FEASIBILITY OF RESTORING THE LOUISIANA BLACK BEAR (*URSUS AMERICANUS LUTEOLUS*) TO PORTIONS OF THEIR HISTORIC RANGE

A Thesis

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by
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DEDICATION

This work is dedicated to my wife, Kate. Without her support, tolerance, and inspiration I could never have made it this far, and the fact that she was expecting our first child the same week I planned on defending inspired me to spend long nights in the lab writing. I now look forward to spending those evenings at home.

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Finally and most affectionately I have to thank my wife Kate. Without her prompting and approval I never would have applied for this position. She put up with more than most women would have and more than she really should have. I don't know how she survived the 5 months alone in Kansas before I could move her to Baton Rouge, but she did it with a smile. After breaking down on our trip here, a tropical storm, money issues, car issues, dog issues, bear issues and the goat on our back porch all occurring the first month that you arrived; I'm surprised you didn't leave. You stayed and although the ride has been rough, we survived. As I write this our son, Mitchell is expected within weeks of my defense. Hopefully he will cooperate and we will not choose the same day, the fact that he kicks me whenever he gets the chance is probably not a good sign. Nevertheless, his arrival is still a joyous occasion, and gives us a chance to put all things in perspective.

They say that you are not supposed to take on more than 1 life changing decision at a time, but they also say that you are not supposed to make important decisions with rock-paper-scissors, and that is how I got down here and that appears to have worked out well.

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ABSTRACT

Black bears (*Ursus americanus*) historically occurred throughout much of North America's forested landscapes, but loss of critical habitat and overharvest significantly reduced abundance and distribution. In the southeastern United States, black bear conservation has become a high priority and restoration has been suggested y to recolonize suitable habitat. My study focused on evaluating restoration of the Louisiana black bear (*U. americanus luteolus*) to the Red River Complex (RRC) in east-central Louisiana. This involved translocating female bears with new born cubs from source populations within Louisiana and monitoring their movements, habitat use, and social acceptance of the restoration program to determine if restoration attempts should be continued. Females relocated using this method had restricted home ranges and movements during the initial 30-days following release, and established home ranges at the release site within 7 months. Females continued to den in the area they established home ranges through the following 2 winters. Vegetation measurements at used locations suggest that habitat suitability in the RRC similar to other areas considered highly suitable for bears in the Southeast. A survey of hunters within the RRC indicates that support for the project was high (> 70%) but knowledge about the restoration was low (< 60%), although public meetings were held prior to the release of bears to the area. This data indicates that restoration of the Louisiana black bear to the RRC is feasible and should be continued in an effort to establish a new breeding sub-population of bears in the region.

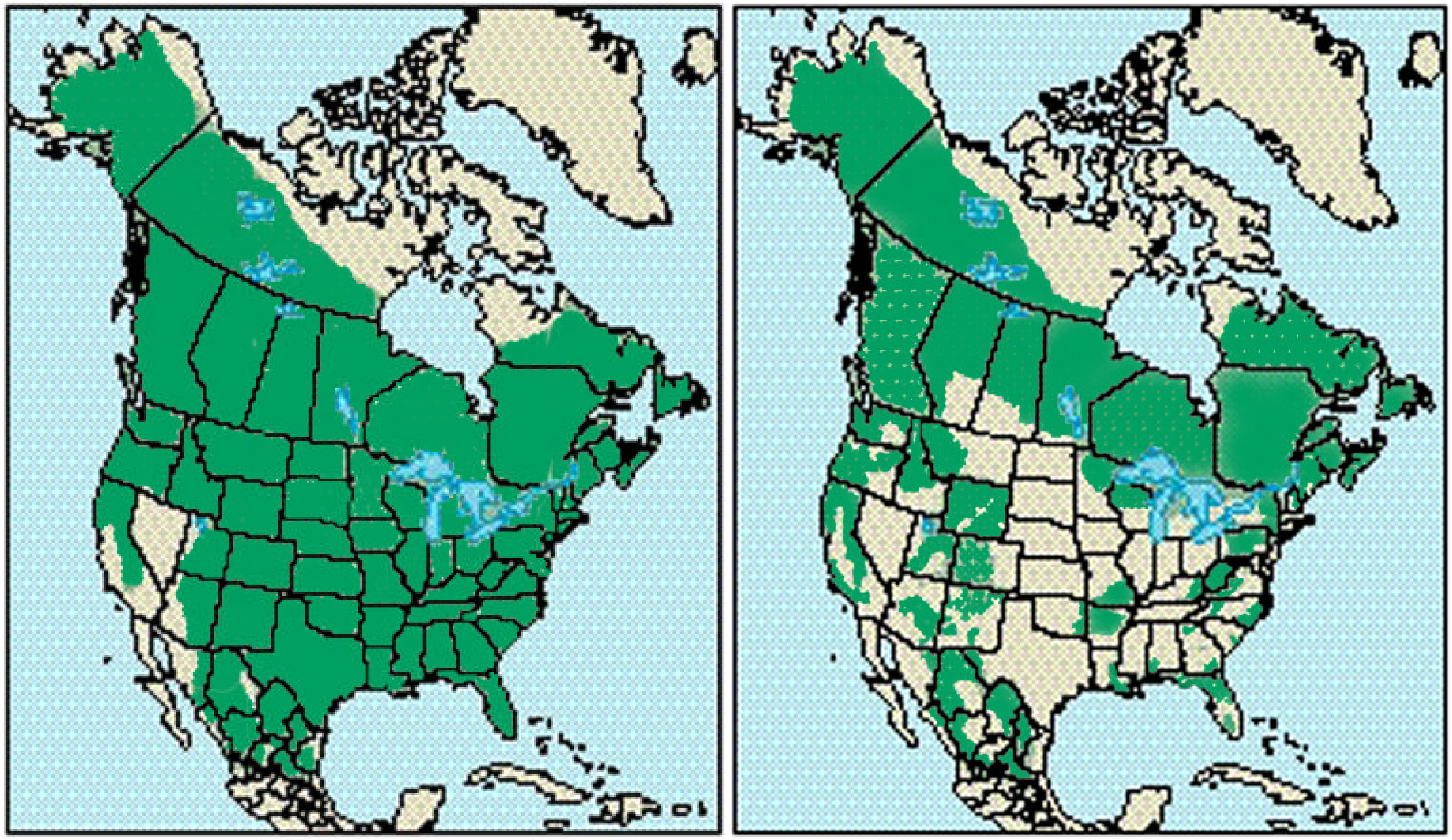
CHAPTER 1. INTRODUCTION AND STUDY AREA

INTRODUCTION

The American black bear (*Ursus americanus*) once ranged across most forested landscapes of North America (Hall 1981), but loss of habitat and overharvest significantly reduced their range (Maehr 1984, Pelton and van Manen 1997). In the southeastern United States, where 3 sub-species historically occurred, black bears only occupy 10 to 20 percent of their former range (Figure 1; Wooding et al. 1994). Bears in this region occur in small isolated patches of habitat connected by narrow wooded corridors.

Regional bear populations are often comprised of smaller, isolated sub-populations (Wooding et al. 1994, Pelton and van Manen 1997). This is true for the Louisiana black bear (*U. a. luteolus*), which once occupied portions of Texas, Mississippi, and Louisiana (Hall 1981), but now only exists in 3 small sub-populations all found within Louisiana. All 3 sub-populations occur within the Mississippi Alluvial Valley (MAV), with 2 in the Atchafalaya River Basin (ARB), and a third in the Tensas River Basin (TRB; Black Bear Conservation Committee 1997; Figure 2). Although conservation of black bears in the MAV began as early as the 1960's, continued loss of habitat and low population levels prompted listing of the Louisiana black bear as a federally threatened species in 1992 under the Endangered Species Act (Weaver 1999).

Reforestation of hardwood areas and conservation of existing forested habitat in the Southeast have increased the amount of potential black bear habitat (Wooding et al. 1994, Black Bear Conservation Committee 1997). Wooding et al. (1994) estimated that 5,139 km^2 of bear habitat existed in their occasional range and 4,526 km^2 of unoccupied



Historic Range (Hall 1981)   Current Range (Pelton and van Manen 1994)

Figure 1. Historic and current range of black bears in North America.

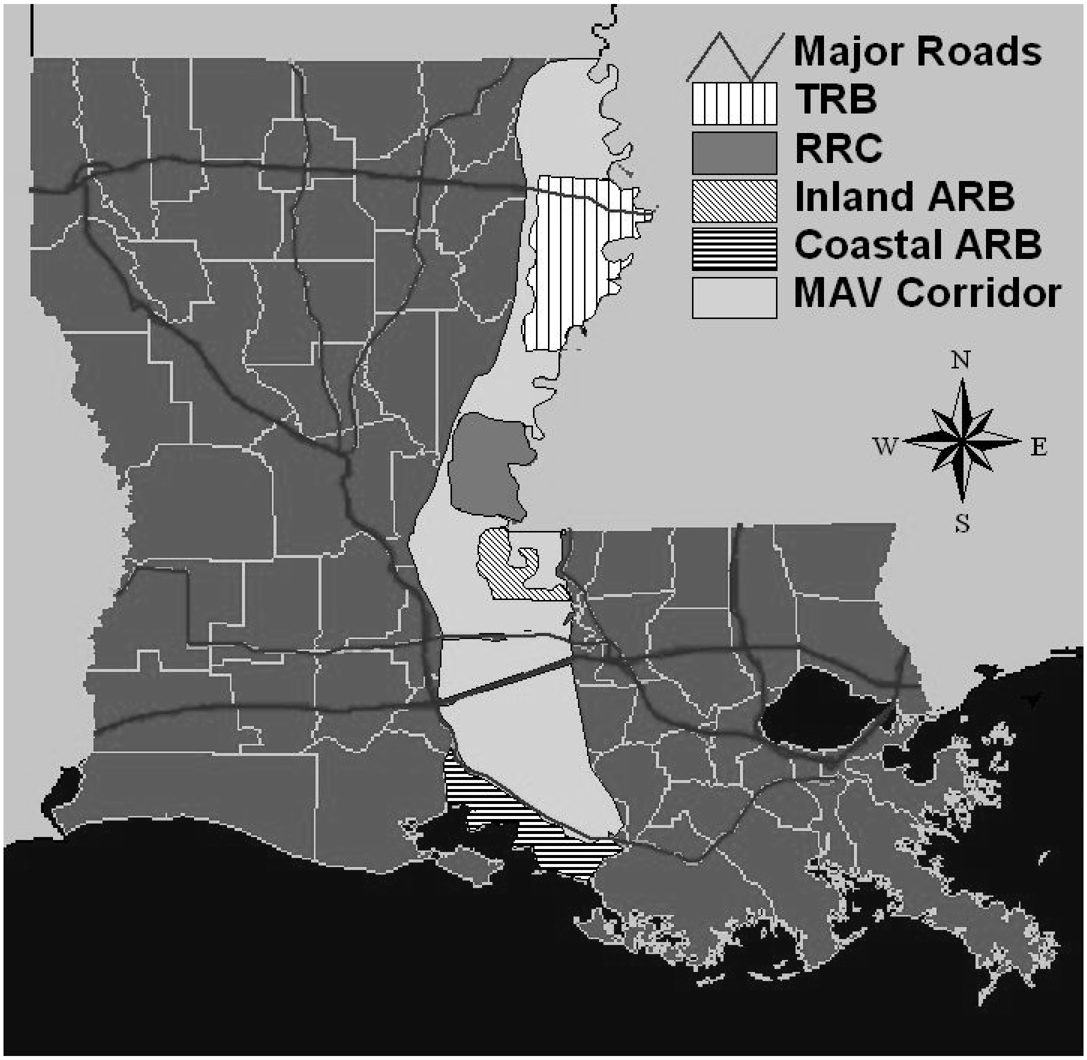


Figure 2. Distribution of 3 Louisiana black bear sub-populations (Tensas River Basin (TRB), Inland Atchafalaya River Basin (ARB), Coastal ARB), proposed Red River Complex (RRC) restoration area, and Mississippi Alluvial Valley (MAV) corridor.

Habitat existed in Louisiana. Although male bears have been found to move considerably during dispersal (Rogers 1987), dispersal of females is often limited. Juvenile females often select home ranges near their natal home range (Kemp 1976, Young and Ruff 1982, Schwartz and Franzmann 1992) and adult females rarely use corridors to access forest patches outside their core area (Marchinton 1995, Anderson 1997). To aid bear recolonization of suitable but unoccupied habitats, translocation has been suggested as a conservation tool (Wooding et al. 1994, Clark et al. 2001).

Many studies have focused on translocation as a conservation tool, either to restore extirpated populations, bolster declining populations, move nuisance individuals, or introduce both non-native and native species for sport hunting (Griffith et al. 1989, Wolf et al. 1996). Although numerous projects have focused on relocating black bears for restoration purposes, few have reported success (Taylor 1971, McArthur 1981, Massopust and Anderson 1984, Shull et al. 1994, Smith and Clark 1994, Clark et al. 2001). Large carnivores exhibit a strong homing tendency when translocated (see Rogers 1988 for review), making relocation and restoration attempts difficult (Shull et al. 1994, Clark et al. 2001). The most effective black bear restoration effort occurred in Arkansas during the 1960's where the bear population was estimated to be as low as 25 individuals (Smith and Clark 1994). Black bears were trapped in Minnesota and released at 3 sites in central Arkansas, 254 bears released over 11 years. Based on dispersal and mortality records movements appeared to be extensive (Rogers 1973, Smith and Clark 1994). Follow-up studies of these releases revealed that bears had established themselves over much of the state and currently the population has spread to Missouri and Oklahoma (Smith and Clark 1994). Louisiana initiated a similar release program during the 1960's, only releasing 131 bears. Releases and movements were poorly documented, but movement and recapture data available suggest widespread dispersal and mortality of relocated individuals (Taylor 1971, Lowery 1974).

Guidelines have since been developed to increase success of wildlife restorations. Fellers and Drost (1995) reviewed data from wildlife releases on public lands and outlined factors contributing to success of these projects. Van Manen (1990) and Clark and Smith (1994) created guidelines directly related to black bear restoration, similar to those established by Fellers and Drost (1995). Restoration guidelines stressed the importance of using appropriate release techniques, intensive post-release monitoring, assessment of habitat at the release site, and human dimensions surveys to increase the success rate of restoration attempts. As part of the initial phase of a long-term Louisiana black bear restoration project I evaluated use of female bears with newborn cubs for restoration purposes by documenting post-release movements and site fidelity. I also monitored habitat use, habitat suitability, and public opinion at the release site in an effort to determine if continued bear restoration to the RRC is feasible and should be continued and a breeding population successfully established in the area.

Relocation techniques for bears have historically involved capture, transport, and immediate release of individuals at a predetermined site (Shull et al. 1994), often termed a “hard release” (Griffith et al. 1989, Fellers and Drost 1995). Bear restoration attempts using this method often have a high number of dispersing individuals, reducing success (Taylor 1971, Fies et al. 1987, Shull et al. 1994, Clark et al. 2001). “Hard release” methods do not allow for an acclimation period, whereas alternative “Soft-release” techniques have been successfully used with other carnivore restoration attempts (Belden and Hagedorn 1993, Bangs and Fritts 1996, van Manen et al. 2000). This method restricts the animal's movements for a short period of time before release, impeding immediate dispersal from the release site and allowing for an acclimation period (Belden and Hagedorn 1993, Bangs and Fritts 1996, Eastridge and Clark 2001). Although this method has been used with other large carnivore restorations, few studies have used "Soft-release" techniques with bears (Clark et al. 2001, Eastridge and Clark 2001). Eastridge and Clark (2001) compared 2 "Soft-release" techniques and evaluated their success for restoration purposes. The first technique involved releasing female bears during summer after holding them in an acclimation pen during a 2-week period prior to release. Four of 5 animals left the relocation site within 2 weeks of release, but 2 of the relocated individuals returned to the release area within 6 months (Eastridge and Clark 2001). The alternative method occurred in winter and involved translocating pregnant females and females with newborn cubs to predetermined den sites on the restoration area. All females relocated using the winter release method established home ranges at the release site, although 1 attempted to return to the source population more than a year after relocation (Eastridge and Clark 2001). The technique of winter releasing females with neonates was first used with bears in Pennsylvania, and also has been used in an Arkansas bear restoration program (Clark et al. 2001). Clark et al (2001) advocated the use of this method, stating that the combined factors of hibernation, parturition, and cub-rearing all enhanced site fidelity. Additional benefits of this method are that females have relatively small home ranges during winter, only a small number of colonizers are necessary for population establishment, and it is a natural method of restricting movements.

Because many large carnivore species have large home ranges and often exhibit homing behaviors, post-release monitoring can aid in determining release success (van Manen 1990, Smith and Clark 1994, Fellers and Drost 1995, Eastridge and Clark 2001). Eastridge and Clark (2001) monitored bears intensively from the ground for the initial 2 weeks post-release, then approximately twice per week using aerial telemetry. Similar protocols have been established for monitoring panthers (*Felis concolor*; Belden and Hagedorn 1993) and wolves (*Canis lupus*; Bangs and Fritts 1996). During the bear restoration efforts of the 1960's in Arkansas and Louisiana, little data were recorded on post-release activities, making assessment of success difficult (Taylor 1971, Rogers 1973, Smith and Clark 1994).

To increase success of wildlife restoration attempts, sites designated for restoration should be assessed for resource availability (Griffith et al. 1989, Wolf et al. 1996). Bears can use a number of habitat types, but priority release sites should provide seasonally available food and cover (van Manen 1990, Bowman 1999). Prior to release of black bears into the Big South Fork Region of Kentucky/Tennessee (BSF), an extensive assessment of habitat was performed (van Manen 1990, Eastridge 2000) to determine the availability of resources necessary for bear survival. Shropshire (1996) and Bowman (1999) compared habitats used by bear in Louisiana and Arkansas to potential restoration sites in Mississippi to determine habitat suitability. To understand bear habitat requirements in Louisiana and identify areas for potential bear occurrence, habitat availability and suitability surveys have been performed in the ARB, Tunica Hills Region (THR), and TRB (Nyland 1995, Stinson 1996, Anderson 1997). As part of the restoration plan for the Louisiana black bear, the Black Bear Conservation Committee

(1997) advocated that habitat suitability and Habitat Suitability Model models be developed to identify suitable release sites.

Enck and Bath (2001) stressed the importance of incorporating human dimensions research with wildlife restoration. They suggested that if public attitudes are negative in the area associated with the best habitat, then that area may not be a suitable site for release. Mech (1979) and Reading and Kellert (1993) both indicated the importance of gauging public opinion and gaining public support before conducting restorations involving threatened or endangered species. A number of projects have performed human dimensions work to aid in predicting habitat suitability and to educate the public (see Ench and Bath 2001 for review). Projects associated with bear restoration in Mississippi and BSF both incorporated public opinion surveys to determine habitat suitability (Peine et al. 1995, Bowman 1999, Fly 2001). Although release and reestablishment of black bears in Arkansas were successful with little public input, Smith and Clark (1994) stressed that surveys of public opinion and extensive education be performed before attempting this type of conservation action.

My objective was to determine the feasibility of restoring the Louisiana black bear to suitable habitats found within its former distribution. Five female Louisiana black bears with neonatal cubs were moved to a rural area with high quality bottomland hardwood forests in the MAV (United States Fish and Wildlife Service 2001). Movement and habitat use of translocated bears were monitored to determine if females remained within the restoration zone aiding in the establishment of a new population in the RRC. This information was combined with hunter surveys to gauge public opinion of the restoration program. My findings are designed to be a guide for future restoration programs involving the Louisiana black bear.

STUDY AREA

The Red River Complex (RRC; over 1274 km^2) is located between the TRB and ARB bear populations, and consists of high quality bottomland hardwood habitat (Black Bear Conservation Committee 1997, United States Fish and Wildlife Service 2001; Figure 2). The RRC is comprised of 5 Louisiana Department of Wildlife and Fisheries Wildlife Management Areas (WMA; Red River, Three Rivers, Grassy Lake, Pomme De Terre, and Spring Bayou), 2 National Wildlife Refuges (Lake Ophelia and Cocodrie Bayou), and various types of private agriculture and forest lands (United States Fish and Wildlife Service 2001). The RRC is a part of a high priority corridor of bottomland hardwood restoration, and is considered part of the secondary range of the Louisiana black bear (Wooding et al. 1994). Red River WMA (RRWMA) is the most isolated and largest publicly-owned portion of the RRC (approximately 146 km^2 in size or 12% of RRC) and chosen as the initial release site within the RRC. RRWMA is bordered by the Mississippi River to the east, Red and Atchafalaya Rivers to the south and west, Three Rivers WMA to the south, and private lands to the north (Figure 3).

RRWMA is dominated by bottomland hardwood habitat, with the predominant overstory and understory species consisting of overcup oak (*Quercus lyrata*), Nuttall oak (*Q. nutallii*), green ash (*Fraxinus americana*), sweet pecan (*Carya illinoensis*), water hickory (*C. aquatica*), American elm (*Ulmus americana*), baldcypress (*Taxodium distichum*), persimmon (*Diospyros virginiana*), sugarberry (*Celtis laevigata*), red maple (*Acer rubrum*), swamp privet (*Forestiera acumunata*), swamp dogwood (*Cornus stricta*),

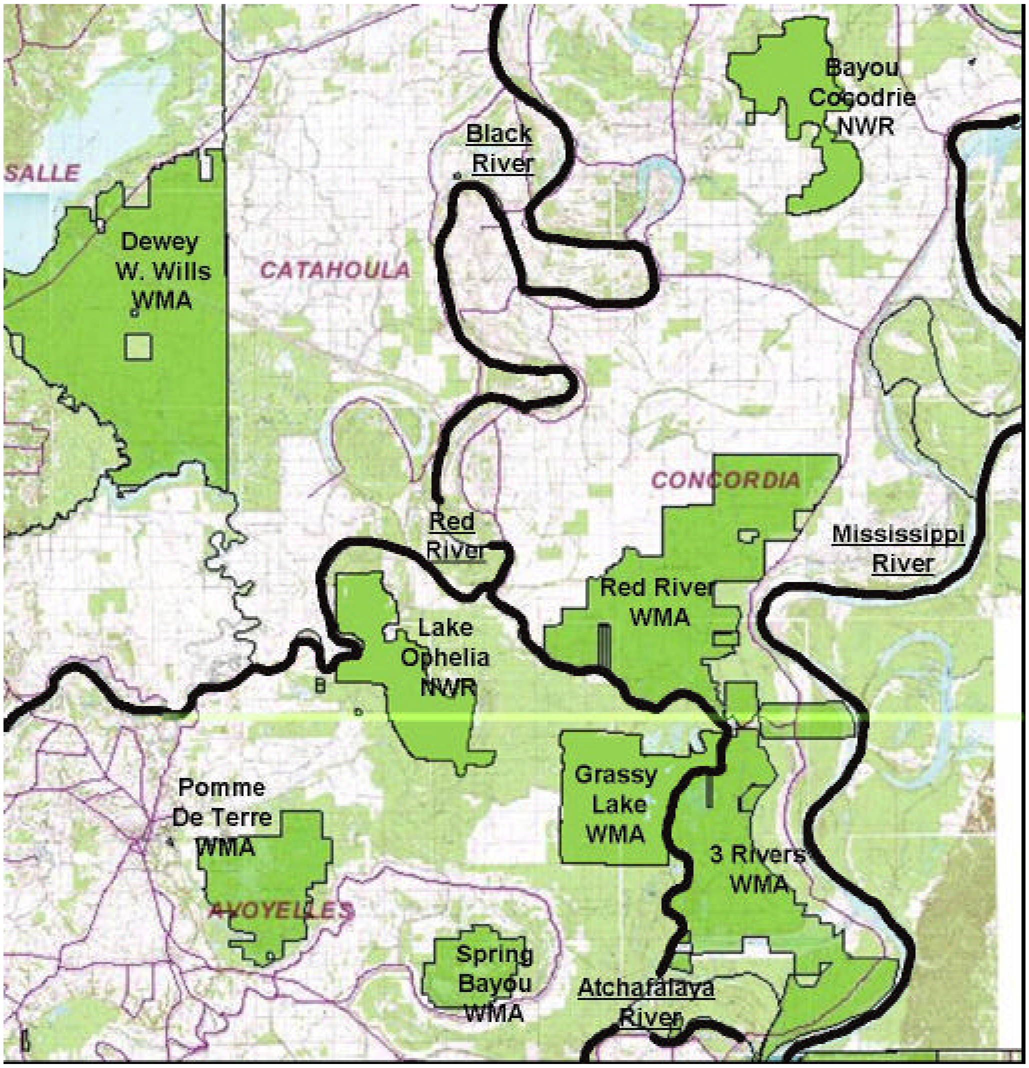


Figure 3. Proposed Louisiana black bear restoration area (Red River Complex) in east central Louisiana, including public lands and river systems.

deciduous holly (*Ilex decidua*), hawthorn (*Crataegus* spp.), and honey locust (*Gledistsia triacanthos*). Understory vegetation consists mainly of blackberry (*Rubus* spp.), poison ivy (*Rhus radicans*), greenbrier (*Smilax* spp.), trumpet creeper (*Campsis radicans*), palmetto (*Sabal minor*) and pepper-vine (*Ampelopsis arborea*). Surrounding agricultural habitats contain corn (*Zea mays*), grain sorghum (*Sorghum vulgare*), rice (*Oryza sativa*), wheat (*Triticum aestivum*), and soybean (*Glycine max*). Numerous bayous, canals, lakes, and swamps are contained within the borders of RRWMA with Cocodrie Bayou (a primary waterway) flowing through the center of the area and surrounding private lands from north to south. This bayou creates a forested corridor from RRWMA north through private lands to Cocodrie Bayou National Wildlife Refuge (CBNWR). Few paved roads occur in this region, but numerous secondary gravel and dirt roads are available for use. RRWMA has a series of maintained all-terrain vehicle (ATV) trails bisecting forest patches (Louisiana Department of Wildlife and Fisheries 1998). Private lands are comprised of small forest blocks connected by waterway corridors. Agriculture is the primary land management activity on private property. Forest patches on private land are bisected by secondary gravel and dirt roads along with ATV trails. Small communities of farms and camps are located at the edges of RRWMA.

A number of game species inhabit RRWMA and surrounding lands, with primary habitat management practices targeted toward white-tailed deer (*Odocoileus virginianus*), eastern wild turkey (*Meleagris gallopavo*), and migratory waterfowl. In addition to harvest of the above mentioned species, wild hogs (*Sus scrofa*), eastern cottontail and swamp rabbits (*Sylvilagus floridanus* and *S. aquaticus*), and fox and gray squirrels (*Sciurus niger* and *S. carolinensis*) are other common game species. Trapping for raccoons (*Procyon lotor*), river otter (*Lutra canadensis*), red and gray fox (*Vulpes vulpes* and *Urocyon cinereoargenteus*), and coyotes (*Canis latrans*) is common. A variety of non-game species occur on RRWMA, including wading birds, songbirds, and occasionally the Louisiana black bear (United States Fish and Wildlife Service 2001). The majority of hunting activity on RRWMA occurs during the 3-day firearms deer season in November and the late bucks' only season in December and January (consisting of an 8 to 10 day season). Substantial use also occurs during the initial weekend of the small game season in October. ATV traffic is restricted to marked trails and only allowed during small game and deer seasons (October through February). Five campgrounds are located in the RRWMA and Three Rivers WMA (TRWMA) area, but are only used intensively during the above mentioned hunting seasons. Hunting with dogs is allowed for small game and waterfowl, but is prohibited for hogs and deer. Hunting for deer and waterfowl are the primary activities that occur on the private lands surrounding RRWMA. Hunting for deer on surrounding private lands is governed by the general regulations for the rest of the State. The season is longer (mid-September – late-January), and the use of dogs and baiting is legal. Baiting for deer with corn is a common practice on these properties.

CHAPTER 2. MOVEMENT AND HOME RANGE OF FEMALE LOUISIANA BLACK BEARS RELEASED WITH NEONATAL CUBS

Although bear releases have been performed for decades (Shull et al. 1994, Clark et al. 2001), little is known about movements of translocated individuals beyond site fidelity. The goal of releasing individuals is for them to establish a home range in a selected area. Burt (1943) defined a home range as "that area traversed by the individual in its normal activities of food gathering, mating, and caring for young". Size and shape of an individual's home range may vary with sex, age, season, population density, and the distribution of key components across the landscape (Pelton 1982). Movements within each animal's home range and the concentration of those movements (core areas) often reflecting the location of key habitat components (Seaman and Powell 1990), which for bears consist of sites containing hard and soft mast, escape cover, secure den sites, and dispersal corridors (Pelton 1982, Powell et al. 1997, Pelton 2001). Powell et al. (1997) described the home range of an individual as the area it is familiar with, uses on a regular basis, and is familiar with the location of resources. This becomes a problem for defining home ranges and determining when home range establishment occurs for released individuals.

Powell et al. (1997) suggested that home range is greatly influenced by the familiarity of an individual with their surroundings. Numerous studies have looked at movements of relocated bears, but most of these studies have focused on nuisance individuals, so movements were erratic and extensive (Rogers 1973, Massopust and Anderson 1984, Fies et al.1987, Shull et al.1994, Eastridge 2000). Eastridge (2000) found that movements of non-nuisance females with cubs of the year (COY) were initially restricted and when females became familiar with their surroundings they eventually established home ranges within BSF. Home ranges during this exploratory period may be larger than those from the source population in spite of range restrictions because of restricted cub mobility (Burghardt and Burghardt 1972, Alt 1989, Smith and Pelton 1990, Hirsch et al. 1999). Although females with COY have restricted home ranges following den emergence, their annual home range often does not differ from those of other females in the population (Weaver 1999, Bartoskewitz 2001). Female home ranges during summer and fall are often considerably larger than those from spring (Powell et al. 1997), females with COY showing a similar behavior (Smith and Pelton 1990, Hirsch et al. 1999). The dramatic increase in female home range may be due to the rapid development, increased mobility, and increased energy demands of cubs in late spring and summer (Hock 1966, Burghardt and Burghardt 1972, Smith and Pelton 1990, Powell et al. 1997, Weaver 1999).

To determine effectiveness of using females with neonates for restoration purposes, female bears were moved from source populations in Louisiana to suitable habitats found within the corridor between the TRB and ARB populations. I monitored bears post-release to determine home range sizes and exploratory movements relating to cub developmental stages, seasons, and on an annual basis to determine if home range establishment occurred. I also compared home range estimates of relocated bears to those available from the primary source population (TRB) to determine if there were differences in home range size.

METHODS

Capture and Relocation

Bears were originally trapped and radio-marked at the source populations using techniques described by Anderson (1997) and located during February and March to determine candidate status. Females located in accessible dens with neonatal cubs were designated as candidates. These females were captured in March at natal dens where they were removed, re-collared, weighed, and ear tagged as necessary. Cubs were sexed, weighed, and marked with PIT tags (Biomark, Meridian, ID) to facilitate identification as adults. Females also were marked with PIT tags if tags were not already present. Bears were transported as a family unit in straw-lined culvert traps to the release site (> 180 km) by United States Fish and Wildlife Service personnel. Females remained immobilized during transport and release. Bears were placed in den boxes (1.2 ×1.0 × 1.0 m plywood box) located at pre-selected sites within the boundaries of RRWMA. Dens were placed in areas of RRWMA with restricted access, low flood potential, and high habitat suitability. Boxes were lined with litter from the surrounding area, and were placed at sites at least 3 weeks prior to release to allow assessment of flood potential and to allow boxes to settle on the ground. Box design included an open front, an opening on each side (0.3 × 0.3 m), and a hinged door on the back which was able to be sealed. Once females and cubs were placed in boxes, the rear door was sealed and the side and front openings were blocked by logs to prevent cubs from escaping.

Monitoring

Monitoring began within 24-hours of release via ground telemetry. Telemetry protocols required that location attempts be conducted = 1/day up to 90 days after release and = 1/week after this period. Females were located from fixed triangulation stations using a 2 element H-antenna (Telonics, Mesa, AZ). Telemetry stations were marked using a Global Positioning System unit (GPS) and Universal Transverse Mercator (UTM) locations recorded. If females could not be located during 3 days of ground searching during the initial 3 month release period, searches using antennas attached to a fixed wing aircraft were conducted. Locations were marked on an aerial photograph while in the air and ground locations were obtained as soon as possible. After the spring intensive monitoring period aerial telemetry was conducted after 1 week of ground searching if a bear could not be located. Ground locations were plotted using the program Locate II (Pacer, Truro, Nova Scotia, Canada), and UTM locations were output.

Telemetry error was assessed to better estimate bear location accuracy. Test collars were placed throughout the habitat used by bears during the study. Test collars were located via ground telemetry using the methods described above. The location of these collars were marked using a GPS unit, and compared to their respective telemetry locations. Distance from the location to the actual collar location was calculated to obtain an error distribution.

Home range size was estimated from telemetry locations using the fixed kernel method available in Arcview (Environmental Systems Research Institute (ESRI), Redlands California, USA). Core areas and home range size were estimated using 50% and 95% confidence intervals annually and by season (Powell et al. 1997). Seasonal movements were analyzed during 3 temporal periods (spring, summer, and fall). Seasons were delineated: spring (post release through May 30 or March 1 through May 30), summer (June 1-August 31), and fall (September 1-November 30). Because females had relatively restricted movements during winter (December-February) a minimum number of locations were collected and no home range analysis was performed. Home range overlap was calculated annually for 2001 and 2002 between the 2 females surviving both study years. Overlap was calculated by merging home ranges at areas of intersection and counting number of points occurring in the other female's home range. This was then divided by the total number of locations collected to determine a percentage overlap. A one-way analysis of variance (ANOVA) comparing seasonal and annual home range overlap between the 2 females was performed. Because each female used for this analysis was monitored for 3 seasons during 2 years of the study there were 6 seasons and 2 years available for analysis. Each seasonal and annual home range was used as the experimental unit to increase sample size for this analysis.

Because cub development and mobility increases considerably during the first 6 months (Hock 1966, Burghardt and Burghardt 1972), so I compared movements of females in 30 day increments following the day of release for 120 days. Female condition and number of cubs are sources of variation that may influence movements during the initial stages of release. To account for this variation, I blocked by female to remove individual variation from the ANOVA model. Using the Arcview Home Range Analysis extension (Rogers and Carr 1998), mean distance traveled and movement paths were calculated for each female during these 4 stages. Home ranges of released females also were compared to home ranges from the source populations calculated using comparable methods (fixed or adaptive kernel methods; Powell et al. 1997). The difference between 95% (home range) and 50% (core area) estimates were compared between source and relocated individuals, along with home ranges from the source to core areas of relocated bears from 2001 and 2002. Differences in home range sizes were compared using an ANOVA, and a 2-tailed *t*-test with SAS (SAS Institute Inc. 1999). Data were log transformed when appropriate to meet normality requirements for analysis.

RESULTS

Translocation

Four bears with 9 cubs were translocated to RRWMA during March 2001, and 1 additional female with 3 cubs was moved during 2002 (Table 1). One female abandoned her cubs and subsequently attempted to return to the ARB population within 1 week after relocation in 2001. The remaining 3 females and cubs were monitored through January of 2002; 1 female died of unknown causes. The remaining 2 females were monitored through winter 2003. The female translocated in 2002 lost her collar at the den site after 2 weeks. Cub survival was relatively high through summer of 2001, with 5 of 7 cubs remaining at the release site surviving into the fall (Table 1).

Telemetry Error

I used 12 known location transmitters to assess telemetry error. Mean error distance was 146 m (SD = 115 m, range = 30 - 362 m). Ninety percent of test locations were within 300 m, and 50% were within 100 m of actual collar location. This error is comparable to that of other studies in this region and results should not be affected by telemetry error (Marchinton 1995, Anderson 1997).

Den Emergence and Initial Movements

Female 450 exited her den 2 days post release, moving one of her cubs approximately 100 m south of her den site. She eventually abandoned both cubs and continued to move south following Cocodrie Bayou through RRWMA. Approximately 16 days post-release, female 450 crossed the Red River and continued to travel south, with ground contact being lost 7 days after the river crossing. She was periodically located via aerial telemetry, having traveled approximately 70 km from her release location on RRWMA. She has been found in the vicinity of her current location on

Table 1. Release and fate of female black bears and cubs translocated to Red River WMA, Concordia Parish, Louisiana during 2001 and 2002.

Bear	Year Released	Weight (kg)	Age Moved (years)	Source	Number Cubs	Cub Fate	Emergence* (days post-release)	Adult Fate
980	2001	79	11	Delta Woods, Madison Parish (TRB)	2 female 1 male	2 though 10/02	15	Private land north of RRWMA
300	2001	73	6	Delta Woods, Madison Parish (TRB)	2 female 1 male	2 though 8/01 1 though 1/02	8	Died 1/02
800	2001	74	9	St. Mary Parish (ARB)	1 female	Unknown as of fall 10/01	3	Private land north of RRWMA
450	2001	70	4	Iberia Parish (ARB)	1 male 1 female	Fostered	2	Abandoned cubs, home range central St. Landry Parish
940	2002	90	>10	Delta Woods (TRB)	3 males	Unknown	6	Slipped collar

* Direct den emergence or movements from immediate denning area (50m).

private property in St. Landry Parish since May 2001, this is approximately 25 km south of the RRC. This female's cubs were recovered on RRWMA and fostered to a female at the source (ARB). Female 940 left the area immediately surrounding the den site 6 days post-release. She traveled approximately 0.8 km south from the den site, returning in the afternoon. She remained within 300 m of the den site after this excursion, showing exploratory movements during this period. Her collar was recovered within the den; cubs were apparently moved by the female prior to collar loss. The remaining 3 females exited dens between 3-15 days post-release where intensive monitoring was initiated, and movements remained restricted to the portion of RRWMA where they were released for a minimum of 30 days before any dramatic shift in area use was noted. Female 980 remained at the den site for approximately 15 days and stayed in the section of RRWMA where she was released for approximately 60 days. Female 300 remained close to her den for 7 days following release and in the portion of RRWMA where she was released for approximately 45 days. Female 800 left the den site within 3 days after release, but remained in the section of RRWMA where she was released for approximately 30 days. This female appeared to be more mobile than 980 and 800, possibly due to only having 1 cub.

Monitoring and Home Range

During 2001, over 200 useable locations were recorded for each female remaining at the release site, with the 2 surviving bears being located over 175 times each in 2002. During summer 2001 contact was lost with bear 300 for 52 days (from 11June to 3 August) due to equipment failure. Monitoring continued normally as of 3 August 2001, after sighting from local landowners indicated her presence in the area. From sighting information obtained from landowners, this female is believed to have used the area where she was relocated for at least 2 weeks prior to her confirmed presence. The remaining females were monitored continually from March 2001 to January 2002, with the 2 surviving bears monitored through winter 2003. Animals 980, 800, and 300 all established home ranges within 12 km of RRWMA during 2001 (Figure 4). Movements of 800 and 980 remained constrained during 2002, indicating they had established permanent home ranges in this area. No difference was found in mean annual home range size for 50% (t_3 = 1.27, P = 0.2947) and 95% (t_3 = 1.48, P = 0.2347) home range estimates between years (Table 2).

Home range overlap was compared for animals 980 and 800 between 2001 and 2002. Home range overlap of 980 was extensive with 800 during 2001 (88.2%), whereas 800 had minimal overlap (19.2%) at the 95% level. During 2002, home range overlap was minimal, with 980 again having the greater percentage of overlap (18.2% vs. 10.2%). Core area overlap was minimal during the release year of both 980 and 800 (2.4% and 1.3% respectively), and non-existent during 2002. Differences were found between seasons ($F_{2,11}$ = 5.00, P = 0.029), but not years ($F_{1,11}$ = 2.30, P = 0.158).

Female home ranges were extremely small during the first 30 days post-release, with the largest core and overall area use belonging to 800, which had only 1 cub (Table 3). Mean home range size of females during 4 developmental periods were different for both 50% and 95% estimates ($F_{2,4}$= 27.46, P = 0.005 and $F_{2,4}$ = 23.71, P = 0.006, respectively). Only home ranges during the 90 and 120 day period were similar (Table 3; Figure 5). Mean movements during the 4 periods differed by both period ($F_{3,6}$ = 4.79, P = 0.049) and individual ($F_{2,6}$ = 9.25, P = 0.015).

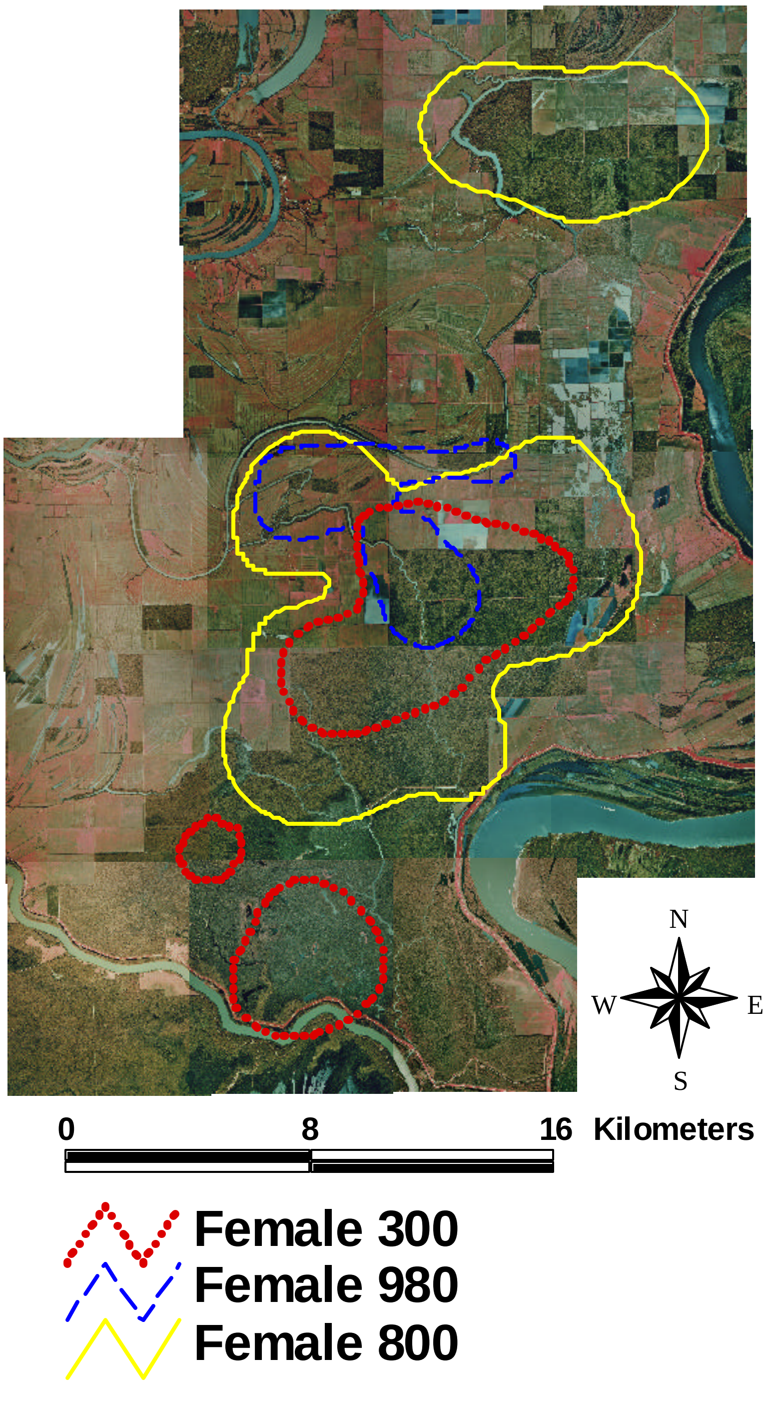


Figure 4. Annual home range (95% kernel estimate) of female Louisiana black bears relocated to Red River Wildlife Management Area, Concordia, Parish, Louisiana during 2001.

Table 2. Seasonal and annual home range sizes (km^2) for 3 female Louisiana black bears translocated to Red River Wildlife Management Area, Concordia Parish, Louisiana using a fixed kernel estimate method 2001 and 2002.

	50% Kernel Estimate				95% Kernel Estimate			
	Animal				Animal			
Season	800	980	300	Mean (SD)*	800	980	300	Mean (SD)*
Spring 01 (Release-5/30)	1.80	0.10	2.80	1.57 (1.37)	26.20	0.93	21.20	16.11 (13.38)
Summer 01 (6/1-8/31)	10.04	3.44	6.33	11.99 (6.85)	49.90	20.25	50.39	53.14 (16.10)
Fall 01 (9/1-11/30)	19.85	7.95	10.60	12.77 (6.27)	129.21	46.51	66.80	80.83 (43.10)
Annual 01 (Release-11/30)	16.38	4.87	7.83	9.69 (5.98)	161.02	42.64	65.64	89.75 (62.77)
Spring 02 (3/1-5/30)	0.65	2.50	N/A	1.57 (1.31)	4.64	12.09	N/A	8.37 (5.27)
Summer 02 (6/1-8/31)	5.05	3.29	N/A	4.17 (1.24)	68.13	31.53	N/A	49.83 (25.88)
Fall 02 (9/1-11/30)	0.98	2.16	N/A	1.57 (0.83)	5.77	10.06	N/A	8.19 (3.41)
Annual 02 (3/1-11/30)	2.73	6.49	N/A	4.62 (2.67)	27.10	44.11	N/A	35.61 (12.03)

* Mean estimate of home range size for 3 female bears for each season and estimate level.

Table 3. Home range size (km^2) during 4 cub developmental periods of 3 female black bears relocated to Red River Wildlife Management Area, Concordia Parish, Louisiana in March 2001.

	50% Kernel Estimate				95% Kernel Estimate			
	Animal				Animal			
Days post-release	300	800	980	Mean	300	800	980	Mean
1-30	0.01	0.16	0.01	0.06^{A}	0.11	1.08	0.11	0.43^{A}
31-60	0.03	2.00	0.03	0.69^{B}	0.38	27.36	0.41	9.38^{B}
61-90	0.28	3.9	0.48	1.55^{C}	2.45	43.93	2.42	16.28^{C}
91-120	2.08	6.21	1.90	3.39^{C}	13.41	52.22	11.56	25.73^{C}

*Different letters indicate a difference ($P < 0.05$) for cub developmental stages.

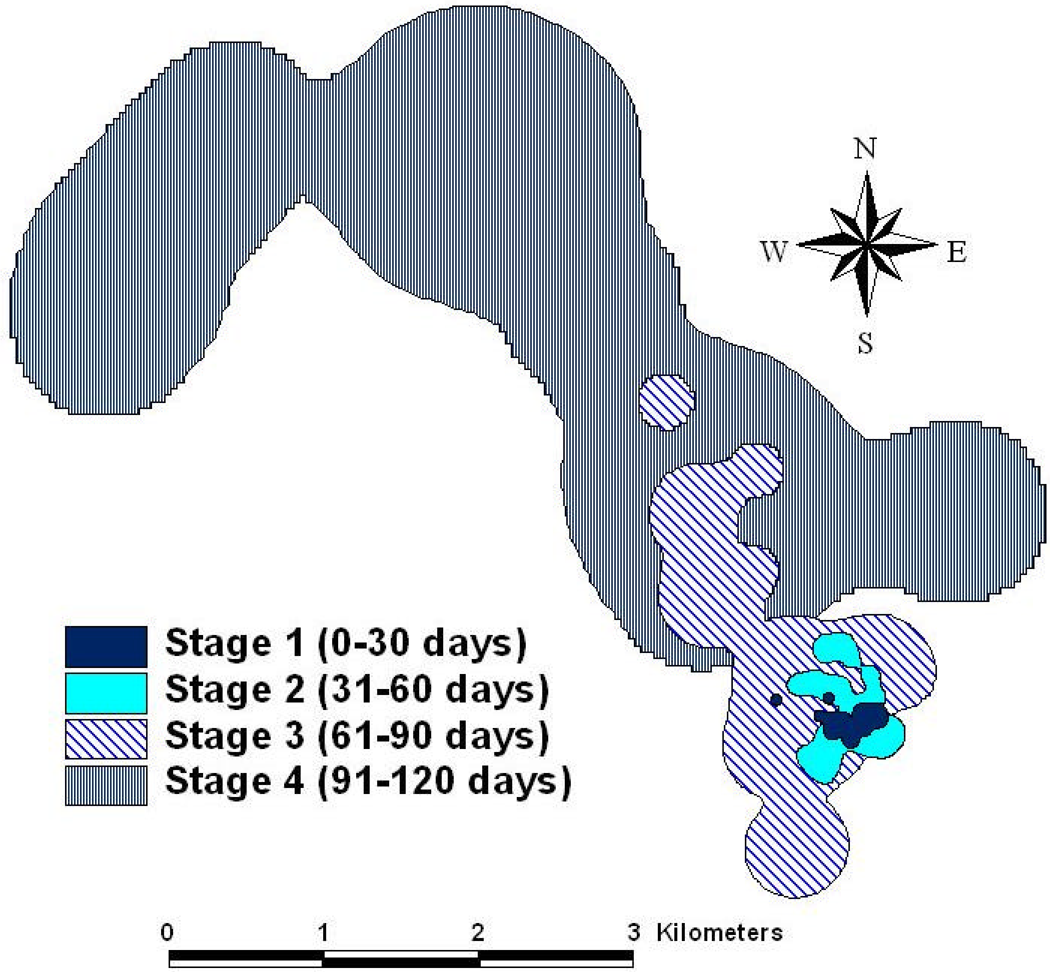


Figure 5. Home range (95% kernel estimate) of female 980 and 3 neonatal cubs relocated to Red River Wildlife Management Area, Concordia Parish, Louisiana in 2001, during 4 cub developmental stages.

Home range estimates were available for female bears studied on the Deltic Property in the TRB (Marchinton 1995, Anderson 1997, Beausoleil 1999, Weaver 1999), the source for 3 of 5 females relocated. Annual home range estimates for 2001 and 2002 were larger than those from the source for both 50% and 95% kernel estimates ($t_7 = 3.92$, $P = 0.006$ and $t_7 = -4.72$, $P = 0.002$, respectively). When core area estimates of relocated bears (0 $\pm$ SD, 7.66 $\pm$ 5.23 km^2) were compared to 95% home range estimates of female from the source (9.77 $\pm$ 3.65 km^2), no difference was found ($t_7 = 0.96$, $P = 0.367$).

DISCUSSION

Black bear restoration in the Southeast has been a high priority in the latter half of the 20th Century (Smith and Clark 1994, Wooding et al. 1994, Clark et al. 2001). In Louisiana it is of special concern because of the federally threatened status of the Louisiana Black Bear (Black Bear Conservation Committee 1997). Previous pitfalls of black bear restoration have involved low site fidelity and a need to release large numbers of individuals to ensure success (Comly 1993, Smith and Clark 1994, Clark et al. 2001). Eastridge and Clark (2001) showed that release of female bears with neonatal cubs during the winter denning season can be effective in increasing site fidelity and may only require a small number of colonizing individuals for population establishment. Three of 4 female bears released during the initial year remained within the vicinity of RRWMA. Although 1 female left RRWMA immediately following release, her movements became restricted only 25 km south of the restoration zone, therefore her relocation was considered successful. Monitoring suggested that the 3 remaining bears established home ranges during fall, monitoring of 2 individuals 2 years after release supports this. Eastridge (2000) indicated that all but 1 female established home ranges within 1 year after release.

Other studies have found that translocated bears that show signs of leaving the release area (orienting in a homeward direction, initial long distance movements in 1 direction) directly after release are often unsuccessful (Massopust and Anderson 1984, Fies et al. 1987, Comly 1993, Eastridge and Clark 2001) In this study, only 1of 5 bears exhibited this behavior, and presumably attempted to return to the ARB after release. Although bear 940 was only monitored for 2 weeks post-release, she showed no signs of homing, and moved her 3 cubs from the artificial den prior to collar loss. An ear-tagged bear with 2 yearling cubs was observed on CBNWR during October 2003, and is believed to have been female 940. Eastridge (2000) found that only 1 winter-released female attempted to return home past the 2-week intensive monitoring period, whereas 5 of 6 summer release females showed extensive movements and dispersed from the release site within this period. These observations indicate that females translocated using the winter release method may only need to be monitored for a short period after release to determine if they are going to stay and establish home ranges within the vicinity of a release site (Eastridge 2000).

Released females had larger home ranges than females from the source population, but a comparison of core area use of released females was similar to 95% estimates of females from the TRB. Home ranges must supply all the resources necessary for survival (Burt 1943), with core areas having more concentrated use than the remainder of the home range (Seaman and Powell 1990). Because females were unfamiliar with their surroundings, it is likely that they made forays from the core area to locate resources and increase their familiarity with the landscape (Powell et al. 1997). These forays significantly increased home range size (Table 3). Females within the TRB are often restricted to and familiar with smaller forest blocks, which provide resources necessary for survival. Burt (1943) suggests that individuals may make occasional trips outside their home range, which he believed were exploratory and should not be considered as part of the home range. Because all movements of relocated females are exploratory in nature especially those outside the core area, managers should place more emphasis on core areas than on artificially inflated home range estimates when determining home range establishment and habitat use.

With this soft-release method, cubs are used as a tool to restrict female mobility and create a natural acclimation period. It is important to determine how long that acclimation period may last. Because of intensive monitoring during the initial year post-release, I was able to assess the importance of cub development on female movements. Many authors have suggested that females with neonates have restricted movements during spring (Clark and Pelton 1990, Powell et al. 1997, Hirsch et al. 1999, Weaver 1999), but the influence of cub mobility is poorly understood. Cub development has been described by only a few authors although black bears have been intensively studied (Matson 1954, Hock 1966, Butterworth 1969, Burghardt and Burghardt 1972, Alt 1989).

Black bear cubs are extremely small at birth (0.3 to 0.4 kg), and born with their eyes closed. Their eyes remain closed for approximately 28 to 42 days, with size remaining small (< 2 kg) and mobility limited (Matson 1954, Hock 1966, Butterworth 1969, Alt 1989). Once a cub’s eyes open, their mobility increases and they are able to move within the den using pushing and pulling motions. Mobility and food consumption increase substantially from this point, by 80-days cubs are able to climb, eat solid food, and weigh approximately 5 kg (Butterworth 1969, Burghardt and Burghardt 1972). Cubs in this study were approximately 42 to 56 days old at the time of release, weighing between 0.9 to 2.2 kg, with eyes fully open. They were mobile within the den, being able to climb on available structure, but were unsteady and appeared to have restricted coordination (Matson 1954, Butterworth 1969, Alt 1989). During the initial 30-day monitoring period (cubs ˜ 80-days old), female home ranges were restricted and mean distance moved also was small (184 km). Matson (1954) noted that a female with 3 cubs approximately 70-days old was able to move to a new den site > 500 m from the natal den. Female 800 had the largest home range and mean movement distance during the first 120-days after release, but also only had 1 cub, so her ability to move across the landscape was potentially easier. Home ranges increased significantly during the latter 2 developmental periods after release (cubs ˜ 5 months and 6 months old, respectively). During this period cub size and mobility increase dramatically (Hock 1966) allowing cubs to travel with females, and therefore allowing them to extend their exploratory movements farther away from the den site. At the end of the 90-day developmental period (the beginning of June) cubs weigh 8 to10 kg, have an increased energy demand, are feeding more on solid food, and are more mobile (Hock 1966, Butterworth 1969, Burghardt and Burghardt 1972).

During late spring and early summer, soft mast and agricultural crops are available to meet these demands, prompting extended forays (Maddrey 1995, Anderson 1997). Relocated bears increased their home range size during this time, and shifted their home range to incorporate these resources (mainly agricultural crops). Females increased the use of the Bayou Cocodrie corridor and the isolated forest patches associated with it. These areas provided necessary cover resources, and were surrounded primarily by corn, milo, and wheat. On multiple occasions females were located in agricultural fields > 2 km from the nearest forest patch, but forays of 100 to 300 m were more common. Female 800 was often located in isolated agricultural fields (> 1 km from a forest patch), and would remain there up to 4 days before returning to RRWMA. During this period she used the field and sparsely wooded drainage canals as refugia and recently reforested Wetland Reserve Program (WRP) fields as travel corridors. Once these agricultural resources were discovered by relocated females they became important habitat features, with 1 female establishing a home range within the Bayou Cocodrie corridor (Figure 4).

CHAPTER 3. MICRO AND MACRO HABITAT USE OF RELOCATED FEMALE LOUISIANA BLACK BEARS

Black bears use a number of habitat types in the Southeast (Pelton 2001), but habitat use in the lower MAV is primarily restricted to bottomland hardwoods (Weaver et al. 1990, White 1996, Anderson 1997, Bowman 1999). Bear habitats must provide 5 basic resources; escape cover, fall food (hard and soft mast), spring and summer food, corridors, and den sites (Pelton 2000). Although bottomland hardwood habitats in Louisiana are comprised of small disjunct patches, they are extremely productive and provide abundant food and cover resources necessary for bear survival. This productivity has allowed high densities of bears to exist in these small isolated patches (Anderson 1997, Weaver 1999, Boersen 2001).

Bear populations have been able to persist in the MAV, although much of the forested habitat has been fragmented by agriculture and urban development (Wooding et al. 1994, Pelton and van Manen 1997). Remaining forest patches provide understory vegetation with soft mast resources, and escape cover (Weaver et al. 1990, Bowman 1999). Because bears are omnivorous, the combination of highly productive mast species and agricultural crops found in these areas fulfills dietary requirements (Weaver et al. 1990, Clark 1991, Anderson 1997). In the lower MAV most bears use tree dens, which provide security from flooding and disturbance (Weaver and Pelton 1994, Oli et al. 1997), but the loss of suitable cavities has forced bears to occasionally use brushpiles and ground nests. Although these sites are used primarily by males and solitary females, their use by pregnant females has been documented, even in areas where tree cavities are available (Weaver and Pelton 1994, Anderson 1997, Oli et al. 1997, Weaver 1999).

Translocation has been used as a tool to aid recolonization of bears to habitats meeting suitability requirements (Wooding et al 1994), with suitability determination at both microhabitat and landscape levels providing the best estimate of overall quality (Johnson 1980, Bowman 1999). Prior to release of bears into BSF an intensive habitat assessment was performed at the microhabitat level by measuring vegetation characteristics associated with bear habitat use (van Manen 1990, Eastridge 2000). Similar habitat analysis was performed in portions of Mississippi to determine suitability of public lands for bear restoration (Shropshire 1996, Bowman 1999). Suitability of sites in Mississippi was assessed by comparing site characteristics to areas where stable bear populations exist in the MAV (White River NWR and the TRB). Vegetation sampling at the microhabitat level aided in quantifying mast availability, escape cover, and dens (van Manen 1990, Bowman 1999), whereas landscape-level analysis addressed availability and juxtaposition of habitats. To correspond with Louisiana black bear restoration, an assessment of the RRC was performed at a landscape level. Based on forest composition data, the RRC was considered to contain suitable habitat able to support black bear restoration (United States Fish and Wildlife Service 2001). Although studies have assessed habitat suitability prior to black bear restoration, few studies have assessed bear habitat use after release. In Arkansas, habitat use of a restored bear population was conducted 20 years after bears were considered established in the region (Clark 1991).

Monitoring habitats used by released individuals data on habitat suitability can be obtained in addition to information useful in predicting habitat use of individuals released with future restoration attempts. To accomplish this 3 female Louisiana black bears with neonatal cubs released during March 2001 were monitored via telemetry and habitat use sampled on 2 spatial scales from May through November 2001 and 2002. Vegetation surveys of used and random locations found within each female's weekly area of use were performed to identify important microhabitat features and determine availability of required resources (primarily mast and escape cover). To assess landscape-level habitat use, habitats found at telemetry locations were compared to those within seasonal home ranges and those available within a portion of the RRC. This allowed identification of important habitat features and determine if use differed from habitats available within each female's home range or those available within the study area.

METHODS

Vegetation Sampling

A multi-scale assessment of habitat use at the microhabitat level was performed by sampling vegetation composition and structure at used and random locations. Weekly vegetation survey plots were selected at used and random locations between May and mid-November during 2001 and 2002 for each female. Location data was used obtained by telemetry, and 1 location/week was selected for each bear to sample. This location was paired with a random site selected from areas considered accessible to each female. Random plots were determined by selecting a telemetry station where a female was monitored during the week and traveling in a random azimuth 1 to 499 paces from that point. Most telemetry locations were recorded within 1 km of the actual location of each female, indicating this area could be considered a part of the female's potential area of use during that week. Sites used by females were located using a GPS unit, with an accuracy of 8 m or less.

Each sampling plot (random and used) consisted of a 30 m diameter circle (approximately 0.1 ha). Vegetation composition, canopy closure, vertical obstruction, and average vegetation height were measured from 15 m back to plot center in each of the cardinal directions using the point-center-quarter method (van Manen 1990, Bowman 1999). Vegetation composition was measured using a 0.5 m^2 Daubenmire frame to determine percentage cover of grass, forb, woody, vine, debris, bare ground, crop, water, palm, and fern (Daubenmire 1959). Crown closure was measured with a forest densiometer to determine area of occupation as a percentage (Lemmon 1956, Avery 1975). Vegetation cover and average vegetation height were measured with a 1.83 m (6 feet) Nudd's board with 6 equal-spaced segments (Nudds 1977). Measurements using the Nudds board and densiometer were recorded from the kneeling position, with those from the Daubenmire frame observed from waist height. By measuring samples at this height, I hoped to better estimate vegetation characteristics at bear level (shoulder height 31 cm; Kolenosky and Strathearn 1987). To determine tree density and species composition, an absolute count of all stems > 3 cm diameter at breast height (DBH) was performed. Species data, DBH, and distance from stem to plot center were recorded at each tree. The line intercept method (Canfield 1941) was used to determine plant species diversity 0.5 m above ground along a 30 m line bisecting plot center in a randomly selected direction. The most abundant structure type was recorded at 5 cm intervals along the tape. Vegetation was identified to genus when multiple species occurred in the habitat and further identification was not practical, others were identified to species except for a few grasses, which could only be identified to family. If I could not identify a species, I collected a sample and submitted it to a plant taxonomist for identification. Samples unidentified by taxonomists were classified by life form and placed in general categories (unknown grass, forb, or sedge).

Logistic regression was used to create a model to correctly identify used and random points (SAS Institute Inc. 1999). Mean site variables were created from vertical obstruction, site composition, and canopy closure. Tree density, species composition, and food resource availability compiled from the line intercept also were used for site analysis. Vertical obstruction readings (AVEPER1, 2, 3, 4, 5, 6) were combined to create 2 obstruction levels AVETOP (AVEPER 1, 2, 3) and AVEBOT (AVEPER 4, 5, 6). A correlation analysis was performed to reduce number of variables in the model. Variables entered into the model included AVEVERT, AVEPERTOP, AVEPERBOT, and average forb, grass, woody, debris, ground, water, palm, crop, vertical cover, and canopy (AVFORB, AVGRASS, AVVINE, AVWOODY, AVDEBRIS, AVGROUND, AVWATER, AVPALM, AVCROP, AVEVERT, and AVCAN), total tree DBH (TOTDBH), mast tree DBH (MASTDBH), total number of trees (TOTTREE), number of hard and soft mast trees (HARD, SOFT; Appendix 1), and total number of tree species (TOTSPEC). A proportion of potential bear food items at ground level was calculated from line intercept data (FOOD; Anderson 1997, Bowman 1999). An equal number of used and random locations were sampled and assured a prior probability of group membership of 0.5. Significant (a = 0.05) variables were selected using stepwise variable selection procedures with default significance levels of entry and significance used to build the model (SAS Institute Inc. 1999).

Line intercept data were further analyzed to determine if fine-scale vegetation differences were evident between used and random locations. Species occurring on plots were assigned to 1 of 8 categories comprised of plants with similar life forms or functions. Plants were assigned to food or cover categories such as hard mast, soft mast, vines, and beneficial crops (bear crop), or to general categories such as crops not considered food items (other crop), grass, forb, and non-mast producing woody plants (Stinson 1996, Anderson 1997, Bowman 1999). An ANOVA was performed to examine differences in vegetative composition between used and random locations. Data were transformed as necessary to meet assumptions of normality and homogeneity (SAS Institute Inc 1999).

Habitat Use

A cursory evaluation of habitat use was performed to better understand the influence of landscape composition on habitat use and area suitability. Habitat use was examined at 2 spatial scales for comparison with availability. The first level (first-order) involved a comparison of habitats within a home range vs. habitat availability across the entire study area. Level 2 (second-order) compared habitats used within a home range vs. the availability of habitats within a home range. An area of available habitat was delineated within the RRC around RRWMA using the Red, Atchafalaya, Black, and Mississippi Rivers, Highway 84, and State Route 910 as borders. Although bears are known to cross rivers (White 1996) and highways (Pace et al. 2000), females in this study that established home ranges did not cross these site-specific boundaries.

I identified 4 primary habitat types within a portion of the RRC, using recent infrared aerial photographs. Using the digitizing tool in Arcview, I created polygon features of the 4 habitats for use in identifying general habitat use at a landscape level. The 4 habitat types identified in this landcover map included contiguous forests (> 1.25 km^2), corridors (ditches, wooded waterways, and forest patches < 1.25 km^2), open areas (crops and fallow fields), and unusable areas (urban areas, open water, and roads).

Home ranges for each bear were calculated for each season (spring, summer, and fall) from all points available at a 95% estimate level using a fixed kernel estimate, and overlaid on the delineated landcover map. Seasonal habitat selection was determined by calculating the proportion of each habitat available across the study area, those available in an individual's home range, and by the proportion of locations occurring in those habitats.

In fragmented habitats like those found in Louisiana, corridors are important habitat features and often facilitate the use of agricultural fields. To better assess corridor use and accurately assess excursions into agricultural fields, Anderson (1997) buffered corridors by 100 m (approximate telemetry error). By doing this he was able to better identify if locations were isolated to field interiors or were associated with the escape cover provided by corridors. Using Arcview, I placed a100 m buffer around all corridors (approximate telemetry error), and compared use between buffered and unbuffered corridors to determine if females used areas close to the escape cover of corridors or made extended forays into field interiors. Telemetry locations within corridors and fields are believed to be an accurate representation of habitat use although telemetry error of > 100 m was recorded. This is because of the narrow width of corridors, the close proximity of researchers to bears in agricultural areas, the locations where triangulation bearings were recorded from (often roads between corridors and fields), and the ability to occasionally visually locate bears during telemetry.

RESULTS

Microhabitat Use

A total of 248 vegetation plots were sampled during 2001 and 2002 (124 paired random and used locations). Locations occurred within a number of different habitat types including contiguous forests, corridors, active agricultural fields, harvested agriculture, and fallow areas. Correlation procedures revealed that average vertical cover (AVEVERT) was highly correlated with AVETOP (r = 0.859, $P = < 0.001$) and AVEBOT (r = 0.864, $P = < 0.001$), and so these 2 parameters were removed from the logistic regression model. Four parameters were retained in the model and could be used to identify used locations, including an intercept term (ß = -2.447, SE = 0463, X^2 = 27.984, P = < 0.001), average vertical cover (AVEVERT; ß = 0.995, SE = 0.294, x^2 = 11.425, P = < 0.001), average amount of debris (AVDEBRIS; ß = 3.401, SE = 1.409, x^2 = 5.827, P = 0.016), average amount of water (AVWATER; ß = 2.055, SE = 0.914, x^2 = 5.056, P = 0.025), and the average canopy closure (AVECAN; ß = 1.444, SE = 0.291, x^2 = 24.652, P = < 0.001; Table 4). The model correctly classified 76.4% of used locations and 58.5% of random locations (X^2 = 8.436, P = 0.392).

No difference in amount of hard or soft mast, forbs, grasses, non-mast producing woody species, or non-beneficial crops were found between used and randomly sampled locations from line intercept data. More vines (primarily mast producers or important cover species) occurred at used locations, and more beneficial crops occurred at random locations (Table 5).

Landscape Level Habitat Use

A portion of the RRC (1135.34 km^2) was designated for the landscape-level analysis, with open areas comprising 57% of the study area (648.86 km^2). Woods comprised 27% (314.20 km^2), with corridors and unusable areas comprising < 10% each (104.53 km^2 and 67.75 km^2, respectively). Seasonal distribution and use of available habitats indicated that seasonal shifts in habitat use occurred. Females tended to use open areas (fields) and corridors more during summer. Female 980 shifted her entire home range to the center within the Bayou Cocodrie corridor after spring 2001 (Table 6). Although habitats considered unusable occurred in female home ranges, locations occurred in these areas only for female 300. During fall, this female used habitats within

Table 4. Summary of site classification variables for used and random vegetation locations around Red River Wildlife Management Area, Concordia, Parish, Louisiana sampled during 2001 and 2002 (NIM = variables not used in the final model, * significant variables for correctly classifying used sites).

	Site			
	Used (n = 124)		Random (n = 124)	
Variable	Mean	STDERR	Mean	STDERR
AVEPER1 NIM	48.99	3.19	36.54	3.59
AVEPER2 NIM	48.82	3.20	37.18	3.60
AVEPER3 NIM	52.76	3.28	41.95	3.65
AVEPER4 NIM	59.20	3.24	48.24	3.67
AVEPER5 NIM	69.83	2.95	58.22	3.72
AVEPER6 NIM	80.83	2.65	70.71	3.38
AVETOP (AVEPER 1-3) NIM	50.19	3.17	38.55	3.55
AVEBOT (AVEPER 4-6) NIM	69.95	2.80	59.05	3.43
AVEVERT*	34.78	2.07	28.46	2.15
AVGRASS	6.36	1.30	9.30	1.86
AVFORB	4.41	0.81	3.85	0.80
AVWOODY	3.81	0.93	2.03	0.45
AVVINE	35.43	2.50	19.10	2.30
AVDEBRIS*	2.71	0.51	0.82	0.22
AVGROUND	31.24	2.33	35.66	3.04
AVWATER*	4.27	1.11	1.73	0.73
AVPALM	2.87	1.28	1.38	0.85
AVCROP	10.95	2.59	25.61	3.38
AVFERN	0.88	0.40	0	0
AVECAN*	73.03	2.87	41.00	3.85
TOTDBH	11.92	0.66	7.33	0.87
MASTDBH	12.22	0.66	7.78	0.87
TOTTREE	41.92	2.73	23.26	3.02
HARD	15.90	1.34	9.52	1.43
SOFT	14.41	1.21	7.87	1.12
TOTSPEC	6.32	0.34	3.43	0.38
FOOD	46.12	2.63	47.01	3.00

Table 5. Mean percentage of vegetation types with associated standard errors (STDERR) occurring at used and random locations associated with relocated female Louisiana black bears around Red River Wildlife Management Area, Concordia Parish, Louisiana (Plots sampled May-November 2001 and 2002).

	Used		Random			
	Mean	STDERR	Mean	STDERR	$F_{1,247}$	P
Hard Mast	0. 75	0.18	0.43	0.11	2.43	0.121
Soft Mast	4.96	1.29	2.48	0.10	2.29	0.132
Bear Crop	5.96	1.56	15.51	2.24	12.23	0.001
Other Crop	1.68	0.96	2.82	1.22	0.54	0.465
Woody	0.72	0.13	0.44	0.14	2.21	0.139
Forbs	5.15	0.69	6.34	1.14	0.8	0.379
Grass	5.26	1.04	6.22	1.05	0.43	0.513
Vine	32.08	2.29	18.06	2.15	19.93	< 0.001

Table 6. Percentage of seasonal home ranges (95% kernel estimate, HR) and used locations (points, USED) for 3 Louisiana black bears associated with 4 habitat types within a portion of the Red River Complex restoration area, Louisiana 2001, 2002.

			Spring 2001		Summer 2001		Fall 2001		Spring 2002		Summer 2002		Fall 2002	
Animal	Habitat	Study Area Availability	HR	USED	HR	USED	HR	USED	HR	USED	HR	USED	HR	USED
980	Woods	28	100	98	17	25	0	0	0	0	24	23	0	0
	Corridor	9	0	0	10	34	19	40	33	83	14	35	23	54
	Open	57	0	2	43	41	81	60	67	17	60	42	73	46
	Unusable	6	0	0	0	0	0	0	0	0	0	0	0	0
800	Woods	28	92	95	44	59	32	67	0	100	38	74	88	100
	Corridor	9	0	1	4	4	7	4	96	0	9	17	0	0
	Open	57	8	4	52	37	60	39	0	0	52	9	12	0
	Unusable	6	0	0	0	0	1	0	4	0	1	0	0	0
300	Woods	28	98	99	60	79	63	87	NA	NA	NA	NA	NA	NA
	Corridor	9	0	0	2	0	3	2	NA	NA	NA	NA	NA	NA
	Open	57	2	1	38	21	33	8	NA	NA	NA	NA	NA	NA
	Unusable	6	0	0	0	0	1	3	NA	NA	NA	NA	NA	NA

the southern portion of RRWMA, and unusable habitats in this area consisted of open water, so locations identified as occurring within those areas are probably a result of telemetry error. I found that females used agricultural fields adjacent to wooded corridors, but that most excursions into open areas extended more than 100 m from corridor edges (Table 7).

DISCUSSION

Although wildlife managers are often able to predict habitat suitability of a proposed restoration site, it is difficult to predict how released individuals will perceive and use the area (Bowman 1999). To better understand how landscape and habitat features affect successful restoration of the Louisiana black bear, it is important to identify features selected by released individuals. The RRC was selected as a release site because of favorable comparisons to areas in the region with stable black bear populations and its perceived high habitat suitability (United States Fish and Wildlife Service 2001). The area of the RRC used by released females was similar to other habitats identified as suitable bear release sites at a microhabitat scale (van Manen 1990, Bowman 1999).

Female bears selected areas with structural characteristics similar to those identified as providing suitable protective cover and food resources. van Manen (1990) determined that vertical cover densities of 20% at ground level (˜ 0.6 m) would provide sufficient escape and protective cover. Locations used by females on the RRC contained vertical obstruction densities of 70-80%, not only indicating that the RRC has suitable understory cover, but that females chose areas with a denser understory.

Mast production is often an indicator of quality bear habitat (van Manen 1990,

Table 7. Percentage of locations of relocated female Louisiana black bears in corridors within a portion of the Red River Complex restoration area, Louisiana compared to locations within corridors buffered with a 100 m perimeter (2001, 2002).

Animal	Spring 01		Summer 01		Fall 01		Spring 02		Summer 02		Fall 02	
	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With
980	0	0	34	46	40	63	83	90	35	40	54	100
800	1	2	4	4	4	9	0	0	17	18	0	0
300	0	0	0	0	2	2	NA	NA	NA	NA	NA	NA

Powell et al. 1997, Bowman 1999), with tree densities of > 50% hard mast considered highly suitable (van Manen 1990). Bears on the RRC used areas with suitable hard mast densities and high soft mast composition (37% and 34% respectively). In many portions of black bear range hard mast is the sole food resource during fall, but in areas of the MAV and Coastal Plain soft mast species are available and often constitute a large portion of bear diet during fall season (Weaver et al. 1990, Anderson 1997, Powell et al. 1997, Roof 1997, Stratman and Pelton 1999). Sufficient soft mast production from woody tree species can compensate for lack of hard mast producers or hard mast crop failures and should be included when assessing mast availability (Stinson 1996, Bowman 1999). Furthermore, females used sites with greater vine densities, likely a consequence of soft mast (i.e., *Rubus* spp., peppervine, and *Smilax* spp.) production.

Agricultural crops supply another source of summer and fall foods that are often overlooked by managers when assessing bear habitat. Crops like corn, milo, wheat, and potentially soybean have been found to be important food resources for bears (Maddrey 1995, Anderson 1997). Females were observed using agricultural crops during the growing season and after harvest when waste grain was available. Additionally, debris in the form of fallen logs and brush can provide habitat for colonial insects and beetle larvae, which are often important seasonal food, and an indicator of site quality (Stinson 1996, Pelton et al. 1997). Females selected areas with abundant debris; these structures not only provided food resources but escape cover and potential den sites especially in the MAV where bears often den on the ground (Weaver and Pelton 1994, Oli et al. 1997, White et al. 2001). Females were observed using logs and brushpiles during fall and winter as den sites, and moving logs during spring and summer to locate insect resources.

Although food was not found to be important in identifying used locations of bears, this may have been biased because of vegetation sampling protocols. All potential bear foods were included (soft and hard mast trees, soft mast vines, and agricultural crops) in calculating food resources availability. Because wooded areas on private lands were often small and surrounded by agricultural fields planted with crops considered to be bear foods (corn, milo, and soybeans), vegetation plots occurring in fields often indicated high suitability rankings. Because random locations in crop fields potentially contained 100% food resources, no difference was found when comparing all potential foods at used and random points. Line intercept data indicated that more vines (primarily soft mast producing species) occurred at used points, indicating that availability of natural foods is an important indicator of bear habitat quality.

Females appeared to use habitats differently from their availability across the study area and within their home range depending on the season. Because females were released in a larger contiguous forest (RRWMA) and movements were restricted during the initial release period, it is not surprising that wooded areas were used in a greater proportion than their availability during spring 2001. All females shifted their home ranges to encompass more open areas (primarily cropland) during summer and fall. Other studies have found that bears will shift their home range in response to seasonal food availability (Smith and Pelton 1990, Wooding and Hardisky 1994, Pelton 2000). In agriculturally-dominated areas crops often become important food resources in summer and fall (Maddrey 1995, Anderson 1997).

Anderson (1997) found that bears in fragmented landscapes used wooded corridors to access agricultural crops. Corridor use in this study occurred more than expected from availability both across the study area and within individual home ranges. Because corridors were narrow in many areas (50-100 m), location estimates for corridor use could have been underestimated by telemetry error or by telemetry sampling regimes (Wooding and Hardisky 1994). Anderson (1997) found that buffering corridors by 100 m allowed for a more accurate comparison between corridor use and field excursions. Females using areas within 100 m of wooded corridor edges were considered to be close enough to permanent escape cover. Buffering of corridors in my study appeared to provide a better representation of habitat use for female 980, who spent most of her time in the Bayou Cocodrie corridor, but appeared to have little influence on estimating habitat use of the other females.

Extended forays into crops not only provided females with food resources, but also temporary refugia. Crops like milo and corn provide vertical obstruction and canopy cover similar to wooded areas and may have provided temporary refugia, but obviously could not provide escape cover like trees, which are important for young cubs (Powell et al. 1997). Even females that appeared to use crops for longer periods (˜ 4 days) tended to use areas < 200 m from protective cover such as wooded ditches, canals, or recently converted Conservation Reserve Program (CRP) and WRP land. Anderson (1997) found that bears used ditches as narrow as 5 m when traveling through agricultural fields, but preferred major wooded corridors (bayous). By using corridors, bears could access agricultural crops while traveling shorter distances from wooded escape cover. He believed that females were reluctant to travel across fields to access other forest patches, and only used primary bayou corridors. I found that females used narrow corridors, but use of the larger wooded corridor (Cocodrie Bayou) was more common. As with

Anderson (1997), corridors in the RRC are primarily associated with riparian areas (bayous, canals, ditches, or wetlands). Vegetation plots sampled at used locations often occurred at the edges of these features. One of the microhabitat variables the model used to correctly predict used locations was the amount of water at each plot, which could be linked to corridor use and importance.

Vertical obstruction measurements from agricultural crops indicated corn and milo fields provided vertical obstruction cover similar to wooded habitats during summer and early fall. In addition to foraging sites bears appeared also to use fields as travel lanes between wooded habitats. Females were documented moving up to 1 km through corn fields in summer. Although I found that bears made extended forays into agricultural crops and occasionally used cropland when traveling between forest patches, corridors allowed use of most agricultural areas. The combined resources in these 2 habitats facilitated their use, with corridors providing substantial permanent cover, seasonal food resources, and dens, whereas agricultural crops provided abundant seasonal food resources and temporary cover.

Wooded corridors were important in bear movement between contiguous forests. The Bayou Cocodrie corridor, a meandering combination of wooded bayou and small forest patches, connects RRWMA with BCNWR and other large forested areas. The shortest distance between RRWMA and forests to the north was ˜ 11 km, but the bayou meandered > 30 km through agricultural fields, supplying considerable refuge and access to crops. This corridor not only provided a safe travel route between forest patches, across roads, and easy access to agricultural crops, but permanent refugia for females. Anderson (1997) documented temporary corridor use up to 3 months for females in the

TRB. Of individuals relocated to the RRC, 1 appeared to have established a home range within a wooded corridor. Female 980 moved into a portion of the Bayou Cocodrie corridor directly north of RRWMA during June 2001, and only occasionally returned to larger wooded areas during the next 2 years of monitoring. This suggests that corridors can not only be used to increase connectivity of larger habitat patches, but as permanent habitat if they are large enough to supply specific resources (dens, escape cover, hard mast) and allow access to supplementary resources (crops) through their juxtaposition.

CHAPTER 4. SPORTSMEN KNOWLEDGE AND OPINION OF LOUISIANA BLACK BEAR RESTORATION

Habitat suitability for wildlife restoration is closely linked to social acceptance (Reading and Kellert 1993, Lohr et al. 1996, Ench and Bath 2001). This is especially true when controversial species (i.e. protected species or large carnivores) are concerned (Reading and Kellert 1993, Lohr et al. 1996, Pate et al. 1996, Ench and Brown 2002). Specific to bears in the Southeast, successful reintroductions have occurred in the past without information on public opinion, but Smith and Clark (1994) suggested incorporating the public into future management decisions. In Mississippi and BSF, extensive surveys of public opinion were conducted to determine suitability of black bear release sites prior to restoration (Peine et al. 1995, Bowman 1999, Fly 2001). Bowman (1999) surveyed private landowners and corporations around public lands considered as potential bear release sites. He determined that public acceptance of restoration in Mississippi was high (> 50% of landowners and corporations supported restoration). Prior to black bear restoration into BSF, public meetings were held by state and federal agencies to determine public opinion, help educate and inform about the project, and disseminate factual information about bear ecology (Eastridge 2000). Peine et al. (1995) surveyed visitors to BSF to determine acceptance of black bear restoration, and found that most visitors were in favor of the program (> 75% of all visitors), but that support was lower among local visitors (˜ 60%). A separate telephone survey also indicated that most respondents knew about the proposed restoration program (> 80%), and supported the restoration (57%). Prior to bear restoration in Louisiana, landowners adjacent to the RRC were sent information packets notifying them of the proposed program, and supplying them with educational and contact information. In addition, the United States

Fish and Wildlife Service (USFWS) conducted a series of public meetings to inform and address concerns about the program (United States Fish and Wildlife Service 2001). Overall support was considered high, with only 18% of attending individuals expressing negative comments.

To further gauge public knowledge about the restoration program and disseminate educational information, hunters were surveyed at RRWMA, TRWMA, and Lake Ophelia NWR (LONWR) from 2001-2003. These surveys were designed to provide LDWF, USFWS, and the Black Bear Conservation Committee with information on success of their education programs, provide areas to target with future educational campaigns, and determine the most effective methods to disseminate information.

METHODS

A 1 page, 17 question survey was developed to target sportsmen on RRWMA, TRWMA, and LONWR. Questions were similar to other human dimensions surveys geared toward black bear restoration (Bowman 1999, Fly 2001), and were designed to determine number of individuals familiar with the restoration program, their activities on the area, knowledge about black bears, and basic demographic information. Surveys were administered by volunteers during periods of high area usage (opening weekends of the deer and small game seasons, and during lottery hunts). On LDWF property, sportsmen were visited at camping and parking areas, whereas on LONWR sportsmen were asked to complete surveys while at mandatory check stations. Because RRWMA and TRWMA are treated as 1 management unit by LDWF and hunters may use both areas in the same day, they were treated as 1 unit for this survey and will be referred to as RRWMA (Louisiana Department of Wildlife and Fisheries 1998). RRWMA was sampled in 2001 and 2002 during fall small game and deer hunting seasons (October-

December) and LONWR during the 2002-2003 winter muzzleloader hunts. Individuals unwilling to complete surveys were not recorded, so no response rate was calculated. Individuals stating they had completed surveys during 2001 were counted, but not re-sampled during 2002 surveying on RRWMA. Responses by these individuals were used in calculating knowledge about the project for RRWMA 2002 only and not used in any other analysis.

Summary statistics were calculated and compared between RRWMA 2001, RRWMA 2002, and LONWR. ANOVA and chi-square tests were performed to determine differences between RRWMA sampling years, and respondents on RRWMA during 2001 and LONWR (SAS Institute Inc 1999). By comparing data from surveys on RRWMA during 2001 and 2002, I was able to determine if knowledge about the project increased from attention given to moves during the second year, and determine the effectiveness of the survey as an educational tool. LONWR was proposed as a release site for year 3 of the project. Comparing survey results from LONWR to those from RRWMA 2001, allowed comparison of knowledge and attitudes of sportsmen using state and federal properties and compare 2 areas during the first phase of releases. Data from the 3 surveys were pooled to determine if education programs initiated prior to bear releases were effective. To determine this I compared knowledge about the project of Concordia and Avoyelles Parish residents (areas closest to the RRC) with individuals from the rest of Louisiana.

RESULTS

A total of 518 sportsmen were surveyed from 2001-2003 (RRWMA 2001 = 231, RRWMA 2002 = 193, and LONWR = 94). Thirty individuals who had completed surveys the previous year were encountered on RRWMA during 2002, and were not resurveyed. During 2001, 56% of sportsmen were aware that bears had been released on RRWMA, 33% during 2002 if individuals surveyed the previous year are excluded (42% if included), and 55% were aware that bears were to be released on LONWR. Knowledge about the project from the RRWMA 2001 survey was different from RRWMA 2002 data with (x^2_1 = 9.11, P = 0.003) and without (x^2_1 = 22.86, P = < 0.001) individuals who completed surveys during 2001. Differences were not detected between RRWMA 2001 and LONWR respondents (x^2_1 = 0.03, P = 0.863). Residents of Concordia and Avoyelles Parishes comprised 19% of hunters surveyed on all 3 sites. In these parishes where education programs had been initiated, knowledge about the project was higher (65%) than other portions of the state (41%; x^2_1 = 14.75, P = < 0.001). Individuals aware of the project prior to this survey indicated they initially heard about it by word-of-mouth. On LONWR contact with a state or federal official also was a common method of learning about the releases (Table 8).

Although only approximately 50% of sportsmen surveyed were aware of the project, support for restoration was high (79.0% RRWMA 2001, 85.3% RRWMA 2002, 77.4% LONWR). Sportsmen indicated that areas were used most often for hunting deer (firearms and archery), small game, and wild hogs. Hunters on LONWR (51%) responded similarly to those on RRWMA during 2001 and 2002 (46% and 38% respectively) when asked if they hunted in other areas with black bears. Few sportsmen were concerned about using areas where black bears were present (RRWMA 2001 = 21%, RRWMA 2002 = 26%, LONWR = 20%). Most hunters would like to see more bears in Louisiana (> 78% on all areas). Slightly more hunters on LONWR (92%) knew that the Louisiana black bear was a protected species, than did respondents from RRWMA (2001 = 86%, 2002 = 80%) although no differences were detected between

Table 8. Methods of information dissemination about the Louisiana black bear restoration program on Red River Wildlife Management Area (RRWMA) and Lake Ophelia National Wildlife Refuge (LONWR), east-central Louisiana (% of respondents).

	Site		
	RRWMA 2001	RRWMA 2002	LONWR
Public Meeting	1.9	1.1	3.4
State or Federal Official	8.7	6.6	22.5
Newspaper	16.4	9.8	11.2
Sign	11.5	4.9	2.3
Word-of-Mouth	28.4	25.7	23.6
This Survey	33.2	51.9	37.1

areas (RRWMA 2001 vs. LONWR; $x^2_1 = 2.37$, $P = 0.124$) or years (RRWMA 2001 vs. RRWMA 2002; $x^2_1 = 1.53$, $P = 0.217$). Sportsmen felt that the ability to see a black bear in the wild was the most important benefit from this restoration program (Table 9). Most sportsmen (RRWMA 2001 = 72.7%, RRWMA 2002 = 64.0%, LONWR = 69.7%) knew bear diet consisted of nuts and berries, like that of a raccoon (*Procyon lotor*).

Demographic information between areas was similar with sportsmen living in Louisiana, being predominately male (> 90%), and having similar mean ages (RRWMA 2001 = 35.0 $\pm$ 12.4 years, RRWMA 2002 = 34.4 $\pm$ 12.2 years, LONWR = 37.3 $\pm$ 10.2 years; $F_{2,439} = 0.61$, $P = 0.5436$) and hunting experience levels (RRWMA 2001 = 21.9 $\pm$ 12.7 years, RRWMA 2002 = 21.5 $\pm$ 11.4 years, LONWR = 26.4 $\pm$ 11.0 years; $F_{2,427} = 2.13$. $P = 0.121$). Hunters at both areas had similar educational backgrounds ($F_{2,440} = 1.27$, $P = 0.281$; Table 10), and were from similar community types ($F_{2,439} = 1.61$, $P = 0.200$; Table 11). Both areas had similar representation from rural areas, small towns, and small cities, with LONWR having a greater attendance from individuals living on farms. Of 64 Louisiana parishes, 36 were represented by sportsmen surveyed on the 2 areas (Table 12).

DISCUSSION

Although agencies often incorporate public opinion into decisions about wildlife restoration, their methods are often inappropriate or inadequate in design (Ench and Bath 2001). Success of wildlife restorations can be hindered by community acceptance, even when positive attitudes and initial support appears high (Lohr et al. 1996, Ench and Bath 2001). Support for wildlife reintroduction from landowners and sportsmen are extremely important, because of potential restrictions in land use directly affecting their activities (Reading and Kellert 1993, Bowman 1999, Brooks et al. 1999, Ench and Bath 2001).

Table 9. Personal gains of sportsmen to Louisiana black bear restoration on Red River Wildlife Management Area (RRWMA) and Lake Ophelia National Wildlife Refuge (LONWR), east-central Louisiana (respondents able to choose more than one response, % of total responses).

	Site		
	RRWMA 2001 (*N* = 368)	RRWMA 2002 (*N* = 237)	LONWR (*N* = 122)
See a black bear in the wild	33.4	37.1	43.4
Satisfaction of knowing bears are using the area again	13.6	14.3	7.2
An important part of the wildlife community has been restored and Louisiana natural history enhanced	14.4	15.2	10.7
My children or grandchildren may get to see a black bear in the area	19.3	13.9	10.7
There may again be a hunting season on bears in Louisiana	12.0	11.0	10.7
No opinion	6.5	8.0	9.8
Other	0.8	0.4	0.8

Table 10. Educational level of hunters on Red River Wildlife Management Area (RRWMA) and Lake Ophelia National Wildlife Refuge (LONWR) responding to the black bear restoration survey administered 2001-2003 (% respondents).

	Site		
Education	RRWMA 2001 (*N* = 229)	RRWMA 2002 (*N* = 192)	LONWR (*N* = 93)
Grade School (1)	4.8	6.8	2.2
High School (2)	49.8	52.8	50.5
Some College or Post-High School (3)	19.7	19.3	20.4
Vocational or Technical School (4)	15.7	13.0	10.8
Bachelors Degree (5)	7.9	5.7	9.7
Graduate Degree (6)	2.2	2.1	6.5
Score			
Mean (SD)	2.8 (1.1)	2.6 (1.1)	2.6 (1.1)

Table 11. Community size of hunters on Red River Wildlife Management Area (RRWMA) and Lake Ophelia National Wildlife Refuge (LONWR) responding to the black bear restoration survey administered 2001-2003 (% respondents).

	Site		
Community Size	RRWMA 2001 (*N* = 229)	RRWMA 2002 (*N* = 192)	LONWR (*N* = 93)
Farm	11.3	10.0	21.5
Rural, non-farm	21.6	15.3	17.2
Small town (2,500 or less people)	21.6	30.5	23.7
Small city (2,500 or more people)	31.2	36.3	29.0
Large city (50,000 or more people)	14.3	7.9	8.6

Table 12. Parish distribution of hunters surveyed on Red River Wildlife Management Area (RRWMA) and Lake Ophelia National Wildlife Refuge (LONWR) from 2001-2003 about black bear restoration (% individuals).

Louisiana Parish	RRWMA 2001 (*N* = 231)	RRWMA 2002 (*N* = 194)	LONWR (*N* = 94)
Acadia	4.2	1.2	1.6
Ascension	3.3	0.6	0.0
Allen	0.5	0.6	5.3
Assumption	0.5	3.0	0.0
Avoyelles	19.3	19.6	41.5
Beauregard	0.5	0.0	1.6
Caldwell	1.0	0.0	0.0
Calcasieu	5.2	2.4	7.5
Concordia	1.9	0.0	0.0
Cameron	0.0	1.2	0.0
East Baton Rouge	6.6	6.0	2.1
Evangeline	11.3	13.7	8.5
Iberville	1.0	3.0	0.0
Jefferson	6.2	0.6	1.6
Lafayette	5.7	1.2	0.0
Lafourche	0.5	3.6	5.3
Lincoln	1.4	0.6	1.6
Livingston	5.7	10.1	0.0
Pointe Coupee	0.5	0.0	0.0
Rapides	2.4	2.4	12.8
Sabine	1.0	7.1	0.0
St. Bernard	1.4	1.8	0.0
St. Charles	1.0	1.2	0.0
St. Helena	0.0	0.6	0.0
St. James	4.7	1.2	0.0
St. Landry	2.8	2.4	5.3
St. John the Baptist	5.7	1.2	2.1
St. Martin	0.0	0.0	1.6
Tangipahoa	1.4	2.4	0.0
Terrebonne	4.2	6.0	0.0
Union	0.0	0.6	0.0
Vermilion	0.5	0.0	1.6
Vernon	0.5	0.0	0.0
West Baton Rouge	0.5	0.6	0.0
West Feliciana	0.0	0.6	0.0
Unknown	8.2	13.0	3.2

Only 46% of sportsmen surveyed were aware of the proposal to restore bears to the RRC. In areas where public meetings were held and information packets distributed (Avoyelles and Concordia Parishes) knowledge was higher, but these 2 Parishes accounted for < 20% of visitors to public areas surveyed. A study from BSF indicated that > 80% of respondents were familiar with the proposed bear reintroduction prior to the attempt. Although knowledge about restoration program was low, even in areas where education programs had been initiated, support was high (> 75% in all areas). These results are similar to other areas where bear reintroductions have been proposed (Peine et al. 1995, Bowman 1999, Fly 2001). However, a high level of support does not always indicate continual support for restoration and project success. Bear restoration in BSF was suspended due to public opposition after initiation (Clark et al. 2001), even though public meetings were positive and 2 independent surveys indicated that 57%-77% of visitors approved (Peine et al. 1995, Eastridge 2000, Fly 2001).

Positive attitudes toward a species do not always translate into social acceptance of a species restoration as attitudes are often temporary and change when the public obtains more information (Lohr et al. 1996, Ench and Brown 2002). In this study, most sportsmen were informed about the restoration by word-of-mouth. Fly (2001) also found that this was a common way for respondents to gain information about black bear restoration in BSF. Although word-of-mouth may be an effective method of disseminating information, it does not always distribute correct information. Efforts should be made to use outlets where factual information can best be distributed to supply the public with the best information to base their decisions.

Printed media like newspapers and magazines can be an effective method of disseminating information (Reading and Kellert 1993, Fly 2001). In this study, information in local newspapers were either written by individuals present at the release or articles had information supplied by cooperating agencies. Information distributed to the public in this manner was more reliable because the original source was directly related to the restoration program. With most uninformed respondents coming from areas outside the RRC, media outlets like newspapers, magazines, and television may be best in distributing information to a wider audience. Sportsmen could be targeted by including information in the state hunting regulation manual, regional outdoor magazines, outdoor-oriented television programs, and potentially on internet sites visited by Louisiana sportsmen.

Although mandatory registration at check stations is required on both state and federal properties, signs posted at those areas were not effective in initially notifying individuals of the bear restoration program. On LONWR more sportsmen first heard about the program from a wildlife official than on RRWMA. This may have been because concern about lack of knowledge on RRWMA during the initial year prompted USFWS personnel to become more aggressive in informing the public. Meetings also were found to be ineffective, probably because of low turnout (˜ 55 total individuals in attendance; United State Fish and Wildlife Service 2001) and the fact that they were only held in areas surrounding the RRC (> 80% of respondents were from counties outside this area). Because sportsmen using public lands are often from other portions of the state, outreach should not only be targeted towards the local community, but throughout the region.

In Mississippi, where bear populations are relatively low, knowledge about black bear biology was relatively low and < 40% of private landowners knew that it was illegal to kill a black bear in their state (Bowman 1999). Bowman et al. (2001) found that residents of areas with high and low bear densities both had low overall knowledge levels about black bear biology and management, so further education may be required for the public to better understand bear management and ecology (especially translocation). I found a high percentage of respondents knew bears were federally protected in Louisiana (> 80%). Because of efforts by state, federal, private organizations and the status of the Louisiana black bear, knowledge of Louisiana residents may be higher relating to conservation and management issues. Although sportsmen appeared knowledgeable about some aspects of bear management and ecology, education programs focusing on black bear ecology and restoration should be encouraged.

Although support for restoration of the Louisiana black bear appears high, further efforts to educate and inform the public are warranted. A more in-depth study of the attitudes and knowledge of landowners and Louisiana residents may be required to further gauge area suitability. Because attitudes are dynamic, continual monitoring of public attitudes should be conducted to determine if shifts in public opinion occur. The example of bear restoration to BSF demonstrates that restoration programs which begin with perceived public support may be halted by a turn in public approval (Peine et al. 1995, Clark et al. 2001, Fly 2001).

CHAPTER 5. CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Eastridge and Clark (2001) found that winter translocation of female black bears with neonates can be an effective method of restoring bear populations. Because this method only requires a small number of colonizing individuals as stock for the new population, it is hoped that it can be applied to the Louisiana black bear, which has a restricted number of source individuals available. I found that released females had high site fidelity, with individuals establishing home ranges within 7. Female home ranges were smaller and movements more restricted during spring as suggested in previous studies (Smith and Pelton 1990, Powell et al. 1997, Weaver 1999, Eastridge 2000) with space use and movements least during the first 2 months after release. These data indicate that the release of females with newborns produce a minimum acclimation period of 30 days. Number of cubs may influence length of this acclimation period, with females released with multiple cubs having smaller home ranges during the initial 30 day period, and movement restrictions lasting up to 60 days.

Space use increased considerably during summer, with exploratory movements beginning in late spring and extending through summer into fall. Range restriction occurred during late fall through the following spring, with females showing signs of denning. Released individuals continued to use home ranges established during fall of the release year throughout the second year of monitoring. This information is consistent with the evaluation of this method on BSF (Eastridge 2000).

Home range sizes for released females were considerably larger than individuals from the source population. Exploratory movements and landscape composition may have explained this during the initial release year, but once females became familiar with area features home range size should have restricted. Although movements became more predictable during the second year of monitoring and home range size was somewhat reduced, extended movements (> 5 km straight line distance) still occurred during summer. These movements may have been simple exploratory excursions, targeted towards abundant food resources, a result of other bears moving through their home range, or in relation to mate searching. Although movements were extensive, females eventually returned to their established home range within a period of 1 week. I observed females moving in response to agricultural crop availability, with females traveling directly to areas where early season development of corn and wheat had occurred.

The use of data from source populations is a common practice when modeling population responses and space use at release areas. I determined that this may not be useful in determining space use after release. The USFWS used a home range estimate of 32.7 km^2 (the largest home range reported for a Louisiana black bear) to model carrying capacity of the RRC (United States Fish and Wildlife Service 2001). I found that released individuals had annual home ranges of this size or larger and exhibited little home range overlap once they became established. I found that the size of core areas (50% estimate) for released individuals were similar to 95% home range estimates of bears from the source population. This indicated that a better method of modeling potential space use may be to use annual home ranges from the source as core areas for home range estimates at the release site and extrapolate to determine potential home range size and carrying capacity. Although I found that overlap occurred between females, core area overlap was minimal. Because space use and territoriality may change with changes in density or relatedness of individuals (Powell 1987, Samson and Huot

2001, Oli et al. 2002), especially as the population grows, long-term monitoring of relocated individuals should occur to document if population establishment occurs, and supply better data on space use changes for modeling purposes.

Although cub survival was not quantified directly, information from observational data indicated that 5 or 7 cubs survived through their first summer. Even though 1 female appeared to lose her cub during fall of the release year, she remained within her established home range following that time. Female 300 was observed with 1 cub prior to her death in January 2002, but after that period the cub's status was unknown. Reliable observations from within the winter home range of this adult indicated that the cub may have survived through November 2002. Sightings from BCNWR have identified a bear meeting the description of female 940 using that area. A female with ear tags and 2 COY was observed during fall 2002 using the Brooks Beak Unit. If this is not female 940, the size of the cubs indicated that reproduction may have naturally occurred within the RRC. This is a realistic assumption considering the number of reliable observations of bears in the region directly surrounding RRWMA.

From landscape-level analysis, the RRC was classified as providing suitable black bear habitat (United States Fish and Wildlife Service 2001). Microhabitat analysis of RRWMA and surrounding areas indicate a high degree of habitat suitability. This area appears to provide all the necessary resources bears in the Southeast require for survival (hard and soft mast, dens, escape cover, and corridors). Sites used by females contained suitable amounts of hard mast producing species, high levels of soft mast producing trees, soft mast producing ground cover, greater densities of debris, and access to seasonally important agricultural crops. Vertical obstruction densities indicated that substantial escape cover occurred at both used and random locations (van Manen 1990, Bowman 1999). Locations used by bears were associated with greater canopy cover, taller understory vegetation, more debris, and and a greater availability of water. Because corridors were narrow (50 – 100 m), used locations were often sampled at the edges of bayous and canals. The association of used locations with water may be related to corridor use at the release site.

Debris as an indicator of habitat suitability not only provided a measure of escape cover and food resource availability (Stinson 1996, Powell et al. 1997), but identified a potential estimate of den site availability. Bears in the MAV use a variety of denning structures (Weaver and Pelton 1994, Oli et al. 1997, White et al. 2001), with den trees often preferred by females, especially pregnant individuals. Elevated cavities are believed to be extremely important to bear reproduction in areas where seasonal flooding is a problem, but proper timber management can provide adequate structure for denning when mature trees are not available (those > 84 cm DBH; van Manen 1990, Oli et al. 2001). White et al. (2001) determined that in areas where seasonal flooding is a problem and den trees are not available, bears used ground dens in elevated sites protected from flooding. He also found that age and experience influenced den selection. Older individuals were more likely to use ground dens as were those which had previously selected a secure ground den, one protected from flooding. All relocated females in my study were removed from ground dens and found to use ground dens during visits in 2002 and 2003. In areas where flooding occurred, females selected sites in elevated locations where downed woody debris was located, although large cavity trees appeared to be available. I observed that dens used by relocated females were in portions of the

RRC where previous logging activities had occurred, and slash was common. During vegetation surveys I found that large trees occurred on sample plots, but that assessment of useable cavities was difficult. Timber harvest occurs on both public and private lands within the RRC, and should be managed in a way that preserves large den trees and creates brushpiles and debris. Creating structure for ground denning in upland sites protected from flooding may compensate for low numbers of cavity trees.

In fragmented habitats of Louisiana, agricultural crops are a dominant landscape feature. Studies in similar habitats have found that crops can become important seasonally abundant food resources for bears (Maddrey 1995, Anderson 1997). In my study, females and cubs used these crops as early as May and as late as November, with intensive use occurring during summer, when crops are at their peak production period and not only supply substantial nutrient value, but cover opportunities. Home range size and movements often reflect food availability, so extensive movements may coincided with availability of easily accessible resources (Pelton 1982, Smith and Pelton 1990). Black bears are opportunistic foragers able to consume large quantities of food when they are available (Kolenosky and Strathearn 1987, Pelton 2001); use of agricultural crops is an excellent example of this phenomenon. Anderson (1997) found that females that rarely used corridors extended their home ranges into these cropland during summer to better exploit agricultural resources. I also found that females moved into corridors and small forest patches surrounded by corn and milo during summer. These habitats supplied necessary cover requirements and easy access to abundant and beneficial food resources. During peak of the growing season, field conditions provided substantial cover, allowing females to remain along small wooded ditch banks for multiple days to more easily access crops. Females also used crops as travel corridors to access other portions of farms during peak of the growing season when field cover mimicked that provided by wooded corridors. The combination of connected wooded corridors, which supplied den sites and escape cover, and access to agricultural crops during critical seasons (winter wheat in spring, corn and milo in summer and fall), allowed females to reduce foraging movements during these critical periods. One female eventually established a home range comprised of small forest patches, corridors, and cropland, and was able to raise 2 cubs to 2 years of age. The ability for managers to juxtapose release sites to easily accessible agricultural crops may aid in reducing foraging movements during the initial release year, increase cub survival, and enhance site fidelity.

Because of the intensive use of crops by released individuals, the opportunity for conflict between humans and bears may be increased. Furthermore, although landowners in my study were tolerant of crop damage from bears, this is often a point of conflict in areas with higher bear densities (Bowman et al. 2001). Although cooperating agencies conducted education and informational programs about the restoration project (United States Fish and Wildlife Service 2001), knowledge about the project was low. Wide ranging media resources should be used to target all those who may be affected by restoration projects, with special consideration given to landowners and sportsmen. These 2 groups may feel the most disenfranchised by the release of bears into these areas. Additional surveys should be conducted to determine landowner opinion of proposed restoration and to supply these individuals with educational and contact information. I not only found that landowners reacted positively to bear use of their land, but were interested in management methods that promoted black bear use of their property.

Information on land management should be supplied to those individuals showing interest, in addition assistance from state and federal biologist in designing site specific management plans should also be available. Increased monetary incentives on WRP and CRP enrollments should be given to landowners within the RRC and potential cost share for those initiating management targeted towards black bear. In Louisiana, most bear habitat occurs on private lands (Wooding et al. 1994). Maehr (1990) determined that recovery of the Florida panther (*F. concolor coryi*) could not be accomplished without assistance from private landowners and proper management of those lands. This appears to also be true for the Louisiana black bear, so care should be taken to incorporate these individuals into current conservation plans.

Sportsmen play a prominent role in black bear restoration in Louisiana. Although low numbers of hunters were aware of the project, support was high. Negative comments voiced by hunters about bear restoration to the RRC related to concerns about area closures, impacts on hunting opportunities, and safety. Increased education of this group may not only aid in dispelling these fears, but with monitoring and safety of bear populations at the release areas. Reports by sportsmen and hikers have been used to sample rare or secretive forest carnivore populations with success (Pelton 1972, Woolf et al. 2000). Hunters can supply a seasonally available resource which managers can use to assess wildlife distribution and density. Because hunters are required to check-in and out on both state WMA's and federal NWR's, information on bear observations could be recorded throughout the RRC and help determine restoration success by documenting distribution, abundance, and reproduction. I found $\approx$ 20% of all hunters were concerned about hunting around bears, creating an additional area for conflict management.

Concerns could be addressed through education programs to dispel fears. Because feral hogs in this region resemble black bears in size and color, and are a common game species in the RRC, concerns about accidental harvest are legitimate (Pace et al. 2000). Further education to promote awareness may reduce accidental take.

The release of females with neonatal cubs can be used effectively to establish bears within suitable habitats, even those as fragmented as landscapes within Louisiana. Stocking and monitoring of bears within the RRC should be continued to establish a base population of bears in the area and determine if breeding of released individuals has occurred. In Arkansas and BSF natural reproduction of released individuals occurred as quickly as 2 years after release (R. Eastridge Arkansas Game and Fish Commission, personnel communication). It is unknown if sires were transient individuals or male cubs released as neonates and matured to breeding age, but any natural reproduction within release areas is the ultimate goal. In addition, continued habitat restoration and management within the RRC should be a priority, as should public outreach.

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APPENDIX 1. TREE SPECIES AND MAST CLASSIFICATION

Species and mast classification of trees encountered on vegetation plots sampled within the home ranges of female Louisiana black bears relocated to Red River Wildlife Management Area, Concordia Parish, Louisiana during March 2001.

Common name	Scientific name	Mast value
American elm	*Ulmus americana*	No value
bald cyperus	*Taxodium distichum*	No value
black gum	*Nyssa sylvatica*	Soft
black willow	*Salix nigra*	No value
ashleaf maple	*Acer negundo*	No value
deciduious holly	*Ilex decidua*	Soft
green ash	*Fraxinus americana*	No value
hawthorn spp.	*Crataegus* spp.	Soft
honey locust	*Gleditsia triacanthos*	Soft
live oak	*Quercus virginiana*	Hard
Nutall oak	*Quercus nutallii*	Hard
overcup oak	*Quercus lyrata*	Hard
pecan	*Carya illinoensis*	Hard
persimmon	*Diospyros virginiana*	Soft
red maple	*Acer rubrum*	No value
red oak	*Quercus rubra*	Hard
Shumard oak	*Quercus shumardii*	Hard
sugarberry	*Celtis laevigata*	Soft
swamp dogwood	*Cornus stricta*	Soft
swamp privet	*Forestiera acuminata*	Soft
sweet gum	*Liquidambar styraciflua*	No value
tupelo gum	*Nyssa aquatica*	Soft
water elm	*planera aquatica*	No value
water hickory	*Carya aquatica*	Hard
willow oak	*Quercus lyrata*	Hard
winged elm	*Ulmua alata*	No value
pine sp.	*Pinus sp.*	No value

APPENDIX 2. PLANT TAXA ENCOUNTERED ON LINE INTERCPET

Categorical designation of plant taxa encountered while performing line intercept transects at used and random locations within the home ranges female Louisiana black bears released on Red River Wildlife Management Area, Concordia Parish, Louisiana during March 2001.

Scientific name	Line Intercept Designation
Acaktpha virginia	Forb
Acer rubrum	Woody
Albizia julibrissin	Woody
Alopecurus carolinianus	Grass
Althernanthera philoceroides	Forb
Ambrosia sp.	Forb
Ammania coccinea	Forb
Ampelopsis arborea	Vine
Andropogon virginicus	Grass
Asclepias sp.	Forb
Aster spp.	Forb
Berchemia scandens	Vine
Bidens sp.	Forb
Boehmeria cylindrica	Forb
Botrychum virginea	Forb
Brunnichia cirrhosa	Vine
Bumbelia sp.	Soft Mast
Callicarpa americana	Soft Mast
Campis radicans	Vine
Caperonia palustris	Forb
Carduus sp.	Forb
Carex spp.	Grass
Carya aquatica	Hard Mast
Carya illinoenis	Hard Mast
Carya sp.	Hard Mast
Celtis laevigata	Soft Mast
Cephalanthus occidentalis	Woody
Clematis crispa	Forb
Cnidoscolus stimulosus	Forb
Cocculus carolinus	Vine
Commelina sp.	Forb
Cornus stricta	Soft Mast
Crataegus spp.	Soft Mast
Cucumis melo	Vine
Cymoscidium digitatum	Forb
Cyndon dactylon	Grass
Daucus carota	Forb
Dicanthelium sp.	Grass
Digitaria sp.	Grass
Dioda teres	Forb
Diospyros virginiana	Soft Mast
Echinchloa colonum	Grass
Eclipta prostrata	Frob
Erigeron sp.	Grass
Eupatorium sp.	Forb
Forestiera acuminata	Soft Mast

(table continued)

(table continued)

Scientific name	Line Intercept Designation
Fraxinus pennsylvanica	Woody
Galium sp.	Forb
Glycine max	Bear Crop
Gossypium hirsutum	Other Crop
Hemerocallis fluva	Frob
Heteranthera sp.	Frob
Hibiscus sp.	Forb
Hydrocotyle sp.	Forb
Ilex decidua	Soft Mast
Ipomoea sp.	Forb
Juncus effusus	Frob
Lactuca sp.	Forb
Leersia oryziodes	Grass
Liquidamber styraciflua	Woody
Lolium sp.	Grass
Lonicera sp.	Vine
Mikania scandens	Forb
moss	Forb
Nyssa spp.	Soft Mast
Obolaria virginica	Forb
Oryza sativa	Other Crop
Panicum sp.	Grass
Parthenocissus quinquefolia	Vine
Paspallum sp.	Grass
Passiflora incarnata	Forb
Phytolacca americana	Soft Mast
Planera aquatica	Woody
Polygonum sp.	Forb
Polypodium polypodioides	Forb
Quercus lyrata	Hard Mast
Quercus nuttallii	Hard Mast
Quercus phellos	Hard Mast
Quercus sp.	Hard Mast
Ramunculus sp.	Forb
Rubus spp.	Vine
Rumex sp.	Forb
Sabal minor	Soft Mast
Salanum americanum	Forb
Salix spp.	Woody
Saururaceae cernuus	Forb
Senna obtusifolia	Forb
Sida rhombifolia	Forb
Smilax spp.	Vine
Solanum carolinense	Forb
Solidago spp.	Forb
Sorghastrum spp.	Grass
Sorghum vulgare	Bear Crop
Toxicodendron radicans	Vine
Trachelospermum spp.	Vine
Tragia sp.	Forb
Triticum aestivum	Bear Crop
Ulmus alata	Woody
Ulmus americana	Woody

(table continued)

(table continued)

Scientific name	Line Intercept Designation
Viola sp.	Forb
Vitus spp.	Vine
Wisteria frutescens	Forb
Zea mays	Bear Crop

APPENDIX 3. RED RIVER WMA SURVEY

Surveys administered to hunters at Red River and Three Rivers Wildlife Management Areas, Concordia Parish, Louisiana during October-November 2001 and 2002.

Louisiana Black Bear Restoration Project-
Voluntary Hunter Survey

1. Are you aware that female Louisiana Black Bears with cubs have been released on Red River WMA ?
   1. YES
   2. NO

2. Where was the first place you heard about this project ?
   1. Public Meeting
   2. State/Federal Wildlife Official
   3. Newspaper
   4. Sign or Poster
   5. Word of mouth
   6. This is the first I have heard of this project

3. What is the primary species you are hunting today ?
   1. Small game (rabbits and squirrel)
   2. Deer (archery)
   3. Deer (firearms)
   4. Waterfowl
   5. Doves
   6. Hogs
   7. Other ______________________

4. What other species do you hunt on Red River or Three Rivers WMA's ? (circle all answers that apply)
   1. Small game (rabbits and squirrel)
   2. Deer (archery)
   3. Deer (firearms)
   4. Waterfowl
   5. Doves
   6. Hogs
   7. Other ______________________

5. How do you feel about black bears being restored to this area ?
   1. I STRONGLY AGREE with the program and support it fully
   2. I AGREE with the program but feel there are some problems
   3. I have NO OPINION about the project and am NEUTRAL
   4. I DISAGREE with the restoration project but feel there are some good points
   5. I STRONGLY DISAGREE with the restoration program and oppose it fully

6. Do you hunt in any other areas where black bears are present ?
   1. YES
   2. NO

7. Are you concerned about hunting in areas where black bears are present ?
   1. YES
   2. NO

8. Would you like to see more black bears in Louisiana?
   1. YES
   2. NO
   3. NO OPINION

9. Do you know that the Louisiana Black Bear is a Federally Threatened Species and protected by State and Federal law ?
   1. YES
   2. NO

10. What do you feel you may personally gain from black bear reintroductions in this area ?
    1. I would like to see a black bear in the wild
    2. I will have the satisfaction of knowing that bears are using this area once again
    3. An important part of the wildlife community had been restored and Louisiana's natural beauty enhanced
    4. My children or grandchildren may someday see a black bear in this area
    5. There may again be a hunting season on bears in Louisiana
    6. No Opinion
    7. Other______________________

11. What animal do you feel a black bear's eating habits most closely resembles?
    1. Wolf (Fresh Meat Only)
    2. Otter (Fish)
    3. Deer (Grass and Twigs)
    4. Raccoon (Nuts, Berries, and any thing else it can find)
    5. Humans

12. What State and Parish or County are you from?

    State____ Parish or County________

13. What is your age ? ______________ years old

14. How long have you hunted ? ____________ years

15. What is the highest level of schooling you have completed ?
    1. Grade School
    2. High School
    3. Some College or Post High School
    4. Vocational or Technical School
    5. Bachelors Degree
    6. Graduate Degree

16. What size community do you live in now ?
    1. Farm
    2. Rural, Non-farm
    3. Small Town (2,500 or less people)
    4. Small City (2,500-50,000 people)
    5. Large City (50,000 + people)

17. What is your gender ?
    1. Female
    2. Male

(front)

LOUISIANA STATE UNIVERSITY
Forestry Wildlife and Fisheries

Dear Louisiana Hunter,

This survey is to help us determine your understanding and opinion about the black bear restoration project, which has begun on Red River and Three Rivers WMA's. It is a voluntary survey, but any information you can provide will aid future decisions regarding this issue. All answers will be kept confidential, and you are not required to include your name or any other information you do not feel comfortable disclosing. Please circle only one answer unless otherwise indicated. Feel free to include any comments you have about the project or survey in the space provided. We ask that only hunter ages 18 and over participate. If you have any questions about the project please contact the Louisiana Department of Wildlife and Fisheries Ferriday, LA office (318) 757-4571 or Tensas River National Wildlife Refuge (318) 574-2664. If you have questions about this survey contact Louisiana State University, School of Forestry, Wildlife, and Fisheries (225) 578-7718. We appreciate your assistance and please remember that bears have been released in the area.

LSU AgCenter Research & Extension

Thank you for your time, if you have any additional comments please feel free to write them in the free space below. Please place surveys in SELF CLEARING PERMIT BOXES located at check stations or at the RED RIVER HEADQUARTERS.

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APPENDIX 4. LAKE OPHELIA NWR SURVEY

Surveys administered to hunters on Lake Ophelia National Wildlife Refuge, Avoyelles Parish, Louisiana during December 2002 and January 2003.

Louisiana Black Bear Restoration Project- Voluntary Hunter Survey

1. Are you aware that female Louisiana Black Bears with cubs may be released on Lake Ophelia NWR ?
   1. YES
   2. NO

2. Where was the first place you heard about this project ?
   1. Public Meeting
   2. State/Federal Wildlife Official
   3. Newspaper
   4. Sign or Poster
   5. Word of mouth
   6. This is the first I have heard of this project

3. What is the primary species you are hunting today ?
   1. Small game (rabbits and squirrel)
   2. Deer (archery)
   3. Deer (firearms)
   4. Waterfowl
   5. Doves
   6. Hogs
   7. Other ____________________

4. What other species do you hunt on Lake Ophelia NWR's ? (circle all answers that apply)
   1. Small game (rabbits and squirrel)
   2. Deer (archery)
   3. Deer (firearms)
   4. Waterfowl
   5. Doves
   6. Hogs
   7. Other ____________________

5. How do you feel about black bears being restored to this area ?
   1. I STRONGLY AGREE with the program and support it fully
   2. I AGREE with the program but feel there are some problems
   3. I have NO OPINION about the project and am NEUTRAL
   4. I DISAGREE with the restoration project but feel there are some good points
   5. I STRONGLY DISAGREE with the restoration program and oppose it fully

6. Do you hunt in any other areas where black bears are present ?
   1. YES
   2. NO

7. Are you concerned about hunting in areas where black bears are present ?
   1. YES
   2. NO

8. Would you like to see more black bears in Louisiana?
   1. YES
   2. NO
   3. NO OPINION

9. Do you know that the Louisiana Black Bear is a Federally Threatened Species and protected by State and Federal law ?
   1. YES
   2. NO

10. What do you feel you may personally gain from black bear reintroductions in this area ?
    1. I would like to see a black bear in the wild
    2. I will have the satisfaction of knowing that bears are using this area once again
    3. An important part of the wildlife community had been restored and Louisiana's natural beauty enhanced
    4. My children or grandchildren may someday see a black bear in this area
    5. There may again be a hunting season on bears in Louisiana
    6. No Opinion
    7. Other____________________

11. What animal do you feel a black bear's eating habits most closely resembles?
    1. Wolf (Fresh Meat Only)
    2. Otter (Fish)
    3. Deer (Grass and Twigs)
    4. Raccoon (Nuts, Berries, and any thing else it can find)
    5. Humans

12. What State and Parish or County are you from!

    State____ Parish or County________

13. What is your age ? ______________ years old

14. How long have you hunted ? ______________ years

15. What is the highest level of schooling you have completed ?
    1. Grade School
    2. High School
    3. Some College or Post High School
    4. Vocational or Technical School
    5. Bachelors Degree
    6. Graduate Degree

16. What size community do you live in now ?
    1. Farm
    2. Rural, Non-farm
    3. Small Town (2,500 or less people)
    4. Small City (2,500-50,000 people)
    5. Large City (50,000 + people)

17. What is your gender ?
    1. Female
    2. Male

(front)

LOUISIANA STATE UNIVERSITY
Forestry Wildlife and Fisheries

Dear Louisiana Hunter,

This survey is to help us determine your understanding and opinion about the black bear restoration project, which has begun on Red River and Three Rivers WMA's. It is a voluntary survey, but any information you can provide will aid future decisions regarding this issue. All answers will be kept confidential, and you are not required to include your name or any other information you do not feel comfortable disclosing. Please circle only one answer unless otherwise indicated. Feel free to include any comments you have about the project or survey in the space provided. We ask that only hunter ages 18 and over participate. If you have any questions about the project please contact the Lake Ophelia National Wildlife Refuge (318) 253-4238. If you have questions about this survey contact Louisiana State University, School of Forestry, Wildlife, and Fisheries (225) 578-7718.

LSU AgCenter Research & Extension

Thank you for your time, if you have any additional comments please feel free to write them in the free space below.

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APPENDIX 5. BLACK BEAR SIGHTINGS AND SIGN

Sightings of bears and bear sign collected in the vicinity of Red River Wildlife Management Area, Concordia Parish, Louisiana during 2001-2002.

Date	Animal*	Comments	Observer
5/25/2001	980	Scat found near original den site. Scat comprised entirely of swamp privet.	KVW[1]
6/5/2001	980	Female and 3 cubs observed in rice fields on Angelina Farms, near Cocodrie Bayou.	Farm Hands
6/14/2001	800	Tracks and scat of female found along north border of Red River WMA.	KVW
6/24/2001	800	Female and cub observed in wheat field on Angelina farm between 4/30-5/3/2001.	Farm Hands
6/29/2001	800	Tracks found in drain between corn fields.	KVW
7/14/2001	300	Female with 2 cubs observed near Green's Bayou on Angelina Farm in milo field.	Farm Hands
6/30/2001	300	Female with 2 cubs observed near Green's Bayou on Red River WMA.	Loggers
8/2/2001	300	Female with 2 cubs observed along western edge of Angelina Farm between 7/20-7/30/2001.	Farm Hands
8/2/2001	300	Female with 2 cubs observed on Angelina farm in milo field, north of Red River WMA.	Farm Hands

(table continued)

(table continued)

Date	Animal*	Comments	Observer
	300	Female and 2 cubs observed in milo field at edge of Red River WMA and Angelina Farm.	KVW
9/3/2001	Unknown	Bear with red radio-collar sighted in milo field south of Shaw, probably from Moganza population.	Hunter
9/14/2001	Unknown	Bear observed around Cocodrie Bayou low water crossing on Angelina farm.	Farm Hands
9/21/2001	Unknown	Scat found near Cocodrie Bayou low water crossing on Angelina farm.	WW[2]
9/30/2001	Unknown	Bear eating waste corn on Angelina farm.	Farm Hands
10/4/2001	980	Bear sighted near Cocodrie Bayou bridge on Angelina farm, signal heard in vicinity of sighting.	Farm Hands
10/5/2001	800	Tracks of female and cub sighted on Womack hunting club.	WW
10/15/2001	Unknown	Collared bears sighted in Lettsworth at corn feeder	Hunter
10/23/2001	800	Bear with orange collar and eartags sighted, corn feeder destroyed.	WW

(table continued)

(table continued)

Date	Animal*	Comments	Observer
10/21/2001	Unknown	Possible bear cub sighted on Red River WMA along Green's Bayou.	LDWF [3]
11/2/2001	980	Scat found near a vegetation plot along Cocodrie Bayou.	KVW
11/17/2201	800	Bear observed east of Maria Plantation, no cubs.	Hunter
11/25/2001	Unknown	Tracks sighted in Dismal Swamp on Red River WMA.	Hunter
1/6/2002	300	Female and 1 cub sighted feeding on deer carcass on Red River WMA, Twin Lakes region.	Hunter
4/11/2002	980	Scat and feeding signs along Cocodrie Bayou near bridge on Angelina farm.	KVW
4/27/2001	980	Scat found along Cocodrie bayou on Angelina farm, near wheat fields.	KVW
6/27/2002	800	Female observed crossing power line on Maria Plantation.	KVW
6/27/2002	Unknown	Tracks found in rice field on Maria Plantation.	Farm Hands
7/1/2002	800	Female crossed ATV trail south of Maria Plantation.	KVW
7/9/2002	800	Female sighted on Cocodrie Bayou NWR.	KVW

(table continued)

(table continued)

Date	Animal*	Comments	Observer
7/22/2002	980	Sighted crossing vegetation plot with 2 cubs.	KVW
7/29/2002	Unknown	Bear crossed Hwy 565 at night, reported to sheriff, and could not have been 800 or 980.	Resident
7/30/2002	Unknown	Large tracks sighted on property east of Angelina farm, could not have been 800 or 980.	Farm Hands
8/7/2002	980	Scat collected on road south of Cocodrie Bayou on Angelina farm.	KVW
8/19/2002	980	Female and at least 1 cub sighted in north section of Red River WMA.	LDWF
8/29/2002	Unknown	Bear sighted in corn field on Angelina farm near Cocodrie Bayou. Not collared, both collared females located in other parts of farm same day.	Farm Hands
11/29/2002	Unknown	Tracks found on lower half of Three Rivers WMA.	Hunter
11/29/2002	Unknown	Bear sighted in October during small game season on Three Rivers WMA.	Hunter
12/4/2002	Unknown	Bear with 2 cubs of the year sighted on Cocodrie Bayou NWR, Brooks Break Unit. Female stood and scratched her back on tree.	Hunter
12/18/2002	Unknown	Bear observed on Lake Ophelia NWR near Dooms Lake section, approached within 10 yards.	Hunter
12/20/2002	Unknown	Bear cub climbed down tree on Red River WMA, Old North fence line estimated at 70lbs.	Hunter

* Animal associated with sighting from telemetry information
[1] K. Van Why, Louisiana State University
[2] W. Wilson, Louisiana State University
[3] Louisiana Department of Wildlife and Fisheries Person

VITA

Kyle Ryan Van Why was born in East Stroudsburg, Pennsylvania, on 23 July 1975, to Larry H. and Betty Ann Van Why. He grew up in the Pocono Mountains learning to appreciate the outdoors from his farther and grandfather, Harold Van Why. He graduated from East Stroudsburg High School in 1993, and traveled to western Pennsylvania to attend California University of Pennsylvania. While there he became interested in carnivore populations and worked on an independent project analyzing fisher diet as a senior. In 1997 he graduated with a Bachelor of Science in Wildlife Biology.

After graduation he worked for a variety of organizations as a wildlife technician. His first job in this field was with the Kansas Department of Wildlife and Parks working on Northern bobwhite. He also worked as a technician for Max McGraw Wildlife Foundation, the North Carolina Wildlife Resource Commission, and the University of Missouri in the years that followed. In 1999 he returned to work for the Kansas Department of Wildlife and Parks and extended his stay in Kansas to work with the Kansas Cooperative Fish and Wildlife Research Unit. He continued his interest in carnivore ecology, and in January of 2001 he was offered a position at Louisiana State University working on the Louisiana black bear with Dr. Michael Chamberlain. While at Louisiana State University Kyle was awarded grants from both the Boone and Crockett and Pope and Young Clubs for research concerning the Louisiana black bear. The degree of Master of Science in wildlife will be awarded during summer 2003.