THE IMPACT OF TRANSLOCATION ON NUISANCE FLORIDA BLACK BEARS

By

KIMBERLY MAUREEN ANNIS

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Toto, I don't think we're in Kansas anymore.

—Dorothy on being translocated to Oz from Kansas by a tornado, *The Wizard of Oz*

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THE IMPACT OF TRANSLOCATION ON NUISANCE
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Kimberly Maureen Annis

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Despite the widespread use of translocation as a tool to eliminate nuisance bear behaviors and reduce human-wildlife conflicts, questions remain concerning the efficacy of the technique. The bear population centered in Florida's Ocala National Forest (ONF) is surrounded by several rapidly growing human communities and has the highest rate of human-bear conflicts and subsequent nuisance bear translocations in the state. The objective of this study was to determine the fate of translocated nuisance bears in Florida and to evaluate the effectiveness of removing nuisance bears from the area of human-bear conflict. I assessed the nuisance behaviors, movements, and survival of 41 translocated nuisance bears, surveyed 25 home and business owners where bears were removed, and evaluated the Florida Fish and Wildlife Conservation Commission's bear database for the reoccurrence of human-bear conflicts at the site of original conflict after bears were removed. Nearly half of all translocated bears engaged in a nuisance event at least once post-release and 34% engaged in nuisance events more than once. A higher percentage of males than females continued nuisance behaviors. Thirteen bears returned to capture sites and the average translocation distance of this group was shorter than those that did not return. An additional 32% remained within ONF and 37% left ONF, but did not return home. Annual survival estimates were lower for females than for males but were not significantly

different (P = 0.40). Survival estimates for males were comparable to those reported for resident bears in ONF. Nineteen survey respondents stated they continued to have bear conflicts within 1 year of a bear being removed from their property and 7 of these respondents had a conflict occur in less than a month. The database revealed that the FWC received a call complaining of another bear conflict within a year at 12 of the 25 capture locations. No one from the remaining 13 locations called the FWC to complain of future conflicts, however the survey revealed that they continued to have conflicts but did not report them to the FWC.

CHAPTER 1
INTRODUCTION

Vast tracts of land are required to maintain viable populations of large-bodied carnivores and expanses of non-fragmented landscape are needed to encompass even a single home range (Noss et al. 1996). Since the 1800s, human persecution coupled with the conversion of native habitat has resulted in the elimination of large carnivores throughout much of their former range (Mech 1995). In most of the United States, large carnivores continue to persist only in protected public lands or in areas with relatively little economic importance to humans. As human population densities continue to increase, the intense development of land resources has resulted in humans being in close proximity to remaining wildland areas and in close proximity to large carnivores, causing a recent rise in human-carnivore conflicts.

Translocation is the intentional capture and transport of a wild animal from one location to another and is utilized to introduce, reintroduce or augment wildlife into new or former ranges. Historically, translocation is used to introduce popular game species for hunting opportunities and more recently used to restore endangered and threatened species throughout North America (Conover 2002). However, translocating wildlife is expensive and is often unsuccessful (Griffith et al. 1989, Wolf et al. 1996, Fischer and Lindenmayer 2000). Translocated animals can experience high rates of post-release mortality (O'Bryan and McCullough 1985, Blanchard and Knight 1995), do not stay where released, or may attempt to return to former homes (Comly 1993, Sullivan et al. 2004, Bradley et al. 2005). Because of such complications, translocation is frequently subject to intense evaluation and public scrutiny, especially when used for imperiled species.

Wildlife residing in residential and suburban areas are a leading cause of human-wildlife conflicts in North America today (Conover 2002). In these areas, food resources, such as garbage, are often readily available to wildlife and are a source of negative human-wildlife interactions. Despite this conflict, there is little public tolerance for the lethal management of nuisance wildlife, especially for large carnivores; therefore, translocation is often used as an alternative. Translocation has been employed for at least 40 years as a standard method to remove problem animals from areas where human-wildlife conflicts occur (Linnell et al. 1997). The stressful and negative experience of capture and translocation is thought to cause the animal to avoid further contact with humans, and moving it to a new location is thought to prevent it from returning to the area of original conflict. The public perception of this technique is that the animal is moved to a more "natural" habitat and that it will "live happily ever after" (Craven et al. 1998). However, when human-derived food resources have contributed to the nuisance situation, simply removing an individual generally does not eliminate the problem (Linnell et al. 1997, Athreya 2006).

Fossil records indicate that American black bears (*Ursus americanus*) have been present in North America for approximately 3 million years and that they once ranged throughout all of North America (Kurten and Anderson 1980). Like most large-bodied carnivores, black bears also need large areas of land to maintain viable home ranges; however, the conversion of native habitat for human use and intensive, unregulated hunting resulted in the extirpation of many populations by the early 1900s. Uniquely, the black bear has an ability to live in close proximity to humans. As human developments proliferate in areas adjacent to remaining bear habitat human-bear conflicts have steadily increased and the deterrence of human-bear conflicts has recently become an important aspect of many state management agencies in the United States.

The Florida black bear (*U. a. floridanus*) is one of 3 recognized subspecies of the American black bear. Historically, it ranged throughout all of Florida and into southern portions of Mississippi, Alabama, and Georgia (Hall 1981). However, by the 1970s the Florida black bear had dwindled to an estimated 300–500 bears and were eliminated from approximately 83% of their former range (Wooding 1993). It was listed in 1974 as a state threatened species (Wooding 1993) and currently remains listed throughout Florida, with the exception of Columbia and Baker counties and the Apalachicola National Forest. Ecologically and aesthetically the Florida black bear is a major vertebrate component of Florida, being only one of two native large carnivores that remain in the state (Dobey et al. 2005).

There are 8 bear populations in Florida (Simek et al. 2005) (Figure 1–1). The Ocala bear population is one of the densest bear populations (McCown et al. 2004) and is also adjacent to some of the most rapidly growing human communities in the state (Simek et al. 2005). It far exceeds all other bear populations in the state in the number of public reports concerning bears submitted to the FWC (Figure 1–2) and number of annual nuisance bear translocations (Figure 1–3).

The success of using on-site releases with nuisance apiary-raiding bears in Florida has been well documented (Brady and Maehr 1982, Wooding et al. 1988), but there has been no documentation of the success in using translocation to eliminate future nuisance behaviors. In addition, there has been little data collected on previously translocated bears to determine their fate after release. Reviews of wildlife translocation studies concluded that translocation failed to suitably solve human-wildlife conflict issues, especially in bears (Linnell et al. 1997, Fischer and Lindenmayer 2000). In addition, Linnell et al. (1997) reported that using translocation to mitigate human-wildlife conflicts commonly lacked long-term goals. Given the common use of translocation in Florida and the lack of previous data, further examination of this management tool is certainly justified, especially for a threatened species such as the Florida black bear.

The purpose of this study was to investigate the impact of translocating nuisance Florida black bears and to evaluate the effectiveness of using translocation as a management tool to reduce nuisance bear problems at the area of original human-bear conflict. My objectives were to determine 1) whether translocated nuisance bears continued to engage in nuisance behaviors, 2) whether they returned home, 3) if they exhibited higher annual mortality rates than those of resident bears in the ONF, 4) whether the location of initial conflict continued to experience bear problems, 5) the attitudes about translocating nuisance bears, and 6) subsequent bear-conflict complaints at the site of initial conflict after a specific bear was captured and removed.

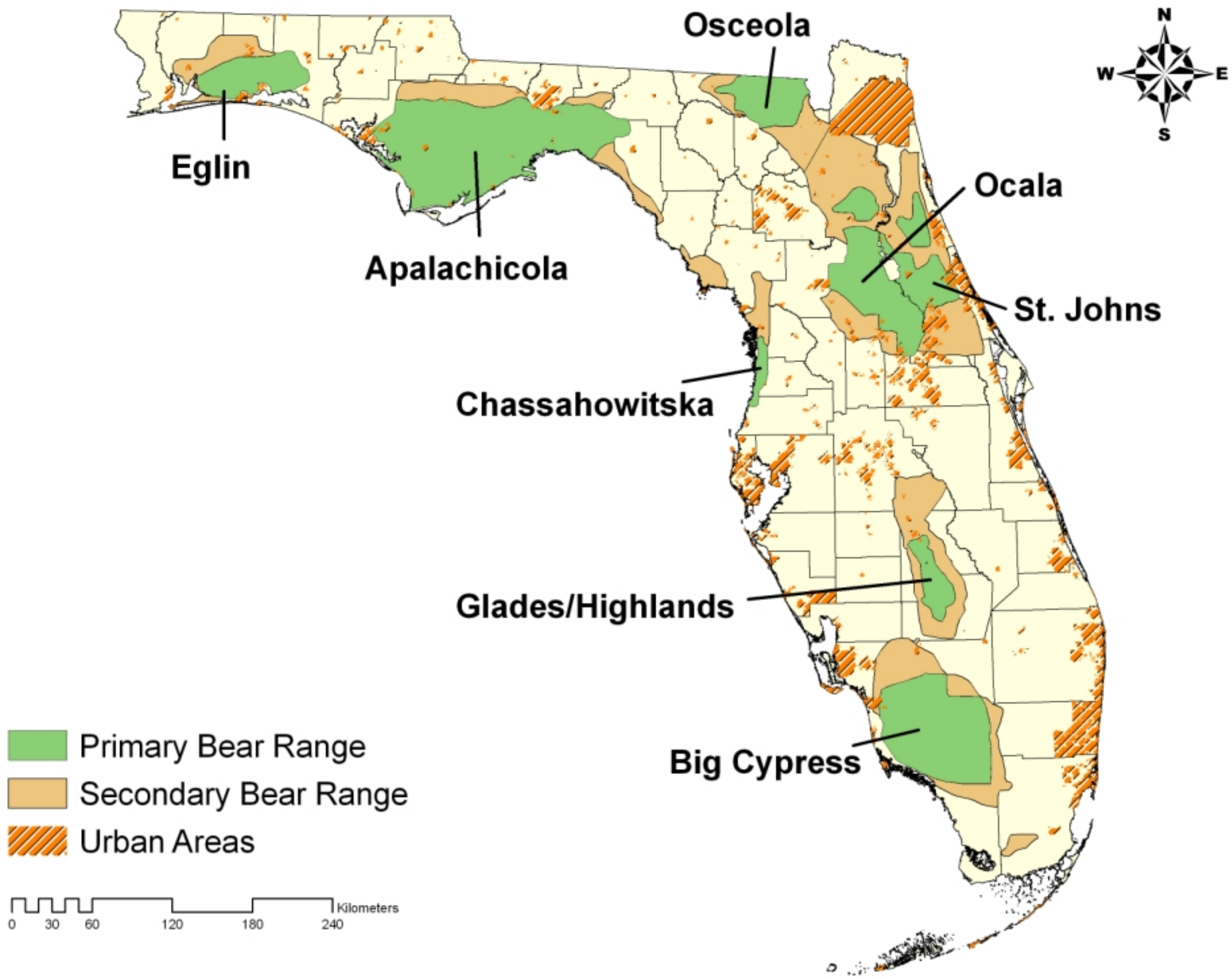

Figure 1–1. Florida black bear populations within Florida, as documented by the Florida Fish and Wildlife Conservation Commission (FWC) in 2005.

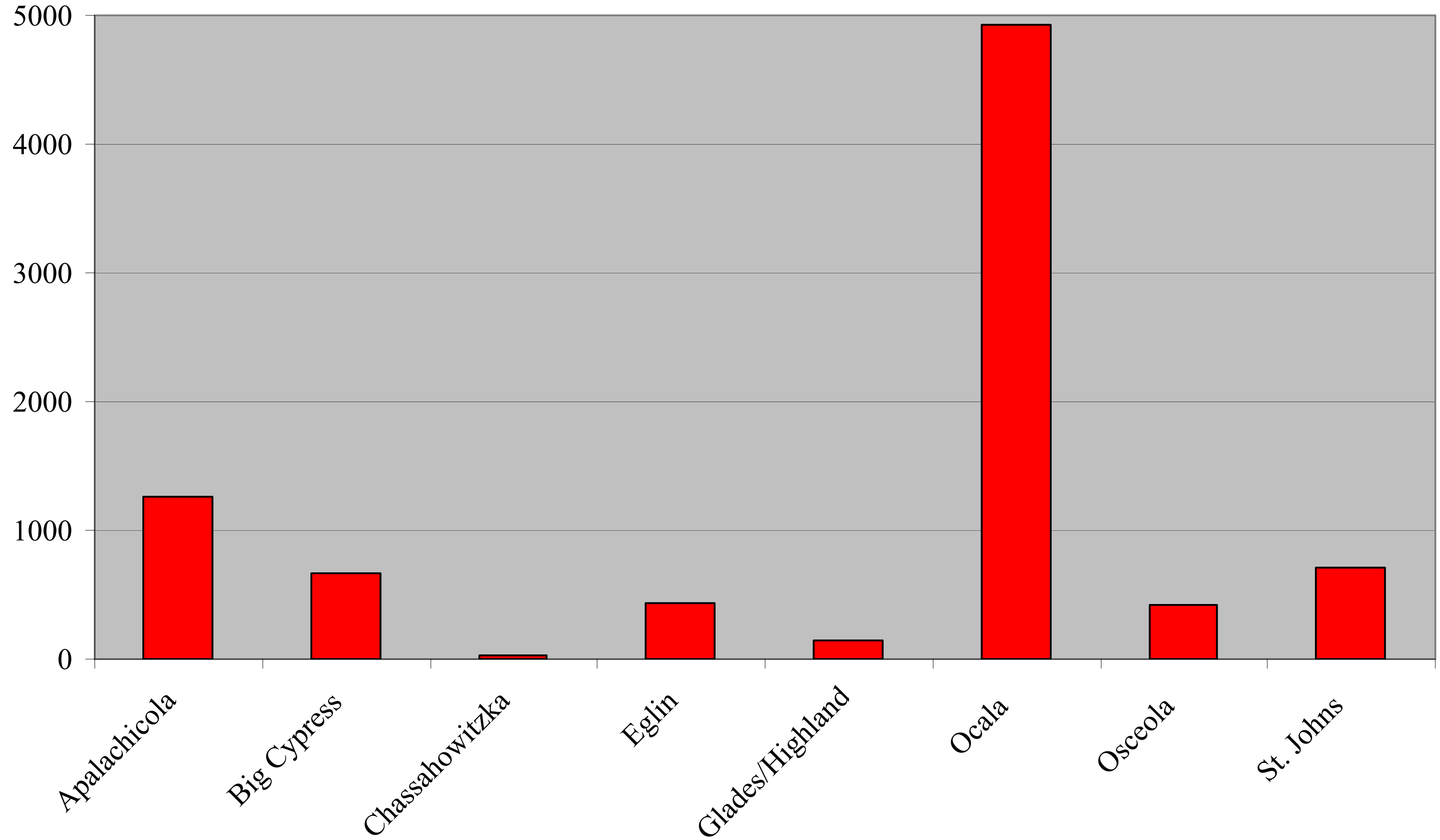

Figure 1–2. Number of bear related phone calls by population in Florida as reported by the Florida Fish and Wildlife Conservation Commission 1978–2006.

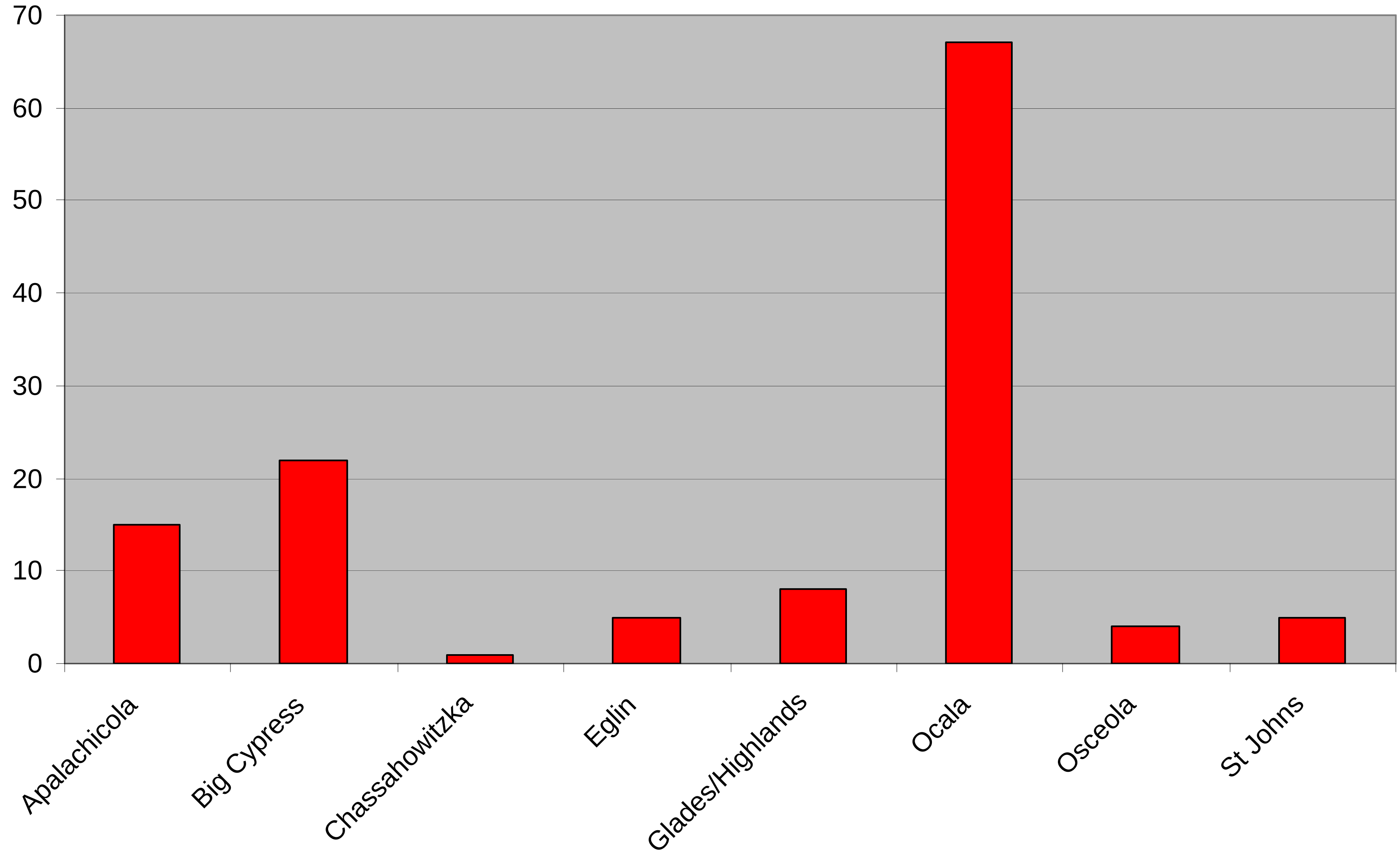

Figure 1–3. Numbers of bear translocations by population in Florida as reported by the Florida Fish and Wildlife Conservation Commission 1999–2004.

CHAPTER 2
STUDY AREA AND METHODS

Study Area

Nuisance bears were captured by the FWC in counties within peninsular Florida and translocated to the ONF for release. Capture locations were characterized primarily by concentrated areas of residential neighborhoods and suburban sprawl adjacent to large tracts of forested lands and occurred at both private residences and businesses. The ONF is located in north-central Florida along an ancient sand dune ridge bordered by the St. Johns River to the east and by the Ocklawaha River to the north and west (Figure 2–1). The 174,019 ha forest contains 4 major plant communities 1) swamps and marshes along the rivers, 2) pine flatwoods between the rivers and the central ridge, 3) dune-like interior ridge of sand pine (*Pinus clausa*) and scrub oak species (*Quercus sp.*) with ponds and seasonal wet prairies throughout, and 4) mixed hardwood swamps associated with large permanent lakes. The climate in north-central Florida is characterized by hot wet summers with abundant rainfall and cool dry winters. Annual precipitation averages 1364 mm with 55% of rainfall occurring from June-September of each year (Ayedelott et al. 1975).

Methods

Captures and Translocations

From 01 May 2004 to 31 December 2005 nuisance bears were live-trapped in culvert traps by agents of FWC's Nuisance Bear Response Program or by FWC biologists. A culvert trap is a large metal cylinder, approximately 2.2 meters long and one meter in diameter, with a drop door located at the entrance and a release device attached to a locking cable at the far end. Bears enter and take bait off a locking cable, which releases the door, trapping the animal inside. Culvert traps are trailer mounted for transport. An apiary-raiding bear was captured in an Aldrich springactivated foot snare set up next to a bee-yard after he would not enter a culvert trap. Bears that were in trees in urban areas were darted and removed from the tree. All bears were translocated to the ONF in culvert traps for handling.

The FWC policy that addresses the translocation of nuisance bears states that a captured bear may be relocated away from the capture site to bear habitat within the range of its population, or, if it is believed that the bear will continue nuisance behavior within the range of its population, it may be released within the range of a different population (Egbert 2001). Accordingly, the FWC also determined when a capture effort would take place. Bears entered the study when the FWC determined the captured bear would be translocated to the ONF for release. The FWC translocated all bears the farthest possible distance from their capture site while meeting 2 criteria: 1) bears were released in one of the 3 approved release locations within ONF, and 2) consecutive releases at the same location were avoided. To maintain continuity for this study, 3 specific sites with shade, cover and nearby water were chosen within the 3 FWC release locations (Figure 2–2).

Bears were immobilized with a 1:1 mixture of Tiletamine hydrochloride and Zolezepam hydrochloride (Telazol®) administered at approximately 4-6mg/kg of estimated body weight with a CO_2 charged low-impact dart pistol. Bears were fitted with radio-collar transmitters equipped with motion and mortality sensors (Telonics Inc., Mesa, Arizona). Untreated leather-breakaway connectors were used to secure each collar (Hellgren et al. 1988). Bears were uniquely marked with lip-tattoos and numbered red, round ear-tags for identification. These ear tags differed from the tags the FWC normally uses so the bear could be identified as a research animal from a distance. A premolar tooth was extracted for age estimation using cementum annuli analysis (Matson's Laboratory, Milltown, Montana, Willey 1974). All bears were handled according to the University of Florida protocol for the use of live vertebrates (Institutional Animal Care and Use Committee protocol # D653).

Monitoring

Instrumented bears were located 1 to 3 times per week from the air using a Cessna-172 aircraft equipped with wing-strut mounted 2-element yagi antennas, and by ground triangulation using a 3-element, hand-held, yagi antenna (Telonics Inc., Mesa, Arizona) and a Communications Systems Inc. receiver. Ground triangulations were made using $\geq$ 3 compass bearings obtained within a 30-minute interval to minimize location error as a result of a bear's movement. Ground locations were collected during both day and nighttime periods. I selected 17-hours as the minimum time interval between locations for biological independence among locations (Swihart et al. 1988). Aerial locations were collected on specific bears approximately once per week during daytime hours. However, extreme movements, severe weather and lack of funding often restricted aerial locations to 1–2 per month.

The total number of day's monitored post-release began with the first translocation for bears that were recaptured and retranslocated during the study. Recaptured bears, which remained in the study, were re-released at their original release site in the ONF. I used SAS (SAS Institute, Inc., Cary, N.C.) for all statistical analysis and all analysis significance was assessed at $\alpha = 0.05$.

Data Analysis

Nuisance Recidivism

Information on nuisance activities prior to capture was compiled for all bears entered into the study by using nuisance bear reports generated through the FWC bear database (a public record database used to document all public calls about bears throughout the state), and by interviewing homeowners, complainants, FWC Bear Response Programs Agents, and FWC biologists.

Once instrumented and released, bears that engaged in nuisance events were identified using 1) radio telemetry, 2) visual sightings and descriptive confirmation, and 3) FWC law enforcement officers and biologists. Nuisance events were recorded if the event could be verified as occurring within a known 24-hour time period and nuisance events that occurred in intervals ≥17 hours were included in the analysis. Nuisance behaviors were identified as 1) utilizing any human-food resource (i.e., household garbage, dumpsters, etc), 2) utilizing pet or wild-bird food, 3) causing apiary or other property damage, 4) entering, or the attempted entry of, a home, and 5) any show of aggression or territoriality within or around human dwellings, especially during daytime hours. Public sightings of radio-collared bears passing through residential or urban areas, or bears in trees that were not also associated with any of the above-described behaviors were not classified as nuisances but were recorded throughout the study.

Logistic regression was used to test the association between nuisance recidivism (yes or no) and sex (male or female), age class (sub-adult ≤ 3yrs old, adult > 3yrs old), weight (continuous, kg), distance of translocation, and month of translocation. Rogers (1986) indicated that a high percentage of black bears return to their capture area when translocated < 64 km. However, the relationship of nuisance recidivism and distance of translocation has not previously been studied. Therefore, I tested both continuous (i.e., total distance in km) and categorical (≤ 64 km or > 64 km) distances of translocation for analysis. Month of translocation was used to designate the season in which the translocation occurred, where months 1–4 represented winter, months 5–8 represented summer, and months 9–12 represented fall. Logistic regression was also used to estimate the probability of recidivism when 2 of the variables were combined. For example, combining age with sex would test if adult male bears were more likely to exhibit recidivism than sub-adult males, adult females or sub-adult females.

Returns and Movements

A translocated bear coming within 1 home-range diameter of the capture location, at any time during the study, was considered a successful return. In a study previously conducted on resident bears in the ONF, the reported annual home ranges for males and females were 94.3 km^2 and 20.48 km^2, respectively (McCown et al. 2004). Assuming home ranges were circular, a return was judged successful when a male bear was located within 11 km and a female bear was within 5 km of their capture site, at any time during the study. ArcGIS 9.0© was used to calculate the distance between 1) capture and release site, 2) release site and post-release locations, 3) capture site and post-release locations, 4) distance to capture site, and 5) total travel distance.

Similar to determining nuisance recidivism, logistic regression was used to test for differences in whether a return differed by sex, age class, weight, grouped distance of translocation, and month of translocation. It was also used to estimate the probability of a return when 2 of the variables were combined. For example, combining age with sex tested if adult female bears were more likely to return home than sub-adult females, adult males or sub-adult males.

Survival

Since the event of interest is the probability that death will occur following the treatment (i.e., translocation), I used the day of translocation as the starting date (i.e., day 1) for all bears, regardless of the calendar date they entered the study, and counted forward to the first day mortality was detected, the last day of location (if radio contact was lost or collar drop location), or 31 December 2006 if the animal was still in radio contact.

Annual survival rates were calculated using the Kaplan-Meier analysis, where a survival rate is estimated for each consecutive time period and then compared between samples across each period (Kaplan and Meier 1958). Because the analysis has no underlying assumption of constant survival, it allows for the addition of animals throughout the course of the study and permits animals with lost signals, or dropped collars, to be censored while still providing an unbiased estimate of survival. While the Kaplan-Meier analysis does not require animals to enter the study at the same time, newly radio-tagged animals are assumed to have the same survival function as animals previously radio-tagged during the study (Millspaugh and Marzluff 2001). The estimated annual survival rate of translocated bears was compared to that of resident bears radio-monitored in ONF from 1999 through 2003 (McCown et al. 2004). Estimates were calculated to compare differences in survival of translocated bears between sex, age class, grouped distance of translocation, and whether nuisances did or did not occur.

Nonparametric tests, log-rank or Tarone-Ware (Lawless 1982), were used to test the null hypothesis that survival curves of translocated bears would not differ between sex, age, distance of translocation, and nuisance recidivism. The log-rank test is commonly used to compare survival curves and is the most powerful test statistic when two hazard functions are proportional to each other. However, when survival curves cross the log-rank test may fail to detect a difference (Millspaugh and Marzluff 2001). In this case the Tarone-Ware test statistic has been shown to be more powerful at detecting differences than the log-rank test (Lawless 1982, Millspaugh and Marzluff 2001) and was used in cases where hazard functions were disproportionate.

I determined the cause-specific mortality of translocated bears. All deaths suspected of being illegal kills were investigated by FWC Law Enforcement. Carcasses were necropsied to determine cause of death if it was not otherwise obvious (e.g., vehicle collision) by the FWC state wildlife veterinarian at the FWC Wildlife Research Laboratory in Gainesville, Florida, or in the field where the carcass was discovered.

Survey

I conducted a telephone survey of homeowners and businesses who experienced bear conflicts resulting in the capture and translocation of a bear monitored during this study. An FWC bear database was used to obtain contact information that was collected during the initial complaint. Twelve open-ended questions were asked of all respondents to determine their perceptions regarding the effectiveness of using translocation to eliminate their specific nuisance bear problem (Table 2–1). The survey was created using the total design method (Dillman 1978) to ascertain the beliefs and behaviors of the interviewees based on their experiences with nuisance bears before, during, and 1 year after a bear(s) was captured and removed from their property. Surveys were conducted during April and May 2007 and ranged from 17 to 36 months after the specified bear(s) was removed. In addition, utilizing the FWC bear database, I quantified the number and types of complaints the FWC received from the capture location, and adjacent neighbors, prior to capture and for 1 year after a bear was captured and removed.

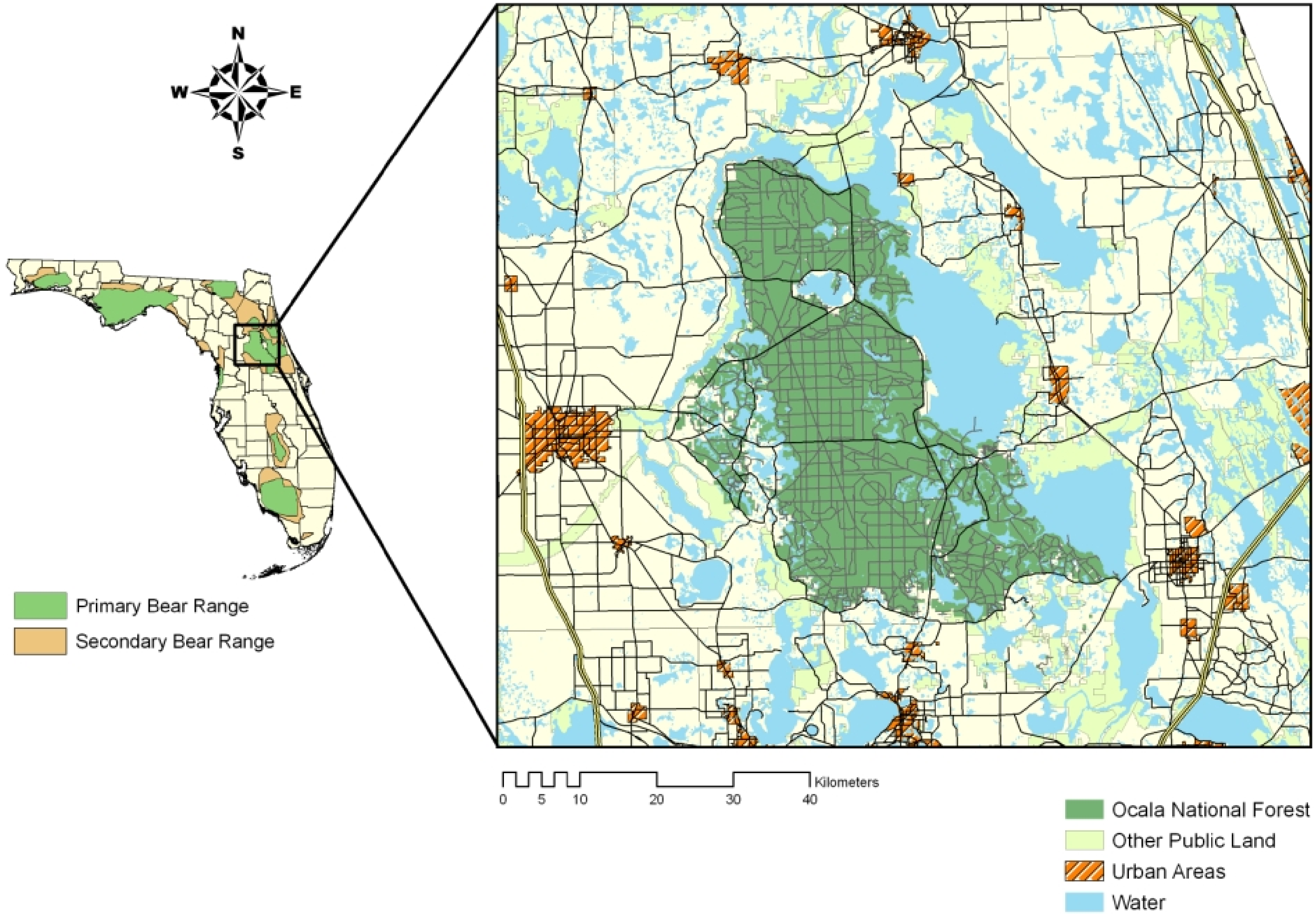

Figure 2–1. Location of the Ocala bear population centered in the Ocala National Forest in north-central Florida.

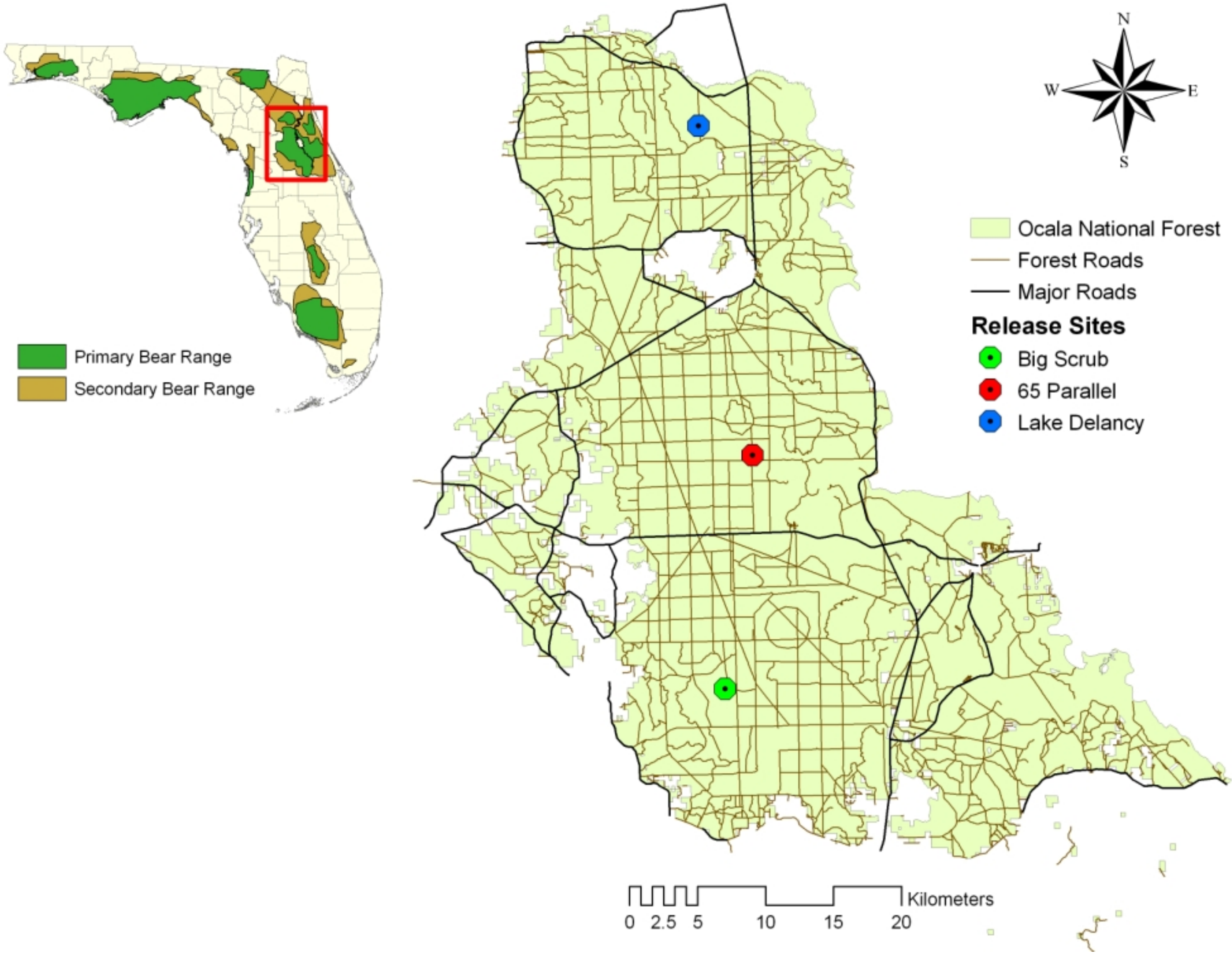

Figure 2–2. The 3 sites where translocated bears were released within the Ocala National Forest in north-central Florida May 2004–December 2005.

Table 2-1. Questions asked to survey respondents.

Order #	Question
1	If I could just jog your memory for a moment and ask if you can recall what bear problems you were having, prior to the FWC capturing and removing the bear.
2	At the time you were experiencing bear problems were you aware of your neighbors experiencing any problems?
3	When you contacted the FWC about the problem what kind of advice were you given?
4	Did you try and follow the advice the FWC gave?
5	Did you request that the bear be removed?
6	Do you feel that the FWC removed the correct bear?
7a	Did you continue to experience bear problems after the bear was removed?
7b	If so, were the bear problems you experienced similar to those before the bear was removed or were the problems different?
7c	How soon did your problems reoccur? 1 day 1 week 1 month 6 months 1 year
8	Are you aware of your neighbors experiencing any bear problems after the bear was removed?
9	Since (date bear was removed) do you continued to attempt to follow the advice that the FWC gave you?
10	Do you feel that the advice the FWC gave you solved your problem?
11	Do you feel that removing the bear solved your problem?
12	Aside from the type of assistance you have received from the FWC, can you think of anything else the FWC should do about nuisance bears?

CHAPTER 3
RESULTS

Forty-one bears (33 male [M], 8 female [F]) were captured (Table 3–1) and translocated to the ONF; 5 (4M, 1F) were recaptured and translocated to ONF a second time and 2 males were recaptured and translocated to the Apalachicola National Forest, removing them from the study (Table 3–2). Including recaptures, 48 captures occurred in 22 towns within 10 Florida counties (Figure 3–1); 36 bears were captured at private residences, 4 at businesses, 4 in trees within residential communities or urban areas, 3 in campgrounds (1 private and 1 public), and 1 at an apiary. Including recaptures, the number of capture locations was 31 private residences, 3 businesses, 4 trees, and 2 campgrounds.

The average age of bears was 4 years (range 1–15 years). In total, I collected 2,456 locations (mean 61 locations/bear, range 8–179 locations/bear) (Figure 3–2). Nuisance events and visual sightings comprised 138 of all locations. Bears were tracked for an average of 297 days (range 26–779 days). The median distance bears were translocated from their capture site was 56.11 km (mean 81.90, range 30.75–319.34 km).

Nuisance Recidivism

At the time of capture 12 different nuisance activities were identified (Table 3–2). Bears seeking food in household garbage was the primary nuisance activity that triggered complaints to the FWC, followed by bears in dumpsters, at bird feeders and entering screen porches. Nineteen bears engaged in more than one type of nuisance activity (e.g., household garbage and bird seed). Two male bears were captured from trees in residential areas, but had not engaged in nuisance activities at the capture location. Using nuisance histories at each capture location and homeowner’s description of the bears, 8 of the 41 captured bears (6M, 2F) were identified as incidental captures and were not believed to be the bears initially targeted by the FWC.

Ninety-six nuisance events were recorded post-release, but only 73 could be used in analysis. Of 96 nuisance events, the public reported 63 to the FWC. The remaining 33 events were either witnessed by myself, or a technician, or were reported directly to me by the public while I was in the vicinity of where the nuisance occurred.

Seventeen males and 2 females (46%) engaged in nuisance activities at least once post-release. Fourteen males (34%) engaged in nuisance activities more than once and 1 male was involved in more than 10 nuisance events. A higher percentage of males than females exhibited post-release nuisance behaviors (89% and 11%, respectively) with an equal distribution among sub-adults and adults (10 sub-adults, 9 adults). Three bears (2M, 1F) returned home and engaged in nuisance activities at least once and an additional male engaged in nuisances at least twice upon return. The median time to the first nuisance recidivism event was 143 days and ranged widely from 7-359 days. Feeding from household garbage remained the primary nuisance activity that bears engaged in post-translocation, with bird feeders a close second.

Seven bears (17%) were recaptured by the FWC due to continued nuisance behaviors. Three males and 1 female were recaptured at locations outside of the ONF and were translocated back to their original release site within the ONF. Two males were recaptured inside the ONF and translocated to the Apalachicola National Forest, removing them from the study. One male was recaptured inside the ONF and was euthanized due to his repeated attempts at home-entry.

Only 3 bears were translocated during the winter season and no nuisance events were recorded after their release. Since the sample size for winter translocations was small it made the test for seasonal affect questionable. The test remained questionable even when seasons were grouped in to 2 categories, fall and summer, shifting the months of translocation for winter bears into the nearest next season. Therefore the affect of season was removed for all remaining analysis.

In the first logistic regression analysis I used the distance of translocation as one of the predictor variables (i.e., continuous). However, distances of translocations were irregular and left large gaps between measurements. The distance of 64 km has been used as a benchmark for determining successful or unsuccessful translocations (Rogers 1986, Linnell et al. 1997, Conover 2002) based on whether or not a bear returned home. Since no previous nuisance studies have examined the effect of distance of translocation on nuisance recidivism, I chose to run a second logistic regression analysis using the 2 distance criteria of $\leq$ 64 km or > 64 km, to see if there were differences between categorical and continuous distance variables.

Males were more likely to engage in nuisances than females ($\chi^2 = 3.775$, df = 1, P = 0.05). Nuisance recidivism did not differ between age groups ($\chi^2 = 1.26$, df = 1, P = 0.26) but heavier bears ($\chi^2 = 4.15$, df = 1, P = 0.04) and bears translocated > 64 km ($\chi^2 = 5.67$, df = 1, P = 0.02) were more likely to engage in nuisances.

Returns and Movements

Thirteen bears (8M, 5F) (32%) returned to their capture area after release; females returned at a higher rate (63%) than males (24%). The average distance translocated for the bears that returned was 49 km (range = 31-80 km) and the time to return varied from 13-242 days. Bears that returned had a shorter average distance of translocation than those bears that did not return.

The probability of a bear returning home did not differ between age groups ($\chi^2 = 0.95$, df = 1, P = 0.32). Females were more likely to return home than males ($\chi^2 = 6.28$, df = 1, P = .01), heavier bears were less likely to return ($\chi^2 = 5.65$, df = 1, P = 0.02), and bears translocated $\leq$ 64 km were more likely to return ($\chi^2 = 7.51$, df = 1, P = 0.006). Data did not suggest that age group, weight or distance influenced the probability of a return for either a male or a female.

Of the 28 bears that did not return, 12 remained in ONF, 10 left, and 6 left but later returned to ONF. The average distance traveled by bears that did not return was 244 km, with 4 (3M, 1F) traveling between 517 and 872 km. Of the 4 bears recaptured and retranslocated to ONF, the 3 males remained within the ONF for the remainder of their monitoring period, but the female left the ONF within 9 days.

Survival

Eight bears (6M, 2F) died post-release and humans directly or indirectly caused 7 of these deaths (Table 3–5). This includes a male bear whose collar was found in a creek at a bridge crossing and is presumed to be dead. Although no carcass was found, I presume the bear was illegally killed due to the suspicious circumstances in which the collar was discovered.

The annual survival estimate for translocated males was 0.75 (95% CI: 0.52–0.88) and 0.80 for translocated females (95% CI: 0.20–0.97). There was no significant difference in annual survival estimates between sexes ($\chi^2 = 0.31$, df = 1, P = 0.57), age groups ($\chi2 = 0.41$, df = 1, P = 0.52), or nuisance recidivism ($\chi^2 = 0.51$, df = 1, P = 0.47). A significant difference in estimated survival was detected for distance of translocation ($\chi^2 = 4.84$, df = 1, P = 0.02). Bears that were translocated > 64 km had lower annual survival (0.45, 95% CI: 0.09–0.77) than those that were translocated $\leq$ 64 km (0.88, 95% CI: 0.59–0.97) (Figure 3–3.).

Annual survival estimates for resident males (0.76, 95% CI 0.48–1.00) (McCown et al. 2004) were similar to that of translocated males. Annual survival estimates for translocated females were somewhat lower than that of resident females (0.93 95% CI 0.835–1.00) (McCown et al. 2004), however differences may be due to the small sample size of translocated females.

Survey

Of the 40 locations where bears were captured or recaptured, 25 people were contacted by phone and agreed to be interviewed. Attempts were made to contact all locations, but 11 could not be contacted due to disconnected phones or because the person no longer lived at the address. At one business and one campground little was remembered about the specific conflict in question but the respondents were able to answer other parts of the survey as appropriate. There was no available contact information for one location where a bear was captured from a tree and a respondent could not recall any information at another location where a bear was also captured from a tree. The person listed in the FWC bear database as the primary complainant was interviewed in all but 3 cases. In these cases the spouse, son and employee, who were also involved in the specified nuisance event, were interviewed instead. Those respondents that were able to recall the specified nuisance situation and subsequent capture did so in detail and supported the information collected by the FWC at the time of the conflict.

Twenty-one respondents were aware of their neighbors having bear problems similar to their own at the time they called they FWC with a complaint. Prior to the FWC beginning a trapping effort 18 respondents stated that they tried to follow the advice the FWC gave them in response to their situation. Fourteen respondents stated that they specifically requested that the FWC remove the problem bear while 6 stated that the FWC removed the bear without being requested to do so. Twenty-one felt that the FWC removed the “correct” bear (i.e., the bear identified as causing the primary problem), but 19 stated that they continued to have problems even after the bear was removed. The immediate problem was solved for 10 respondents when a specific bear was removed, even though they continued to have conflicts after the removal.

In 5 cases the FWC reported that they did not capture the correct bear and made an effort to re-set the trap to catch the correct bear twice. Four homeowners felt that the FWC did not catch the correct bear; the FWC acknowledged this in one instance, but in no case was a trap reset. At 3 locations trapping efforts targeted multiple bears and efforts were made by the FWC to catch and remove all bears.

According to the records in the FWC bear database 12 of 25 respondents called the FWC back within 1 year to report another bear conflict. Seven locations reported having bear conflicts within 1 day to 1 month, 3 locations reported a conflict within 1 to 6 months, and 2 locations reported a conflict within 6 months to 1 year. Of the 13 that did not report another bear conflict, 7 stated that they continued to have bear conflicts even though they did not report them to the FWC.

Survey respondents were asked if they could identify something more that they would like the FWC to do about their bear conflicts. There was a variety of different answers, but 2 primary suggestions were that they wanted the FWC to respond more quickly to a bear conflict and that they would like help with preventing garbage from being available to bear throughout their neighborhood. Other responses included 1) taking homeowners bear problems more seriously, 2) less primary assistance provided by phone or through brochure mailings, 3) follow up with homeowners to ask if problems continued, 4) provide bear resistant trash cans, 5) provide assistance with changing to bear-resistant dumpsters, and 6) open a bear hunting season. Two respondents stated they would not call the FWC back if they have another bear conflict. One stated that she saw the FWC as “bear catchers” and that she would not “rat out” another bear. This was after she discovered that the bear removed from her property was later illegally killed.

Table 3–1. Initial capture and translocation data of nuisance Florida black bears moved to the Ocala National Forest from peninsular Florida May 2004–December 2005.

ID	Sex	Age	Date	Capture location	Distance moved (km)	Release location
N648	M	2	5/24/04	Sanford; business	49.98	Big Scrub
N649	M	3	5/25/04	Sanford; business	58.86	65 Parallel
N01	M	3	6/18/04	Clewiston; tree	285.37	65 Parallel
N26	M	3	8/1/04	Labelle; residence	255.82	Big Scrub
N02	F	3	8/23/04	Paisley; private campground	35.09	65 Parallel
N03	M	2	10/7/04	Longwood; business	83.60	Lake Delancey
N04	M	5	10/27/04	Apopka; residence	90.16	Lake Delancey
N05	M	2	11/11/04	Longwood; residence	64.45	65 Parallel
N06	M	2	11/15/04	Sanford; residence	50.08	Big Scrub
N07	F	2	12/14/04	Deland; residence	41.89	65 Parallel
N08	M	4	12/23/04	Longwood; residence	88.58	Lake Delancey
N10	M	4	1/8/05	Longwood; residence	52.08	Big Scrub
N11	M	3	3/15/05	ONF; public campground	30.75	Big Scrub
N12	M	5	4/22/05	Altoona; residence	50.88	Lake Delancey
N13	M	4	5/5/05	Umatilla; residence	56.99	Lake Delancey
N14	M	5	5/16/05	Paisley; residence	56.05	Lake Delancey
N15	M	2	6/28/05	Longwood; business	60.90	65 Parallel
N16	M	1	7/12/05	Winter Haven; tree	119.82	Big Scrub
N17	M	3	7/15/05	Bonita Springs; residence	319.34	65 Parallel
N19	M	4	7/21/05	Fort McCoy; residence	47.36	Big Scrub
N20	F	2	7/25/05	Bonita Springs; residence	319.24	65 Parallel
N21	F	3	8/21/05	Deland; residence	62.19	Lake Delancey
N22	M	1.5	8/26/05	Fort McCoy; residence	47.45	Big Scrub
N23	F	15	8/31/05	Paisley; residence	55.67	Lake Delancey
N24	M	4	9/9/05	Altoona; residence	47.40	Lake Delancey
N25	F	5	9/9/05	Sanford; residence	54.37	65 Parallel
N27	M	15	9/15/05	Eustis; residence	62.12	Lake Delancey
N28	M	7	9/17/05	Paisley; residence	33.97	65 Parallel
N29	F	9	9/24/05	Paisley; residence	55.73	Lake Delancey
N30	M	3	10/5/05	Deland; residence	41.31	65 Parallel
N31	M	3	10/12/05	Sorrento; residence	45.18	Big Scrub
N32	F	4	10/19/05	Longwood; residence	67.93	65 Parallel
N33	M	5	11/1/05	Apopka; residence	80.15	Lake Delancey
N34	M	15	11/5/05	Deland; residence	41.31	65 Parallel
N35	M	1	12/1/05	Debary; residence	46.98	Big Scrub
N36	M	4	12/6/05	Longwood; residence	67.39	New 65 Parallel
N37	M	2	12/7/05	Longwood; residence	54.65	Big Scrub
N38	M	5	12/15/05	Longwood; residence	90.68	Lake Delancey
N39	M	6	12/16/05	Longwood; residence	66.75	New 65 Parallel
N40	M	3	12/22/05	Longwood; residence	54.10	Big Scrub
N41	M	3	12/23/05	Longwood; residence	66.75	New 65 Parallel

Table 3–2. Recapture and retranslocation data of nuisance Florida black bears captured a second time during the study May 2004–December 2006.

ID	Sex	Age	Date	Capture location	Distance moved	Release location
N01	M	3	3/17/05	ONF; public campground	NA*	ANF Mud Swamp
N05	M	2	11/16/05	Ocklawaha; residence	45.41	Lake Delancey
N16	M	2	8/17/05	Jacksonville; residence	128.77	Big Scrub
N20	F	2	3/2/06	Daytona Beach; tree	69.97	65 Parallel
N26	M	3	11/1/04	Silver Springs; residence	0	none**
N36	M	4	6/16/06	Green Cove Springs; tree	84.71	65 Parallel
N37	M	2	3/10/06	Altoona; residence	NA	ANF Mud Swamp

*NA = not applicable; bears were translocated to Apalachicola National Forest and removed from the study.

**Bear was euthanized after capture

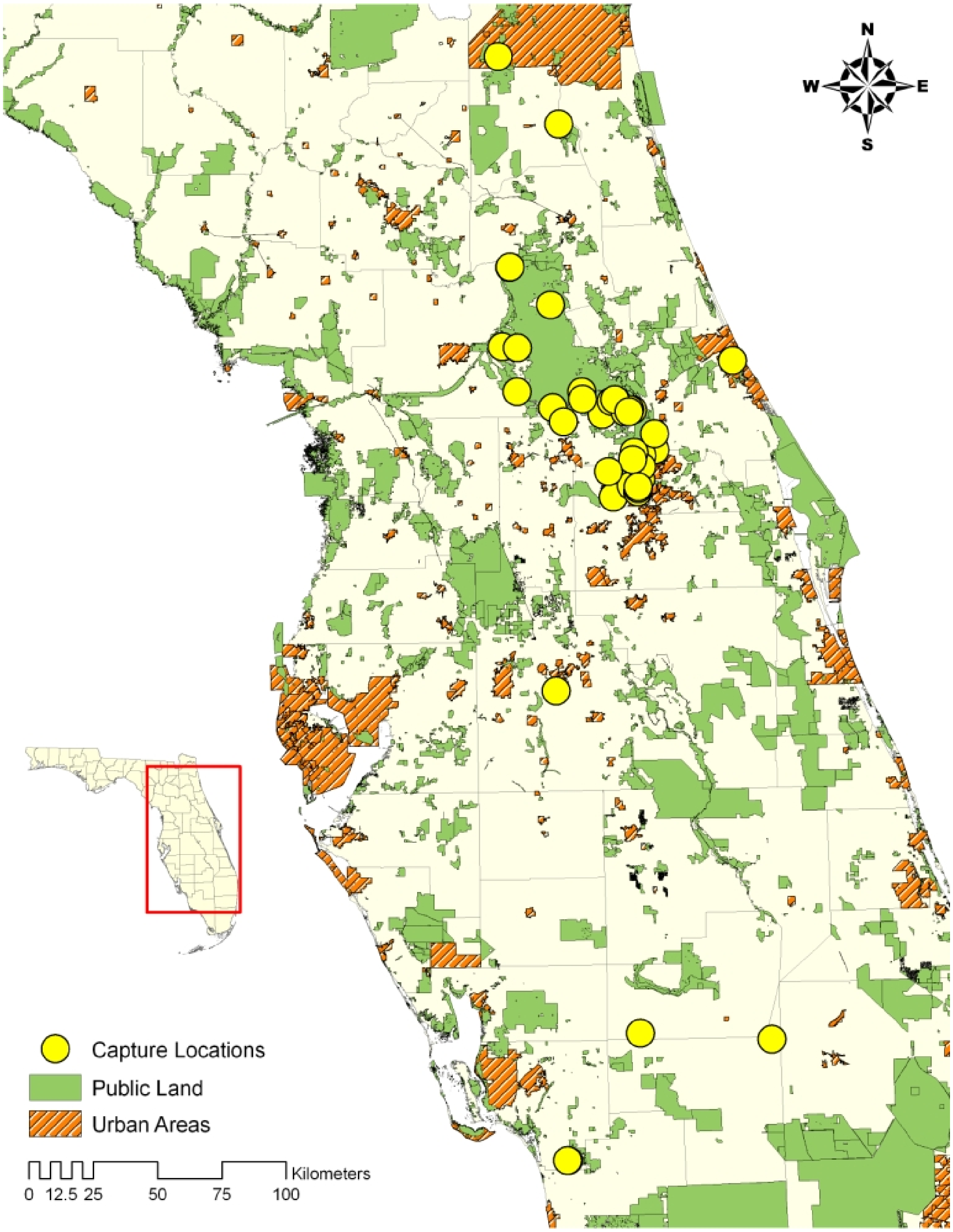

Figure 3–1. Capture locations of nuisance Florida black bears in peninsular Florida translocated to the Ocala National Forest May 2004–December 2005 and of subsequent recaptures May 2004–December 2007.

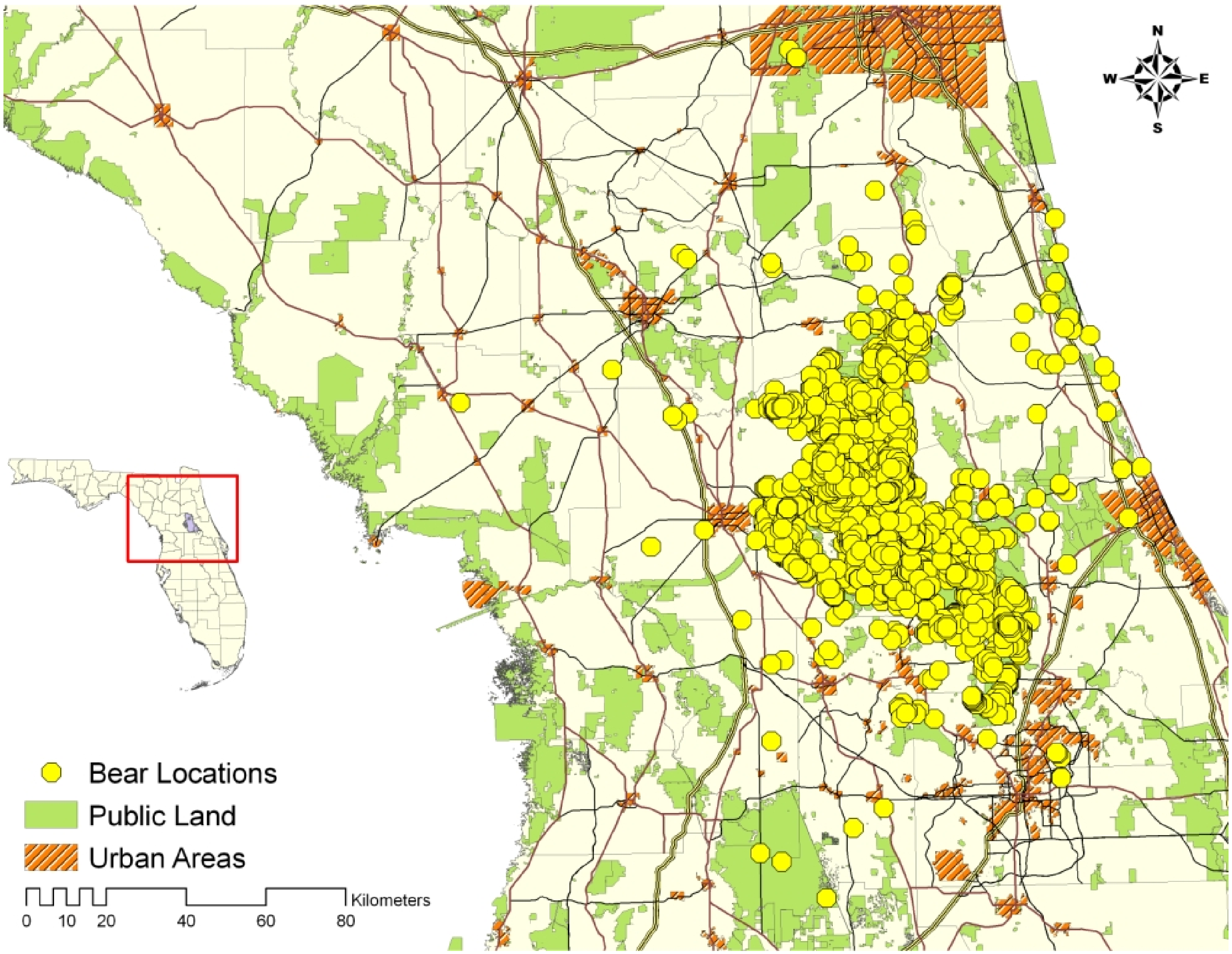

Figure 3–2. All locations of translocated nuisance bears post-release in Florida May 2004–December 2006.

Table 3–3. Types of nuisance activities bears engaged in before and after translocation to the Ocala National Forest.

Nuisance Activity	Pre Translocation	Post Translocation
Dumpster	5	1
Household garbage	20	14
In campground	1	2
Bird feeder	4	7
Pet food	3	3
Killed livestock	1	1
Apiary damage	1	0
Attempted home entry	0	1
On screened porch	4	1
Shed/garage damage	3	0
Fence damage	3	0
Digging in yard	2	2
In a tree	2	2

Table 3–4. Causes of mortality for translocated nuisance black bears in north-central Florida May 2004–December 2006.

Bear	Sex	Age	Capture	Death	Cause	Location
N20	F	2	7/25/05	7/23/06	HBC[a]	Outside ONF, I-95 Palm Coast, FL
N23	F	15	8/31/05	10/5/06	Natural	Outside ONF, Paisley, FL
N26	M	3*	8/1/04	11/1/04	Euthanized	Inside ONF, Lynne, FL
N08	M	4	12/24/04	1/19/05	Illegal/unk[b]	Outside ONF, Blackwater Creek/SR-44
N15	M	2	6/29/05	12/5/05	Illegal/Shot	Outside ONF, Eustis, FL
N27	M	15	9/15/05	8/17/06	Wildfire	Inside ONF, Juniper Prairie W.A.
N38	M	5	12/15/05	6/9/06	HBC	Outside ONF, SR-20 Palatka, FL
N39	M	6	12/17/05	7/2/06	Illegal/Shot	Outside ONF, Bostwick, FL

*Age estimated

[a] HBC = Hit By Car

[b] Method unknown, collar found dumped in creek at bridge crossing

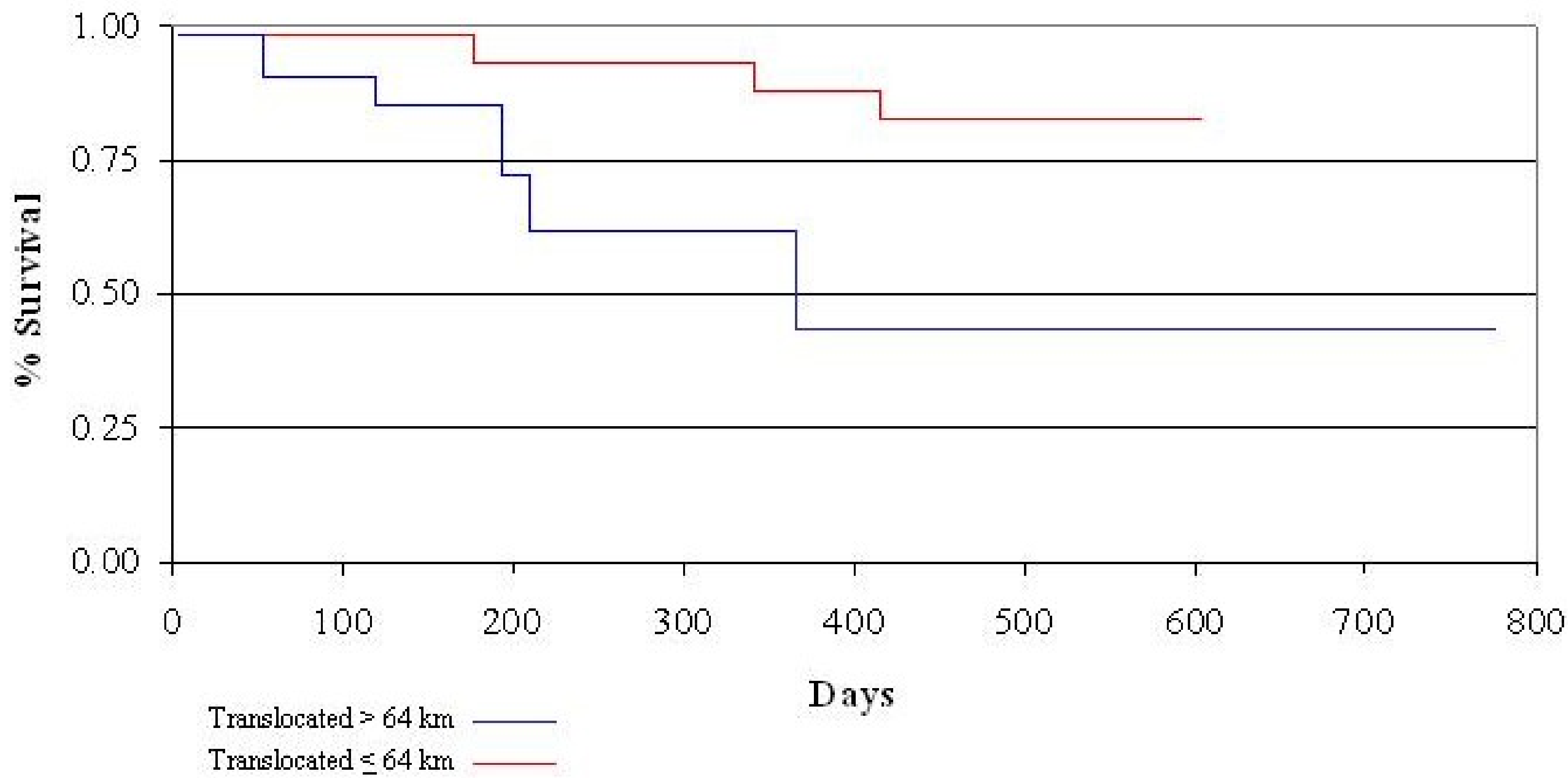

Figure 3–3. Annual survival curve estimate for nuisance bears translocated to the Ocala National Forest in Florida > 64 km (black) and ≤ 64 km (red) May 2005–December 2006.

CHAPTER 4
DISCUSSION

Nuisance Recidivism

The percentage of translocated bears that continued to engage in nuisance behaviors (46%) was considerably higher that those reported in other studies (Conover 2002). However, those studies used recipient sites where the potential for continued human-bear interaction was low (i.e., released in highly remote locations) (Linnell et al. 1997, Conover 2002), so their lower rates of recidivism was possibly related more to the reduced potential for conflict in the release area and less with the possible effect of the translocation procedure. Linnell et al. (1997) found that bears released in areas with a higher potential for human-conflict, as characterized by the ONF for this study, often caused more conflict after release. The percent of recaptures as a result of nuisance behavior (17%) observed in this study was similar to the results of other studies (McLaughlin et al. 1981, cited by Rogers 1986).

The relationship between continued nuisance behaviors and the sex of the bear remained significant throughout all analyses. Considering that 89% of all bears that engaged in nuisance activities post-translocation were males, this relationship was not unexpected. It has been well documented that males predominate among bears captured as nuisances (McLean and Pelton 1990, Clark et al. 2002, Beckman and Berger 2003). Males also predominated among nuisance bears captured during this study and in previously captured nuisance bears throughout Florida. The lack of significance of age may be due to the equal distribution of sub-adult and adult bears that engaged in nuisance activities post-translocation.

There was considerable difference in the results comparing the 2 distance variables. This is possibly due to the wide range of the actual distances of translocation (30–319 km) and the uneven distribution of those distances. Grouping distances resulted in the increased significance of weight and distance. The mean weight of male bears in this study was greater than the mean weight of ONF resident males (McCown et al. 2004). Bears that utilize human-food can be significantly heavier than those bears that do not (Beckman and Berger 2003), and the longer they utilize these resources the heavier they become. This increases the likelihood they are food-conditioned (i.e., dependent on a particular non-natural food source) to human-food resources and may be more likely to seek out these resources even after translocation occurs (Conover 2002). In addition, bears that are heavy as a result of eating artificial foods may reach a weight threshold that requires the bear to continue to eat artificial foods in order to be maintained.

The probability that bears translocated farther than 64 km were more likely to continue nuisance activities was an unanticipated result. The FWC resorts to the translocation of nuisance bears only as a final management option; therefore the bears that were translocated may have already been food-conditioned and/or habituated (i.e., unperturbed in the presence of nearby humans). As the distance of translocation is increased it decreases the likelihood that a bear will be able to return home. This may result in an increased wandering or searching behavior and a higher likelihood that they will encounter humans and human food-resources.

Marking each translocated bear probably increased the probability that the public would report nuisances to the FWC. It is reasonable to assume that nuisance activities occurred when there was no witness, witnesses overlooked identifying marks (e.g., ear tags, radio collar, etc.), or witnesses did not report the event. Therefore, I was only able to document a fraction of all probably nuisances, and of those, only 65% were reported to the FWC by the public. It suggests that the amount of nuisance recidivism detected in this study is almost certainly underestimated.

Returns and Movements

The desired objective of translocation is that bears would remain within ONF boundaries; therefore the return of nuisance bears to their capture area was considered an undesirable outcome. Studies of translocated nuisance bears show that few remain close to their release sites and often move long distances post-release (Rogers 1986, Comly 1993, Linnell et al. 1997). Rogers (1986) suggested that the success of translocation depended largely on the age of the bear and the distance it was moved; sub-adults were more likely to remain at the release site than were adults and the optimum translocation distance to ensure <50% of bears from returning was >64 km. However, despite a median translocation distance of 56.11 km in this study, < 50% of bears returned. This may partially explain the significance of translocation distance to the probability of return. Few bears (4 of 13) that returned were recorded engaging in a nuisance event, suggesting that translocation may have been successful in reducing the probability of recidivism in those individuals. However, it is also possible that recidivism was simply not detected or that the public did not report nuisance incidences to the FWC.

The relationship between bears that returned home and the sex of the bear was significant when compared against all other variable combinations. Female bears returned at a higher probability than expected. While the small sample size of translocated females compared to translocated males may be a factor, few nuisance females are captured and translocated to the ONF each year. Therefore the small sample size and rate of return may be representative of the area.

Previous studies indicated that translocated sub-adults were less likely to return home when translocated greater than 64 km (Rogers 1986). However the median translocation distance of sub-adults and adults were equal (56 km) and less than the recommended translocation distance. Therefore the even distribution of sub-adult and adult bears that returned home is not unusual and may describe the lack of significance of age in the analysis.

Release site selection is considered an important factor affecting translocation success (Griffith et al. 1989, Bradley et al. 2005). The FWC uses ONF as the recipient site for bears translocated from central Florida. However, bears captured a second time may be translocated to a different population (Egbert 2001). Using these as the primary criteria in determining an acceptable release site gives no consideration to population density, the extent of available habitat, or to previously translocated bears. High population density and competition for food and space may make it difficult for a newly translocated bear to remain where it was released. My data show that less than a third of translocated bears remained in ONF. While sex, weight and translocation distance play a role in determining site-fidelity, it is worth considering that population density and subsequent habitat availability may also be a factor affecting site-fidelity.

Survival

Translocated bears had similar survival estimates to that of resident bears, which suggest that translocation did not increase mortality from natural causes. Although there was a slight difference in annual survival between translocated and resident females, this difference may be due to the small sample size of translocated females.

Previous studies have suggested that translocating sub-adult bears may simulate dispersal (Rogers 1986, Comly 1993, Linnell et al. 1997, Conover 2002) and sub-adults may exhibit higher site-fidelity to their release area than adults (Rogers 1986). This high site-fidelity may reduce the probability that their movements will bring them into contact with humans, thereby reducing human-caused mortality. Therefore the lack of significance in mortality based on age group was unanticipated. However, considering the considerable amount of human-disturbance in the ONF the probability that all bears, regardless of age class, will encounter humans may be greater than within other the bear populations in Florida (i.e., Apalachicola and Big Cypress National Forests), which are more remote.

A lower estimated survival was detected for bears translocated > 64 km, which represents less than a third of all translocated bears. Extensive movements by bears across the fragmented landscape of central Florida increases the risk of mortality largely through increased exposure to roads and interactions with humans (Rogers 1986, Comly 1993, Linnell et al. 1997). Translocating bears great enough distances to reduce their likelihood of returning home may result in extensive wandering and increases the probability that they will encounter humans and roadways.

I lost contact with 1 adult male during the study. It is possible his collar failed during the study, however, considering his well-documented nuisance history post-translocation (he was a persistent chicken killer and had been shot in the face) the possibility exists that he was illegally killed and his collar destroyed. This scenario was documented when the collar of an illegally killed sub-adult male was destroyed. Additionally, a sub-adult female's collar was destroyed by the vehicle that killed her. Had the illegal kill not been witnessed and reported to law enforcement, and had a road-cleanup crew not discovered the remains of the female's collar, the fate of these 2 bears would have also remained unknown.

Survey

An important part of determining the success of translocating nuisance bears is whether moving bears eliminated the problem at the location of initial conflict. More than 75% of survey respondents stated that they continued to have conflicts with bears even after a bear was removed from their property. The FWC bear database indicated that less than half of all locations where bears were removed reported additional conflicts within a year; however, interviews with residents revealed that 73% experienced additional conflicts within a year. Based on these results it appears that removing bears did not drastically eliminate subsequent conflicts with bears at the capture site.

Forty percent of those surveyed believed that removing the specified bear solved their immediate problem. However, they also stated they continued to have bear conflicts within a year after removal. While this may seem contradictory, some respondents may have attributed an explicit nuisance situation to a specific bear, which they felt had been captured and removed, while others may have attributed conflicts to any bears in the area.

Educating those that have human-bear conflicts is done by the FWC during initial complaints and when the FWC conducts site visits to determine the nature and severity of the conflict. The extent to which these educational efforts by the FWC have worked is difficult to measure. More than half of all those surveyed stated that they tried to follow FWC advice on securing bear attractants (e.g., securing household garbage in building) before, or during, a capture attempt took place. However, since the FWC normally captures bears as a last resort, remedial measures by the public may not be sufficient if the problem bear has had sufficient time to become food conditioned or habituated. Complainants that wait until the bear problem is intolerable before contacting the FWC often exacerbate this situation.

There were 8 identified incidental captures and in 2 of those cases the FWC reset a trap and captured the targeted bear. The trap was reset in one case because the homeowner complained they didn't catch the "right bear" and in the other case to catch a specific ear-tagged bear. However, homeowners complained in 2 additional cases the "right bear" was not caught and in a seperate case a specific ear-tagged individual was targeted but not captured (a non-ear-tagged bear was captured instead). The FWC did not reset traps in any of these 3 cases, creating confusion in the public's perception of the FWC's attempts to provide a remedy for the conflict.

CHAPTER 5
CONCLUSION AND MANAGEMENT RECOMMENDATIONS

Data on the fate of translocated nuisance bears are important for the management of Florida black bears. Additionally, information regarding the efficacy of translocation as a management tool to reduce or eliminate problem bear behaviors at the location of conflict is paramount for the long-term prevention or mitigation of human-bear conflicts. Through this 3-year study I have provided data on nuisance recidivism, movements, and survival on translocated nuisance bears, and have interviewed complainants to assess their perceptions of FWC actions.

Determining the extent to which translocated nuisance bears resume their nuisance behaviors is imperative when evaluating the efficacy of relocation (Linnell et al. 1997). However, identifying a free-roaming ear-tagged bear is difficult and without other identifying characteristics (e.g., radio collar, prominent chest blaze, etc.) it is challenging to tell one ear-tagged bear from another. Collaring each translocated bear probably increased the identification of those that engaged in nuisances and the rate at which nuisances were reported. However, data suggest that recidivism events were underreported. Therefore recidivism may be notably higher that was detected during this study.

Translocation was not always successful at eliminating nuisances. Clark et al. (2002) found that the modification of nuisance behaviors was most affective when performed on bears captured early in their progression towards nuisance behaviors. In Florida, nuisance bears are translocated only as a final management option; therefore by the time they are captured they may have already become food-conditioned and/or habituated. Moving them just transferred the problem to a new area and contributed to the high percentage of nuisance recidivism and of subsequent recaptures. Translocating bears before they become food-conditioned or habituated may decrease future recidivism events. For bears that are already food-conditioned or habituated, employing other management tools, such as aversive conditioning techniques or lethal management, may increase the success of eliminating subsequent nuisances.

Data suggest that a bear translocated greater than 64 km had a higher probability of mortality and Rogers (1986) found that moving a bear this distance decreases the likelihood that the individual will return to the capture location. When determining the distance a nuisance bear will be moved, both of these factors should be considered and the preferred outcome, the probability of mortality or return, should be chosen by the managing agency before each individual is moved. In addition, if the preferred outcome is also that the translocated individual remains in the release area, population density and habitat availability should be considered when choosing a release site in order to improve release site-fidelity.

The FWC bear database suggests that human-bear conflicts continued at the site of original conflict even after a nuisance bear was removed. In addition, most people surveyed stated that they did not believe that removing bears solved subsequent nuisance bear conflicts. Removing bears did not clearly prevent subsequent problems with bears. However, it is not clear if the real issue is the continuation of artificial food being provided for bears in the area of initial complaint. If so, the problem may be that the people in that area continually create problem bears. Considering that the sample size of people and conflict locations surveyed was small, a larger comprehensive study to determine the public's perceptions of nuisance bears in areas of high human-bear conflict in Florida should be conducted. It could provide valuable information on the beliefs and attitudes of people living in high bear-conflict areas and could influence the implementation of alternative human-bear conflict management and education strategies.

The public view that bears can be moved to a place where they cannot get back into trouble is not a realistic one. Today, there are precious few places in Florida where bears can be translocated without the likelihood of further human interaction. Recent increases in human-bear conflicts in Florida have resulted in an increase in translocated nuisance bears. Considering the mediocre success of using translocation to eliminate further nuisance behaviors, efforts may be better focused on community education and outreach, and other non-lethal management efforts, to eliminate nuisance behaviors at the site of conflict. Educational programs targeted at changing human behavior would not only be useful at reducing human-bear conflicts, but would also help promote the coexistence of bears near communities in the long term. In addition, the creation of regulations implementing the widespread use of bear-resistant garbage bins in areas where conflicts are likely to occur can cultivate the proper storage of bear attractants. Where conflicts are unavoidable, and non-lethal tools are not available, management agencies need to educate the public to accept that lethal control may be a necessity. In this way public focus can be shifted from managing the individual to the management of a whole population (Linnell et al. 1997).

As the human population in Florida continues to increase, habitat fragmentation and reduction are increasing human-bear interactions throughout the state, and long-term solutions should be sought to prevent interactions from turning into conflicts. Long-term solutions can foster public support for bears and significantly contribute to bear conservation and management in the state.

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BIOGRAPHICAL SKETCH

Kimberly Maureen Annis was born on 15 June 1974 in Pittsford, New York. Until the age of 11, she grew up in a lively neighborhood full of adventures and fun, after which she moved with her family to West Bloomfield, Michigan. As a present for her 11th birthday, she received horseback riding lessons and has firmly immersed herself in the world of equines ever since. After graduating from West Bloomfield High School in 1992, she again moved with her parents back to New York. She received her Associate of Arts degree at Monroe Community College in 1997. After discovering a passion for wildlife, she enrolled at the State University of New York College of Environmental Science and Forestry in 1997 and received her Bachelor of Science degree in environmental and forest biology in 2000. After traveling the country to gain experience working in the wildlife field, she came to Florida in 2002 to work for the Florida Fish and Wildlife Conservation Commission as a field biologist studying the Florida black bear. In 2004, she began her graduate work with the Department of Wildlife Ecology and Conservation at the University of Florida. Throughout her graduate career, she continued to work with the Florida Fish and Wildlife Conservation Commission and was fortunate to learn and benefit from the many exceptional biologists with whom she worked. She received her Master of Science degree in wildlife ecology and conservation in December 2007. She currently lives in Libby, Montana, where she works for the Montana Fish, Wildlife & Parks division of wildlife managing grizzly and black bears in the Cabinet-Yaak Ecosystem.