Conservation Commission	Wildlife Management Area
Marjorie Harris Carr Cross Florida Greenway SRCA	FL	State	Florida Natural Areas Inventory	Conservation Area
Stormwater Treatment Areas	FL	State	South Florida Water Management District	Other State
Kissimmee River	FL	State	South Florida Water Management District	Other State
Kissimmee Chain of Lakes	FL	State	South Florida Water Management District	Other State
Allapattah Flats	FL	State	South Florida Water Management District	Other State
Upper Lakes Basin Watershed	FL	State	South Florida Water Management District	Other State
Myakka River	FL	State	Southwest Florida Water Management District	Other State
Lower Hillsborough Flood Detention Area	FL	State	Southwest Florida Water Management District	Other State
Lower Hillsborough Flood Detention Area	FL	State	Southwest Florida Water Management District	Other State
Lake Thonotosassa	FL	State	Southwest Florida Water Management District	Other State
Annutteliga Hammock	FL	State	Southwest Florida Water Management District	Other State
Upper Hillsborough	FL	State	Southwest Florida Water Management District	Other State
Starkey	FL	State	Southwest Florida Water Management District	Other State
Green Swamp	FL	State	Southwest Florida Water Management District	Other State
River Lakes CA	FL	State	St. Johns River Water Management District	Conservation Area
Twelve Mile Swamp CA	FL	State	St. Johns River Water Management District	Conservation Area

Appendix B. Continued.

Protected Area	State	Owner	Managing Agency	Type
Blue Cypress CA	FL	State	St. Johns River Water Management District	Conservation Area
Three Forks Marsh CA	FL	State	St. Johns River Water Management District	Conservation Area
Lochloosa Wildlife CA	FL	State	St. Johns River Water Management District	Conservation Area
Lake George CA	FL	State	St. Johns River Water Management District	Conservation Area
Pellicer Creek Corridor CA	FL	State	St. Johns River Water Management District	Conservation Area
Hal Scott Regional Preserve and Park	FL	State	St. Johns River Water Management District	Natural Area
Fourth Volusia	FL	State	St. Johns River Water Management District	Other State
Altamaha River Scenic Easements	GA	Federal	Georgia Department of Natural Resources	Other Federal
Unknown	GA	Federal	U.S. Army Corps of Engineers	Other Federal
Fort Stewart	GA	Federal	U.S. Department of Defense	Military Reservation
Fort McAllister State Park	GA	State	Georgia Department of Natural Resources	State Park
King Tract WMA	GA	State	Georgia Department of Natural Resources	Wildlife Management Area
Richmond Hill WMA	GA	State	Georgia Department of Natural Resources	Wildlife Management Area
Altamaha WMA	GA	State	Georgia Department of Natural Resources	Wildlife Management Area
H.O. Cook SF	MA	State	Massachusetts Dept of Environmental Management	State Forest
Chesapeake & Ohio Canal NHP	MD	Federal	National Park Service	National Historic Site
Grove Neck Wildlife Sanctuary	MD	Federal	U.S. Army Corps of Engineers	Other Federal
Stemmers MHA	MD	Federal	U.S. Army Corps of Engineers	Other Federal
Aberdeen Proving Ground	MD	Federal	U.S. Department of Defense	Military Reservation
NSWC Indian Head	MD	Federal	U.S. Department of Defense	Military Reservation
Tridelphia Watershed	MD	Local	Local County Parks Department	County Park
Turners Creek Park	MD	Local	Local County Parks Department	County Park
T. Howard Duckett Waters	MD	Local	Local County Parks Department	County Park
Patuxent River Watershed	MD	Local	Local County Parks Department	County Park
Mariner Point Park	MD	Local	Local County Parks Department	County Park
Hawlings River Regional Park	MD	Local	Local County Parks Department	County Park
Francis Silver Park	MD	Local	Local County Parks Department	County Park
Halls Cross Elementary School Park	MD	Local	Local County Parks Department	County Park
North Deen Park	MD	Local	Local County Parks Department	County Park
Smithsonian Environmental Center	MD	Private	Smithsonian Institution	Private Conservation

Appendix B. Continued.

Protected Area	State	Owner	Managing Agency	Type
Sassafras NRMA	MD	State	Maryland Department of Natural Resources	Other State
Doncaster SF	MD	State	Maryland Department of Natural Resources	State Forest
Mattawoman NEA	MD	State	Maryland Department of Natural Resources	State Natural Area
Elk Neck State Park	MD	State	Maryland Department of Natural Resources	State Park
Gunpowder Falls State Park	MD	State	Maryland Department of Natural Resources	State Park
Susquehanna State Park	MD	State	Maryland Department of Natural Resources	State Park
Dierrsen WMA	MD	State	Maryland Department of Natural Resources	Wildlife Management Area
McKee Beshers	MD	State	Maryland Department of Natural Resources	Wildlife Management Area
Brunswick Naval Air Station	ME	Federal	U.S. Department of Defense	Military Reservation
Mill Stream Landing	ME	Private	Freeport Conservation Trust	Conservation Area
Mast Landing Sanctuary	ME	Private	Maine Audubon Society	Nature Preserve
Penobscot Indian Nation Reservation	ME	Tribal	Penobscot Indian Nation	Native American Land
Jordan Lake Educational SF	NC	Federal	North Carolina Division of Forest Resources	State Forest
Jordan Lake SRA	NC	Federal	North Carolina Division of Parks & Recreation	State Recreation Area
Falls Lake SRA	NC	Federal	North Carolina Division of Parks & Recreation	State Recreation Area
Jordan Game Land	NC	Federal	North Carolina Wildlife Resource Commission	Other State
Butner-Falls of Neuse Game Land	NC	Federal	North Carolina Wildlife Resource Commission	Other State
Falls Lake	NC	Federal	U.S. Army Corps of Engineers	Other Federal
Jordan Lake	NC	Federal	U.S. Army Corps of Engineers	Other Federal
Kerr Reservoir	NC	Federal	U.S. Army Corps of Engineers	Other Federal
Pocosin Lakes NWR	NC	Federal	U.S. Fish and Wildlife Service	National Wildlife Refuge
Uwharrie NF	NC	Federal	U.S. Forest Service	National Forest
Pisgah NF	NC	Federal	U.S. Forest Service	National Forest
Voice of America, Site A	NC	Federal	U.S. Information Services	Other Federal
Shearon Harris County Park	NC	Local	Wake County	County Park
Big Tom Wilson Preserve	NC	Private	American Farmland Trust	Conservation Easement
Scuppernong River Preserve	NC	Private	The Nature Conservancy	Private Conservation
Unknown	NC	Private	U.S. Fish and Wildlife Service	Conservation Easement
Lake Phelps State Lake	NC	State	North Carolina Division of Parks & Recreation	Other State
Mount Mitchell State Park	NC	State	North Carolina Division of Parks & Recreation	State Park

Appendix B. Continued.

Protected Area	State	Owner	Managing Agency	Type
Pettigrew State Park	NC	State	North Carolina Division of Parks & Recreation	State Park
Lantern Acres Game Land/Creswell Wetlands	NC	State	North Carolina Wildlife Resource Commission	Other State
Sandhills Game Land	NC	State	North Carolina Wildlife Resource Commission	Other State
Delaware Water Gap NRA	NJ	Federal	National Park Service	National Recreation Area
Paulinskil Trail	NJ	State	New Jersey Department of Environmental Protection	Other State
Mongaup Valley WMA	NY	State	Unknown	Wildlife Management Area
Cherry Island State WMA	NY	State	Unknown	Wildlife Management Area
Putnam Marsh	OH	Private	The Nature Conservancy	Nature Preserve
Unknown	OH	Private	Unknown	Private
Dupont Marsh NA	OH	State	Erie County Park District	Natural Area
Old Woman Creek SNP	OH	State	Ohio Department of Natural Resources	State Nature Reserve
Sheldon Marsh SNP	OH	State	Ohio Department of Natural Resources	State Nature Reserve
Delaware River NRA	PA	Federal	National Park Service	National Recreation Area
Upper Delaware Management Area	PA	Federal	National Park Service	National Recreation Area
Del River Open Space	PA	Local	County or Local Parks Department	Other
Mt. Jack	PA	Local	County or Local Parks Department	Other
Peace Valley	PA	Local	County or Local Parks Department	Other
Delaware SF	PA	State	Pennsylvania Bureau of Forestry	State Forest
Susquehannock State Park	PA	State	Pennsylvania Bureau of State Parks	State Park
State Game Land 56	PA	State	Pennsylvania Game Commission	Wildlife Management Area
Shaw AFB	SC	Federal	U.S. Department of Defense	Military Reservation
ACE Basin NWR	SC	Federal	U.S. Fish and Wildlife Service	National Wildlife Refuge
Musselboro Island	SC	Private	Ducks Unlimited	Private Conservation
Parkers Ferry	SC	Private	Ducks Unlimited	Private Conservation
Bolders Island	SC	Private	Ducks Unlimited	Private Conservation
Chehaw Combahee Plantation	SC	Private	Ducks Unlimited	Private Conservation
Church Tract	SC	Private	Ducks Unlimited	Private Conservation
Willtown Bluff Plantation	SC	Private	Ducks Unlimited	Private Conservation
Pon Pon Plantation	SC	Private	Ducks Unlimited	Private Conservation
Ashepool Plantation	SC	Private	Ducks Unlimited	Private Conservation
Paul and Dalton Plantation	SC	Private	Lowcountry Open Land Trust	Private Conservation
Oak Grove	SC	Private	Lowcountry Open Land Trust	Private Conservation
Nemours Plantation	SC	Private	Nemours Wildlife Foundation	Private Conservation
Hope Plantation	SC	Private	The Nature Conservancy	Conservation Easement

Appendix B. Continued.

Protected Area	State	Owner	Managing Agency	Type
John H. Kerr Reservoir Easements	VA	Private	U.S. Department of Defense	Conservation Easement
Mason Neck State Park	VA	State	Virginia Department of Conservation and Recreation	State Park
Occoneechee State Park	VA	State	Virginia Department of Conservation and Recreation	State Park
Staunton River State Park	VA	State	Virginia Department of Conservation and Recreation	State Park
Westmoreland State Park	VA	State	Virginia Department of Conservation and Recreation	State Park
York River State Park	VA	State	Virginia Department of Conservation and Recreation	State Park
Hog Island WMA	VA	State	Virginia Department of Game and Inland Fisheries	Wildlife Management Area
Lands End WMA	VA	State	Virginia Department of Game and Inland Fisheries	Wildlife Management Area
Missisquoi NWR	VT	Federal	U.S. Fish and Wildlife Service	National Wildlife Refuge
Rock River Access Area	VT	State	Vermont Department of Fish and Wildlife	Other State
Dead Creek Wildlife Management Area	VT	State	Vermont Department of Fish and Wildlife	Wildlife Management Area
Rock River Wildlife Management Area	VT	State	Vermont Department of Fish and Wildlife	Wildlife Management Area
Highgate State Park	VT	State	Vermont Department of Forest Parks and Recreation	State Park
Monongahela NF	WV	Federal	U.S. Forest Service	National Forest
Spruce Knob- Seneca Rocks NRA	WV	Federal	U.S. Forest Service	National Recreation Area
Laurel Fork South Wilderness	WV	Federal	U.S. Forest Service	Wilderness Area
Bluestone Lake WMA	WV	Federal	West Virginia Division of Natural Resources (federally owned)	Wildlife Management Area

APPENDIX C. Nocturnal roost locations in the eastern United States and Canada for migratory Florida sub-adult bald eagles, 1997-2004. Roosts were identified as 1 km areas containing > 1 eagle or >1 season for an individual eagle. Data were collected between one hour after sunset to sunrise.

Waterbody	County	State	Latitude	Longitude	Public Land	Agency	No. individuals
Lochloosa Lake	Alachua	FL	29.528	-82.151	Lochloosa Wildlife Conservation Area	St. Johns River Water Management District	2
Lochloosa Lake	Alachua	FL	29.517	-82.037	n/a		2
Charlotte Harbor	Charlotte	FL	26.855	-82.182	Charlotte Harbor State Buffer Preserve	Florida Department of Environmental Protection	2
Charlotte Harbor	Charlotte	FL	26.810	-81.979	Babcock-Webb WMA	Florida Fish and Wildlife Conservation Commission	3
Everglades	Collier	FL	26.131	-81.638	Picayune Strand State Forest	Florida Division of Forestry	3
Little Manatee River	Hillsborough	FL	27.764	-82.195	Balm-Boyette Scrub	Hillsborough County	4
Manatee River	Manatee	FL	27.562	-82.495	n/a		1
Sarasota Bay	Manatee	FL	27.437	-82.648	n/a		1
Manatee River	Manatee	FL	27.480	-82.464	n/a		5
Lake Okeechobee	Martin	FL	27.151	-80.638	n/a		2
St Lucie Canal	Martin	FL	27.187	-80.368	n/a		2
Lake Okeechobee	Okeechobee	FL	27.327	-80.689	n/a		3
Econlockhatchee River	Orange	FL	28.483	-81.169	n/a		2
Lake Helen Blazes	Osceola	FL	27.985	-80.890	Bull Creek WMA	Florida Fish and Wildlife Conservation Commission	2
Lake Kissimmee	Osceola	FL	27.866	-81.260	Kissimmee Chain of Lakes	South Florida Water Management District	2
Tohopekaliga Lake	Osceola	FL	28.172	-81.426	n/a		2
Tohopekaliga Lake	Osceola	FL	28.200	-81.352	n/a		1
Tohopekaliga Lake	Osceola	FL	28.221	-81.423	n/a		2
Lake Okeechobee	Palm Beach	FL	26.761	-80.541	n/a		1
Itchepackesassa Creek	Polk	FL	28.062	-81.900	Tenoroc Fish Management Area	Florida Fish and Wildlife Conservation Commission	1
Hancock Lake	Polk	FL	27.993	-81.870	Lake Hancock Circle B Bar Ranch	Polk County	5
Myakka River	Sarasota	FL	26.992	-82.310	n/a		3
Lower Myakka Lake	Sarasota	FL	27.232	-82.410	n/a		4
Lower Myakka Lake	Sarasota	FL	27.188	-82.374	Pinelands Reserve	Sarasota County	3
St Johns River	Seminole	FL	28.786	-81.112	n/a		4
Johns Lake	Sumter	FL	28.704	-82.014	n/a		1
Tsala Apopka Lake	Sumter	FL	28.670	-82.215	n/a		1
Tomoka River	Volusia	FL	29.102	-81.123	Port Orange City Forest	City of Port Orange	3
Sassafras River	Cecil	MD	39.383	-75.978	n/a		3
Susquehanna River	Cecil	MD	39.663	-76.163	n/a		3
Potomac River	Charles	MD	38.508	-77.257	n/a		3
B. Everett Jordan Lake	Chatham	NC	35.688	-79.080	B. Everett Jordan Lake	US Army Core of Engineers	2

Appendix C. Continued.

Waterbody	County	State	Latitude	Longitude	Public Land	Agency	No. individuals
B. Everett Jordan Lake	Chatham	NC	35.840	-78.972	B. Everett Jordan Lake	US Army Core of Engineers	3
Core Creek	Craven	NC	35.209	-77.350	n/a		2
Roanoke Rapids Lake	Northampton	NC	36.492	-77.714	n/a		2
Grindle Creek	Pitt	NC	35.666	-77.224	n/a		1
Tranters Creek	Pitt	NC	35.705	-77.198	n/a		1
Lake Champlain	Clinton	NY	44.946	-73.350	Kings Bay WMA	New York State Department of Environmental Conservation	1
Delaware River	Orange	NY	41.397	-74.726	n/a		1
Delaware River	Orange	NY	41.431	-74.743	Mongaup Valley WMA	New York State Department of Environmental Conservation	1
Muddy River Reservoir	Lancaster	PA	39.833	-76.300	n/a		2
James River	Chesterfield	VA	37.358	-77.284	Presquile NWR	US Fish and Wildlife Service	1
Potomac River	Fairfax	VA	38.615	-77.195	Mason Neck NWR	US Fish and Wildlife Service	3
Rappahannock River	King George	VA	38.168	-77.087	Rappahannock NWR	US Fish and Wildlife Service	2
James River	Prince George	VA	37.301	-77.116	James River NWR	US Fish and Wildlife Service	2
James River	Prince George	VA	37.303	-77.008	n/a		2
Rappahannock River	Richmond	VA	37.998	-76.891	n/a		2
Potomac River	Westmoreland	VA	38.141	-76.759	n/a		1
Lake Champlain	Franklin	VT	45.010	-73.094	Highgate State Park	Vermont Department of Forest Parks and Recreation	1
Avon River	Nova Scotia	CAN	45.082	-64.283	n/a		1

APPENDIX D. Home ranges for Florida sub-adult bald eagles tracked with satellite transmitters, 1997-2004.

Mean seasonal home ranges of non-migratory eagle.

Age (year)	95% kernel (km ²)	MCP (km ²)	n
Summer			
1	16,339	13,763	4
2	22,679	14,062	2
3	10,597	12,045	2
Winter			
1	15,120	7,418	3
2	11,781	6,240	2
3	5,683	4,034	2

Mean coarse home ranges of migratory eagles.

Age (year)	95% kernel (km ²)	MCP (km ²)	n	Age (year)	95% kernel (km ²)	MCP (km ²)	n
Summer				Winter			
Females				Females			
1	4,299	2,738	20	1	33,652	16,126	19
2	4,097	2,009	13	2	14,053	8,617	15
3	1,819	544	7	3	20,812	16,103	9
4	1,476	541	2	4	22,953	7,308	1
Males				Males			
1	8,820	5,817	14	1	16,618	9,502	12
2	6,309	2,878	7	2	7,703	5,359	8
3	3,513	148	1	3	5,126	3,600	6
4	96	47	3	4	1,658	958	4
5	2,005	732	1				

APPENDIX E. Migration routes, migration distance, and time traveled for migratory Florida sub-adult bald eagles, 1997-2004. Eagles were tracked using satellite transmitters (Platform Terminal Transmitter – PTT).

PTT	Sex	Age	Route North ^a	Num Days	Depart North	Arrive North	Distance (km ²)	Route South ^a	Num Days	Depart South	Arrive South
01438	F	1	C	22	6/25	7/17	726	C	8	9/21	9/29
01438C	F	1	C	5	5/13	5/18	1120	U	^b		
01439	F	1	M	39	5/31	7/9	2794	C	10	10/9	10/19
01439	F	2	C	11	3/31	4/11	673	C	24	10/1	10/25
01439	F	3	C	^b			1415	U	^b		
01439	F	4	C	18	5/2	5/20	1268	C	18	9/26	10/14
02216B	F	1	C	^b	7/10		619	C	3	7/20	7/23
02216C	F	1	C	15	5/9	5/24	1332	C	3	9/19	9/22
02216C	F	2	C	17	4/4	4/21	821	C	17	9/26	10/13
02217	M	1	M	48	5/30	7/17	2874	C	62	8/20	10/21
03542	F	1	C	5	7/23	7/28	596	C	6	7/30	8/5
03543	F	1	M	36	6/10	7/16	1192	M	48	10/15	12/2
03543	F	2	C	17	5/11	5/28	975	M	11	10/20	10/31
03543	F	3	C	47	4/30	6/16	1112	M	12	9/24	10/6
03543	F	4	C	4	4/20	4/24	907	U	^b		
03558	M	1	C	9	5/24	6/2	1034	U	^d		
03567	F	1	U	2	6/22	6/24	431	U	^d		
03567B	M	1	M	24	5/21	6/14	2351	C	33	9/26	10/29
12558	M	1	M	11	5/10	5/21	1945	M	19	8/8	8/27
12558B	F	1	M	11	5/19	5/30	2380	M	26	9/7	10/3
13167	F	1	O	23	6/10	7/3	1081	U	^b		
13167	F	2	C	27	4/30	5/27	1039	U	^b		
13487	M	1	M	50	5/7	6/26	4146	C	94	8/3	11/5
13487	M	2	M	25	5/13	6/7	3321	C	62	9/1	11/2
13487	M	3	M	33	6/18	7/21	3119	U	48	8/24	10/11
13487	M	4	C	26	6/11	7/7	3122	C	^b	9/1	
13490	M	1	C	17	7/5	7/22	1215	U	^b		
13494	F	1	M	26	5/17	6/12	2628	C	106	8/9	11/23
13494	F	2	C	44	6/30	8/13	1170	C	19	10/28	11/16
13494	F	3	C	20	6/8	6/28	1231	C	20	9/28	10/18
13494	F	4	C	^b			1275	U	^b		
13498	F	1	U	^b				M	46	12/30	2/14
13498	F	2	M	11	6/5	6/16	771	M	54	10/6	11/29
13498	F	3	U	^b				M	36	9/22	10/28
13498	F	4	M	15	4/19	5/4	731	M	29	9/19	10/18
13520	F	1	C	15	5/11	5/26	1288	C	11	10/6	10/17
13520	F	2	C	30	4/4	5/4	3061	C	11	10/13	10/24
13520	F	3	C	32	4/25	5/27	1265	C	10	9/30	10/10
13520	F	4	C	54	4/12	6/5	1428	U	^c		
22985	F	1	M	11	5/20	5/31	1846	C	58	9/28	11/25
22985	F	2	M	24	4/30	5/24	1397	C	17	11/3	11/20
22985	F	3	C	24	4/25	5/19	1365	C	10	9/11	9/21

Appendix E. Continued.

PTT	Sex	Age	Route North ^a	Num Days ^b	Depart North	Arrive North	Distance (km ²)	Route South ^a	Num Days ^b	Depart South	Arrive South
22985	F	4	C	^b	4/19		533	U	^c		
22987	M	1	C	29	5/9	6/7	1543	U	^d		
22988	M	1	M	25	6/2	6/27	2278	M	106	8/13	11/27
22988	M	2	C	74	4/3	6/16	1895	M	49	9/25	11/13
22988	M	3	C	119	3/20	7/17	2229	M	33	10/4	11/6
22989	F	1	C	7	5/5	5/12	1281	U	^d		
22990	F	1	U	^b				M	49	9/25	11/13
22990	F	2	C	10	5/4	5/14	1291	M	42	9/19	10/31
22992	F	1	C	17	5/20	6/6	1325	U	^b		
22992	F	2	U	^b				C	39	10/5	11/13
22992	F	3	C	11	5/3	5/14	1083	C	18	10/3	10/21
22992	F	4	C	11	4/17	4/28	1051	C	11	9/10	9/21
22993	M	1	C	8	5/20	5/28	1497	C	18	10/6	10/24
22993	M	2	C	18	4/20	5/8	1482	C	11	9/26	10/7
22995	F	1	M	27	5/5	6/1	2085	U	^d		
22996	F	1	C	32	4/22	5/24	3125	C	92	9/30	12/31
22996	F	2	C	25	5/3	5/28	2641	C	48	9/28	11/15
22996	F	3	C	55	4/8	6/2	2456	C	27	9/28	10/25
22997	F	1	M	48	6/18	8/5	3059	M	18	9/3	9/21
22997	F	2	C	17	4/21	5/8	2264	C	25	10/8	11/2
22997	F	3	C	31	5/4	6/4	2914	C	24	9/10	10/4
22997	F	4	C	55	4/7	6/1	1715	C	11	8/19	8/30
24977	F	1	M	18	5/10	5/28	2486	C	104	8/21	12/3
24977	F	2	C	26	5/4	5/30	1369	C	25	10/29	11/23
24978	F	1	C	16	5/15	5/31	1281	C	17	8/13	8/30
24978	F	2	C	16	5/2	5/18	966	C	12	8/3	8/15
24978	F	3	U	^b				C	20	9/1	9/21
24978	F	4	C	33	4/1	5/4	1012	U	^b		
24979	F	1	M	44	7/1	8/14	1739	O	11	11/14	11/25
24979	F	2	M	23	3/22	4/14	943	O	19	10/8	10/27
24980	M	1	C	5	6/14	6/19	1168	C	12	9/26	10/8
24980	M	2	C	12	5/16	5/28	1203	C	3	10/11	10/14
24980	M	3	C	3	4/23	4/26	1180	C	11	9/9	9/20
24980	M	4	C	12	4/21	5/3	1215	U	^b		
24981	M	1	M	5	5/18	5/23	1438	M	15	9/15	9/30
24981	M	2	M	89	5/11	8/8	3379	M	17	9/3	9/20
24981	M	3	M	7	5/12	5/19	1150	C	68	8/11	10/18
24981	M	4	M	38	4/30	6/7	1737	M	10	9/13	9/23
24982	F	1	C	16	6/3	6/19	1612	C	20	9/28	10/18
24982	F	2	C	11	4/13	4/24	1284	U	^d		
24983	M	1	C	111	4/17	8/6	3736	M	20	9/21	10/11
24983	M	2	C	20	5/22	6/11	1269	U	^d		
24984	M	1	C	17	5/15	6/1	2155	C	20	9/23	10/13
24984	M	2	C	19	5/17	6/5	1182	M	12	10/21	11/2
24984	M	3	C	24	5/1	5/25	1437	C	51	9/16	11/6
24984	M	4	C	^b		7/15	1315	C	19	10/6	10/25
24984	M	5	C	19	6/6	6/25	727	M	24	9/28	10/22
24985	M	1	C	9	6/13	6/22	1464	C	12	9/25	10/7

Appendix E. Continued.

PTT	Sex	Age	Route North ^a	Num Days	Depart North	Arrive North	Distance (km ²)	Route South ^a	Num Days	Depart South	Arrive South
24985	M	3	C	3	7/23	7/26	950	U	^b		
24985	M	4	C	31	7/18	8/18	1080	C	16	9/10	9/26
24986	F	1	M	47	6/11	7/28	1135	C	10	9/9	9/19
24986	F	2	C	20	4/27	5/17	1060	C	12	10/5	10/17
24986	F	3	C	4	5/10	5/14	986	U	^b		
24986	F	4	U	^b				C	12	9/13	9/25
28106C	F	1	M	8	8/15	8/23	920	M	8	8/25	9/2
28107B	M	1	M	17	6/11	6/28	1744	C	47	9/16	11/2
28107B	M	2	C	11	5/12	5/23	687	C	25	9/21	10/16
28107B	M	3	C	11	4/12	4/23	1508	C	^b		
28108	M	1	M	^b	5/31		970	U	^c		
28108B	M	1	C	10	5/5	5/15	1325	C	10	9/24	10/4
28108B	M	2	C	18	5/19	6/6	1347	C	11	10/7	10/18
28108B	M	3	C	3	5/10	5/13	976	C	11	9/28	10/9
28108B	M	4	C	19	4/24	5/12	1022	C	10	9/27	10/7
28108B	M	5	C	18	4/15	5/3	621	U	^d		
28109	F	1	M	25	6/4	6/29	2851	U	^c		
28110	F	1	M	13	5/21	6/3	1469	C	53	10/19	12/11
28110	F	2	M	14	5/24	6/7	1290	C	^b		
28110B	F	1	M	15	6/27	7/12	1238	M	18	10/14	11/1
28110B	F	2	M	17	4/9	4/26	1207	U	^c		
28112B	M	1	M	26	5/29	6/24	2905	C	64	8/7	10/10
28112B	M	2	C	26	4/25	5/21	1992	C	26	9/21	10/17
28112B	M	3	C	41	5/10	6/20	2268	C	14	9/18	10/2
28112B	M	4	C	41	5/3	6/13	2234	C	26	9/15	10/11
28113	F	1	C	36	5/11	6/16	1417	C	60	9/21	11/20
28113	F	2	C	66	5/5	7/10	2902	M	73	8/19	10/31
28113	F	3	C	^b		6/20		C	52	8/12	10/3
28113	F	4	C	24	5/14	6/7	2254	C	74	7/24	10/6
28114	F	1	M	24	5/1	5/25	2315	C	24	9/9	10/3
28114	F	2	C	101	4/21	7/31	4308	C	51	9/23	11/13
28114	F	3	C	^b		5/6	2597	C	25	9/5	9/30
28115	M	1	C	6	5/25	5/31	752	C	11	11/2	11/13
28115	M	2	C	3	5/6	5/9	636	C	10	10/3	10/13
28115	M	3	C	3	4/26	4/29	688	U	^c		
28116	F	1	M	54	6/18	8/11	2738	U	^b		
28117	F	1	C	5	5/23	5/28	1075	C	31	10/8	11/8
28117	F	2	C	7	5/5	5/12	1308	C	18	9/13	10/1
28118B	F	1	M	13	6/30	7/13	1389	C	31	10/8	11/8
28118B	F	2	C	25	4/23	5/18	1057	C	10	9/27	10/7
28118B	F	3	C	18	4/6	4/24	1167	C	64	8/8	10/11
28118B	F	4	C	60	3/10	5/9	1288	C	^b	9/11	
28119	M	1	C	6	6/2	6/8	832	C	7	10/7	10/14
28119	M	2	C	10	6/16	6/26	694	C	10	9/2	9/12

^a C = coastal, M = mountain, O = other, U = unknown

^b Number of days traveled not calculated because of a large interval in satellite transmissions.

^c Transmitter failed; fate of eagle unknown.

^d Dead.

APPENDIX F. Stopover locations of migratory Florida sub-adult bald eagles ($n = 25$) tracked with satellite transmitters, 1997-2004. Eagles remained at stopover sites 6-31 days ($\bar{x} = 14.8$ days; 95% CI: 12.8 – 16.8; $n = 54$).

Stopover	Latitude	Longitude	Owner	Water type	State
Lower Suwanee River NWR	29.210	-83.040	USFWS	River	FL
Lake Miccosukee	30.600	-83.990		Lake	FL
Ocmulgee River	32.060	-83.060		River	GA
Coosaw River	32.570	-80.700		River	SC
J. Strom Thurmond Lake	33.110	-82.520	US ACE	Reservoir	GA
Weiss Lake	34.180	-85.720		Lake	AL
Sandhills Game Land, McKinney Lake National Fish Hatchery	35.000	-79.660	NC Wildlife Resources Commission	Lake	NC
Lake Wylie	35.150	-80.980		Lake	NC
Cape Fear River	35.340	-78.790		River	NC
Neuse River	35.350	-77.280		River	NC
Lake Tillery, Badin Lake	35.370	-80.120		Lake	NC
Lake Norman	35.440	-80.720		Lake	NC
B. Everett Jordan Lake	35.840	-78.960	US ACE	Reservoir	NC
John H. Kerr Reservoir	36.460	-78.280	US ACE	Reservoir	NC
Langley AFB, Chesapeake Bay	37.080	-76.440	US DOD	Bay	VA
Appomattox River	37.250	-78.270		River	VA
James River, Presquile NWR	37.350	-77.280	USFWS	River	VA
Chesapeake Bay	38.030	-75.670		Bay	MD
Chesapeake Bay	38.140	-76.330		Bay	MD
Potomac River, Caledon SP	38.350	-77.160	VA Dept of Conservation and Recreation	River	VA
Potomac River	38.510	-77.260		River	MD
N Fork South Branch Potomac River	38.630	-79.470		River	WV
Potomac River	38.640	-77.110		River	MD
Chester River	39.130	-76.060		River	MD
Back River, North Point SP	39.240	-76.400	MD DNR	River	MD
Chesapeake and Ohio Canal National Historic Park	39.440	-78.590	NPS	Canal	WV
Susquehanna River	39.610	-76.140		River	MD
Youghiogheny River Lake	39.760	-79.580		Lake	PA
Delaware River NRA	41.080	-74.980	NPS	River	PA
Susquehanna River	41.400	-75.810		River	PA
Upper Delaware Management Area NRA	41.420	-74.770	NPS	River	PA
Neversink Reservoir	41.760	-74.610		Reservoir	NY
Merrimack River	43.280	-71.560		River	NH

Appendix F. Continued.

Stopover	Latitude	Longitude	Owner	Water type	State
Lake George, Adirondack Park State Forest Preserve	43.620	-73.540		Lake	NY
Lake Champlain	44.130	-73.300		Lake	VT
Lake Saint Lawrence	44.960	-75.250		Lake	NY
St. Francis River	45.720	-71.350		River	CAN
Tuadook River	46.950	-66.590		River	CAN
St. Lawrence River	49.320	-67.400		River	CAN
Strait of Belle Isle	50.330	-59.620		Bay	CAN

APPENDIX G. Tracking history of satellite tagged Florida sub-adult bald eagles, 1997-2004.

PTT ^a	Sex	Age ^b	Season ^c	Location
01438	F	1	S	Lake Miccosukee, Leon Co., FL Dead: Poisoned, May's Pond Plantation, Jefferson Co., FL
01438B	M	1	S	n/a, died in nest Dead: disease (Chlymadia), in nest, FL
01438C	F	1	S	Neuse River, Pitt Co., NC
			W	Tamiami Canal, Collier Co., FL
				Unknown: PTT harness severed by eagle, found in Collier Co., FL
01439	F	1	S	Conowingo Reservoir, Lancaster Co., PA
		1	W	Ashepoo River, Colleton Co., SC
		2	S	Rappahannock River, Richmond Co., VA
		2	W	Tamiami Canal, Collier Co., FL
		3	S	Rappahannock River, Richmond Co., VA
		3	W	Turner River Canal, Collier Co. FL
		4	S	Conowingo Reservoir, Lancaster Co., PA
		4	W	Tamiami Canal, Collier Co., FL
				Unknown: transmitter battery failure
02216	F	1	S	n/a, died near nest Dead: storm trauma, Manatee Co., GL
02216B	F	1	S	Pine Island Sound, Lee Co., FL Dead: electrocuted, Charlotte, Co., FL
02216C	F	1	S	Potomac River, King Co., VA
		1	W	St. John's River, Volusia Co., FL
		2	S	Potomac River, Fairfax Co., VA
		2	W	Myakka River, Sarasota Co., FL
				Unknown: transmitter battery failure
02217	M	1	S	Kennebec River, Sagadahoc Co., ME
		1	W	Hancock Lake, Polk Co., FL
				Dead: unknown cause, Hillsborough Co., FL
03542	F	1	S	Tomoka River, Volusia Co., FL Unknown: transmitter battery failure
03543	F	1	S	Knapp Creek, Summers Co., WV
		1	W	Blue Cypress Lake, Indian River Co., FL
		2	S	B. Everett Jordan Lake, Chatham Co. NC
		2	W	St. John's River, Brevard Co., FL
		3	S	John H. Kerr Reservoir, Halifax Co., VA
		3	W	St. John's River, Brevard Co., FL
		4	S	John H. Kerr Reservoir, Halifax Co., VA
		4	W	St. John's River, Brevard Co., FL
				Dead: vehicle collision, Brevard Co., FL
03557	M	1	S	Lake Dora, Lake Co., FL
		1	W	Braden River, Manatee Co., FL
		2	S	Braden River, Manatee Co., FL
				Dead: vehicle collision, Manatee Co., FL
03557b	F	1	S	Tomoka River, Volusia Co., FL
		1	W	Charlotte Harbor, Charlotte Co., FL
		2	S	Charlotte Harbor, Charlotte Co., FL

Appendix. G. Continued.

PTT	Sex	Age	Season	Location
03557b	F	2	W	Charlotte Harbor, Charlotte Co., FL
		3	S	Charlotte Harbor, Charlotte Co., FL
		3	W	Charlotte Harbor, Charlotte Co., FL
		4	S	Charlotte Harbor, Charlotte Co., FL
		4	W	Charlotte Harbor, Charlotte Co., FL
				Unknown: transmitter battery failure
03558	M	1	S	Pamlico River, Beaufort Co., NC
				Dead: shot at fish hatchery, Beaufort Co., NC
03567	F	1	S	St. John's River, Duval Co., FL
				Dead: electrocuted, Duval Co., FL
03567B	M	1	S	Penobscot River, Penobscot Co., ME
		1	W	Newnan's Lake, Alachua Co., FL
				Unknown: transmitter battery failure
12558	M	1	S	Great South Bay, Nassau Co., NY
				Dead: unknown cause, Nelson Co., VA
12558B	F	1	S	Penobscot River, Penobscot Co., ME
		1	W	J. Strom Thurmond Lake, Lincoln Co., GA
				Unknown: PTT harness severed by eagle, found in Highlands Co., FL
13167	F	1	S	Big Brush Creek, Hale Co., AL
		1	W	Blue Cypress Lake, Indian River Co., FL
		2	S	Neuse River, Craven Co., NC
		2	W	Charlotte Harbor, Charlotte Co., FL
				Unknown: transmitter battery failure
13487	M	1	S	Gulf of St. Lawrence, Newfoundland, Canada
		1	W	Lake Okeechobee, Highlands Co., FL
		2	S	Menihok Lake, Newfoundland, Canada
		2	W	Lake Okeechobee, Highlands Co., FL
		3	S	Lac St. Jean, Quebec, Canada
		3	W	Alafia River, Hillsborough Co., FL
		4	S	Lac St. Jean, Quebec, Canada
		4	W	S. Prong Alafia River, Hillsborough Co., FL
13490	M	1	S	Shearon Harris Reservoir, Wake Co., NC
		1	W	Combahee River, Colleton Co., SC
		2	S	Myakka River, Sarasota Co., FL
		2	W	Caloosahatchee River, Lee Co., FL
		3	S	Myakka River, Sarasota Co., FL
		3	W	Myakka River, Sarasota Co., FL
		4	S	Myakka River, Sarasota Co., FL
				Unknown: transmitter battery failure
13494	F	1	S	Lac St. Jean, Quebec, Canada
		1	W	Lake Hatchineha, Polk Co., FL
		2	S	Shenandoah River, Fauquier Co., VA
		2	W	Withlacoochee River, Pasco Co., FL
		3	S	Potomac River, Loudoun Co., VA
		3	W	Withlacoochee River, Pasco Co., FL
		4	S	no locations received
		4	W	Withlacoochee River, Pasco Co., FL
		5	S	Potomac River, Loudoun Co., VA

Appendix. G. Continued.

PTT	Sex	Age	Season	Location
13494	F	5	W	Withlacoochee River, Pasco Co., FL Unknown: transmitter battery failure
13498	F	1	S	Guntersville Lake, Jackson Co., AL
		1	W	Big Fish Lake, Pasco Co., FL
		2	S	Guntersville Lake, Marshall Co. AL
		2	W	Big Fish Lake, Pasco Co., FL
		3	S	Guntersville Lake, Marshall Co. AL
		3	W	Lake Hancock, Polk Co. FL
		4	S	Center Hill Lake, Decal Co. TN
		4	W	Lake Hancock, Polk Co. FL
				Injured: vehicle collision, unreleasable, Polk Co., FL
13510	M	1	S	Charlotte Harbor, Charlotte Co., FL Dead: unknown cause
13520	F	1	S	Potomac River, Westmoreland Co. VA
		1	W	Alafia River, Hillsborough Co., FL
		2	S	Potomac River, Westmoreland Co. VA
		2	W	Alafia River, Hillsborough Co., FL
		3	S	Potomac River, Westmoreland Co. VA
		3	W	Alafia River, Hillsborough Co., FL
		4	S	Potomac River, Westmoreland Co. VA
				Unknown: transmitter battery failure
22985	F	1	S	Androscoggin River, Coos Co. NH
		1	W	Lake Moultrie, Berkley Co. SC
		2	S	Susquehanna River, Cecil Co. MD
		2	W	Econlockhatchee River, Seminole Co. FL
		3	S	Susquehanna River, Cecil Co. MD
		3	W	Lake Okeechobee, Palm Beach Co. FL
		4	S	no locations received
		4	W	no locations received
		5	S	no locations received
		5	W	no locations received
				Dead: electrocuted, Glades Co., FL
22986	M	1	S	n/a, died near nest Dead: unknown cause, Sarasota Co., FL
22987	M	1	S	Sassafras River, Cecil Co. MD Dead: unknown cause, Cecil Co., MD
22988	F	1	S	Richelleu River, Quebec, Canada
		1	W	Tomoka River, Volusia Co. FL
		2	S	Lake Champlain, Quebec, Canada
		2	W	Lake Okeechobee, Palm Beach Co. FL
		3	S	Lake Champlain, Franklin Co. VT
		3	W	Lake Okeechobee, Palm Beach Co. FL
				Dead: unknown cause, Nassau Co., FL
22989	F	1	S	James River, Hopewell City Co., VA Dead: unknown cause, Hopewell City Co., VA
22990	F	1	S	Lake Erie, Erie Co. OH
		1	W	Manatee River, Manatee Co., FL
		2	S	Huron River, Erie Co. OH
		2	W	Manatee River, Manatee Co., FL

Appendix. G. Continued.

PTT	Sex	Age	Season	Location
22990	F			Dead: unknown cause, Hillsborough Co., FL
22991	F	1	S	Econlockhatchee River, Seminole Co. FL
		1	W	Econlockhatchee River, Seminole Co. FL
		2	S	Econlockhatchee River, Seminole Co. FL
		2	W	Kissimmee River, Osceola Co., FL
		3	S	Manatee River, Manatee Co., FL
		3	W	Myakka River, Sarasota Co., FL
22992	F	1	S	Unknown: transmitter battery failure
		1	W	Susquehanna River, Harford Co. MD
		2	S	Suwannee River, Levy Co. FL
		2	W	Rappahannock River, Richmond Co., VA
		3	S	Suwannee River, Levy Co. FL
		3	W	Rappahannock River, Richmond Co., VA
22993	M	1	S	Wolf Sink, Levy Co. FL
		1	W	Dead: unknown cause, Levy Co., FL
		2	S	Potomac River, Charles Co., MD
		2	W	Charlotte Harbor, Charlotte Co., FL
22994	F	1	S	Potomac River, Charles Co., MD
		1	W	Charlotte Harbor, Charlotte Co., FL
22995	F	1	S	Dead: unknown cause, Lee Co., FL
		1	W	n/a, died near nest
22996	F	1	S	Dead: unknown cause, Lee Co., FL
		1	W	Potomac River, Charles Co. MD
		2	S	Dead: unknown collision, Harford Co., MD
		2	W	Avon River, Nova Scotia, Canada
		3	S	Lake Tohopekaliga, Osceola Co., FL
		3	W	Avon River, Nova Scotia, Canada
		4	S	Lake Tohopekaliga, Osceola Co., FL
		4	W	Avon River, Nova Scotia, Canada
22997	F	1	S	Lake Tohopekaliga, Osceola Co., FL
		1	W	Avon River, Nova Scotia, Canada
		2	S	Lake Tohopekaliga, Osceola Co., FL
		2	W	Avon River, Nova Scotia, Canada
		3	S	Lake Tohopekaliga, Osceola Co., FL
		3	W	Avon River, Nova Scotia, Canada
24977	F	1	S	Lake Tohopekaliga, Osceola Co., FL
		1	W	no locations received
		2	S	no locations received
		2	W	no locations received
24978	F	1	S	Dead: electrocuted, Orange Co., FL
		1	W	Penobscot River, Hancock Co., ME
		2	S	Anclote River, Pasco Co., FL
		2	W	Delaware River, Pike Co., PA
24978	F	1	S	Delaware River, Pike Co., PA
		1	W	Alafia River, Hillsborough Co., FL
		2	S	Delaware River, Pike Co., PA
		2	W	Alafia River, Hillsborough Co., FL
24978	F	1	S	Delaware River, Sullivan Co. NY
		1	W	Dead: unknown cause, Charles City, MD
		2	S	Atlantic Ocean, Washington Co. ME
24978	F	1	S	Myakka River, Sarasota Co., FL
		1	W	Susquehanna River, Lucerne Co., PA
		2	S	Myakka River, Sarasota Co., FL
24978	F	1	S	Unknown: transmitter battery failure
		1	W	Albermarle Sound, Washington Co., NC
		2	S	Alafia River, Hillsborough Co., FL
24978	F	1	S	Albermarle Sound, Washington Co., NC
		1	W	Alafia River, Hillsborough Co., FL
24978	F	1	S	Albermarle Sound, Washington Co., NC
		1	W	Alafia River, Hillsborough Co., FL

Appendix. G. Continued.

PTT	Sex	Age	Season	Location
24978	F	2	W	Alafia River, Hillsborough Co., FL
		3	S	Albermarle Sound, Washington Co., NC
		3	W	Alafia River, Hillsborough Co., FL
		4	S	Pamlico River, Beaufort Co., NC
		4	W	Alafia River, Hillsborough Co., FL
		5	S	Albermarle Sound, Washington Co., NC
		5	W	no locations received
				Dead: electrocuted, Hillsborough Co., FL
24979	F	1	S	Ohio River, Massac Co., IL
		1	W	Apalachicola River, Gulf Co., FL
		2	S	Ohio River, Massac Co., IL
		2	W	Dannelly Reservoir, Dallas Co., AL
				Dead: unknown cause, Monroe Co., AL
24980	M	1	S	Pamlico River, Pitt Co., NC
		1	W	The Everglades, Collier Co., FL
		2	S	Pamlico River, Pitt Co., NC
		2	W	Charlotte Harbor, Lee Co., FL
		3	S	Neuse River, Craven Co., NC
		3	W	Charlotte Harbor, Charlotte Co., FL
		4	S	Pamlico River, Pitt Co., NC
		4	W	Charlotte Harbor, Lee Co., FL
		5	S	Roanoke River, Martin Co., NC
		5	W	no locations received
				Dead: unknown cause, Charlotte Co., FL
24981	M	1	S	Sandusky River, Sandusky Co., OH
		1	W	Withlacoochee River, Sumter Co., FL
		2	S	Lake St. Lawrence, St. Lawrence Co., NY
		2	W	Withlacoochee River, Sumter Co., FL
		3	S	Sandusky Bay, Sandusky Co., OH
		3	W	Withlacoochee River, Sumter Co., FL
		4	S	S. Branch Potomac River, Pendleton Co., WV
		4	W	Withlacoochee River, Sumter Co., FL
				Dead: unknown cause, Sumter Co., FL
24982	F	1	S	Conowingo Reservoir, Lancaster Co., PA
		1	W	Charlotte Harbor, Charlotte Co., FL
		2	S	James River, James City Co., VA
				Dead: unknown cause, Newport News City Co., VA
24983	M	1	S	Foster Joseph Sayers Lake, Centre Co., PA
		1	W	St. John's River, Seminole Co., FL
		2	S	Foster Joseph Sayers Lake, Centre Co., PA
				Dead: unknown cause, Clinton Co., PA
24984	M	1	S	James River, Prince George Co., VA
		1	W	S. Prong Alafia River, Hillsborough Co., FL
		2	S	Pamunkey River, New Kent Co., VA
		2	W	Hancock Lake, Polk Co., FL
		3	S	B. Everett Jordan Lake, Chatham Co. NC
		3	W	Hancock Lake, Polk Co., FL
		4	S	B. Everett Jordan Lake, Chatham Co. NC
4	W	Hancock Lake, Polk Co., FL		

Appendix. G. Continued.

PTT	Sex	Age	Season	Location
24984	M	5	S	James River, Charles City Co., VA
		5	W	Hancock Lake, Polk Co., FL Unknown: transmitter battery failure
24985	M	1	S	Roanoke River, Martin Co., NC
		1	W	Charlotte Harbor, Lee Co., FL
		2	S	Neuse River, Craven Co., NC
		2	W	Charlotte Harbor, Lee Co., FL
		3	S	Neuse River, Craven Co., NC
		3	W	Charlotte Harbor, Lee Co., FL
		4	S	Neuse River, Craven Co., NC
		4	W	Charlotte Harbor, Lee Co., FL Dead: unknown cause, Lee Co., FL
24986	F	1	S	Lake Murray, Newberry Co., SC
		1	W	Econlockhatchee River, Orange Co., FL
		2	S	John H. Kerr Reservoir, Mecklenburg Co., VA
		2	W	Lake Conway, Orange Co., FL
		3	S	John H. Kerr Reservoir, Mecklenburg Co., VA
		3	W	Hancock Lake, Polk Co., FL
		4	S	Lake Gaston, Warren Co., NC
		4	W	Hancock Lake, Polk Co., FL Dead: unknown cause, Polk Co., FL
28106	M	1	S	n/a, transmitter failed with eagle in nest Unknown: transmitter battery failure
28106B	M	1	S	n/a, died near nest Dead: starvation, Hillsborough Co., FL
28106C	F	1	S	Little Tennessee River, Graham Co., NC
		1	W	Lake Okeechobee, Okeechobee Co., FL
		2	S	Charlotte Harbor, Charlotte Co., FL Dead: unknown cause, Charlotte Co., FL
28107	M	1	S	n/a, transmitter failed with eagle in nest Dead: unknown cause, unknown county, FL
28107B	M	1	S	Lake Moultrie, Berkley Co. SC
		1	W	St. John's River, Orange Co., FL
		2	S	Sassafras River, Cecil Co. MD
		2	W	Lake Kissimmee, Osceola Co., FL
		3	S	Bohemia River, Cecil Co., MD
		3	W	Lake Kissimmee, Osceola Co., FL Dead: unknown cause, Osceola Co., FL
28108	M	1	S	Weiss Lake, Cherokee Co., AL Unknown: transmitter battery failure
28108B	M	1	S	Potomac River, Westmoreland Co. VA
		1	W	Manatee River, Manatee Co., FL
		2	S	Potomac River, Westmoreland Co. VA
		2	W	Lemon Bay, Sarasota Co., FL
		3	S	Falls Lake Reservoir, Wake Co., NC
		3	W	Lemon Bay, Sarasota Co., FL
		4	S	John H. Kerr Reservoir, Vance Co., NC
		4	W	Myakka River, Sarasota Co., FL
5	S	B. Everett Jordan Lake, Chatham Co. NC		

Appendix. G. Continued.

PTT	Sex	Age	Season	Location
28108B	M			Dead: unknown causes, Chatham Co., NC
28109	F	1	S	St. Croix River, Washington Co., ME Unknown: transmitter battery failure
28109B	M	1	S	Lake Harris, Lake Co., FL
		1	W	Manatee River, Manatee Co., FL
		2	S	Lake Harris, Lake Co., FL
		2	W	Manatee River, Manatee Co., FL
		3	S	no locations received
		3	W	Alafia River, Hillsborough Co., FL
		4	S	Lake Harris, Lake Co., FL
		4	W	Manatee River, Manatee Co., FL Unknown: transmitter battery failure
28110	F	1	S	Potomac River, Westmoreland Co. VA
		1	W	Econlockhatchee River, Orange Co., FL
		2	S	Potomac River, Westmoreland Co. VA
		2	W	Peace River, Sarasota Co., FL
		3	S	Lake Harris, Lake Co., FL
28110B	F	1	S	S. Branch Potomac River, Highland Co., VA
		1	W	Crews Lake, Pasco Co., FL
		2	S	S. Branch Potomac River, Highland Co., VA Unknown: PTT harness severed by eagle, found in Pendleton Co., WV
28111	M	1	S	n/a, few locations received before failure Unknown: transmitter battery failure
28112	F	1	S	n/a, transmitter failed with eagle in nest Unknown: transmitter battery failure
28112B	M	1	S	St. Lawrence River, Quebec, Canada
		1	W	Lake Tohopekaliga, Osceola Co., FL
		2	S	Lake Champlain, Addison Co., VT
		2	W	Lake Tohopekaliga, Osceola Co., FL
		3	S	St. Lawrence River, Quebec, Canada
		3	W	Lake Tohopekaliga, Osceola Co., FL
		4	S	St. Lawrence River, Quebec, Canada
		4	W	Econlockhatchee River, Orange Co., FL Unknown: transmitter battery failure
28113	F	1	S	John H. Kerr Reservoir, Mecklenburg Co., VA
		1	W	Lake Tohopekaliga, Osceola Co., FL
		2	S	Mirimichi River, New Brunswick, Canada
		2	W	Econlockhatchee River, Orange Co., FL
		3	S	St. John River, New Brunswick, Canada
		3	W	St. John's River, Seminole Co., FL
		4	S	St. John River, New Brunswick, Canada
		4	W	Spruce Creek, Volusia Co., FL Unknown: transmitter battery failure
28114	F	1	S	St. Lawrence River, Quebec, Canada
		1	W	Lake Okeechobee, Martin Co., FL
		2	S	St. Lawrence River, Quebec, Canada
		2	W	St. Lucie River, Martin Co., FL
		3	S	St. Lawrence River, Quebec, Canada

Appendix. G. Continued.

PTT	Sex	Age	Season	Location
28114	F	3	W	St. Lucie River, Martin Co., FL
		4	S	St. Lucie River, Martin Co., FL
				Dead: unknown cause, Martin Co., FL
28115	M	1	S	Lake Strom Thurmond, Lincoln Co., GA
		1	W	Manatee River, Manatee Co., FL
		2	S	Lake Strom Thurmond, Lincoln Co., GA
		2	W	Manatee River, Manatee Co., FL
		3	S	Lake Strom Thurmond, Lincoln Co., GA
			Unknown: transmitter battery failure	
28116	F	1	S	Lake Michigan, Emmet Co., MI
		1	W	Cypress Lake, Osceola Co., FL
		2	S	Lake Huron, Ontario, Canada
		2	W	Cypress Lake, Osceola Co., FL
28117	F	1	S	James River, Prince George Co., VA
		1	W	Anclote River, Pasco Co., FL
		2	S	John H. Kerr Reservoir, Mecklenburg Co., VA
		2	W	Lake Thonotosassa, Hillsborough Co., FL
		3	S	John H. Kerr Reservoir, Mecklenburg Co., VA
		3	W	Tampa Bay, Hillsborough Co., FL
			Unknown: transmitter battery failure	
28118	U	1	S	n/a, died in nest
				Dead: avian pox, Lee Co. FL
28118B	F	1	S	Roanoke Rapids Lake, Northampton Co., NC
		1	W	Charlotte Harbor, Charlotte Co., FL
		2	S	Roanoke Rapids Lake, Northampton Co., NC
		2	W	Charlotte Harbor, Charlotte Co., FL
		3	S	Roanoke Rapids Lake, Northampton Co., NC
		3	W	Lemon Bay, Sarasota Co., FL
		4	S	Lake Gaston, Mecklenburg Co., VA
		4	W	Peace River, Charlotte Co., FL
		5	S	Lake Gaston, Mecklenburg Co., VA
		5	W	Myakka River, Sarasota Co., FL
			Unknown: transmitter battery failure	
28119	M	1	S	Little PeeDee River, Marion Co., SC
		1	W	Myakka River, Sarasota Co., FL
		2	S	Lake Marion, Clarendon Co., SC
		2	W	Braden River, Manatee Co., FL
		3	S	Lake Marion, Clarendon Co., SC
		3	W	Braden River, Manatee Co., FL
			Dead: unknown cause, Manatee Co., FL	

^a PTT = platform terminal transmitter; satellite transmitter number used to identify each eagle

^b Age = year; 1 = hatch year (0-1 year old)

^c S= summer, W = winter