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Seasonal space use, habitat preference and survival of female wild turkeys in a Louisiana bottomland hardwood forest

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SEASONAL SPACE USE, HABITAT PREFERENCE AND SURVIVAL OF FEMALE WILD TURKEYS IN A LOUISIANA BOTTOMLAND HARDWOOD FOREST

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ABSTRACT

Female wild turkeys (*Meleagris gallopavo*) were captured and radio-marked in a bottomland hardwood forest in south-central Louisiana. Turkeys were monitored using radio telemetry from fixed points on Sherburne Wildlife Management Area, Atchafalaya National Wildlife Refuge, and Bayou des Ourses to observe seasonal patterns of space use, habitat preference and survival from 2002-04.

The largest mean seasonal home range of 902.87 ha occurred during preincubation (15 Feb – 9 Apr; n = 24) when females typically search for suitable nest sites, and the smallest mean seasonal home range was 434.12 ha, during brood-rearing (1 Jun – 30 Sep; n = 32) when movement was limited by poults. Abundant herbaceous plant communities, resulting from mild winters likely allowed reduced home ranges (621.84 ha) during fall-winter (1 Oct – 14 Feb; n = 18), whereas limited nest sites increased space use during preincubation. Low nest initiation likely contributed to relatively large home ranges (495.91 ha) observed during incubation (10 Apr – 31 May; n = 25).

Upland and lowland forests were selected by females when selecting home ranges, relative to habitat availability on the study area [1st order selection]. Lowland forest was selected during fall-winter, whereas upland forest was selected during the remainder of the year. Water-based forest, upland forest and openings were selected in core areas relative to habitats available in the home range [2nd order selection]. Openings were important during fall-winter and brood-rearing, whereas upland forest was selected during preincubation and water-based forest was preferred during incubation. Females consistently used water-based forest relative to habitat availability in their home ranges throughout the year [3rd order selection].

Mean annual survival was 0.59 from 6 March 2001 to 27 August 2004. Seasonal survival was greatest during preincubation (1.00) potentially due to increased habitat sampling and movement during this time period. Fall-winter survival was high (0.95), likely from mild winter climate and abundant herbaceous vegetation. Lowest survival occurred during incubation (0.80) and brood-rearing (0.85), primarily as a result of increased risks of predation associated with nesting and foraging broods.

CHAPTER 1
INTRODUCTION

The wild turkey (*Meleagris gallopavo*) was abundant throughout the southeastern United States at the time of European colonization (Kennamer et al. 1992; Dickson 2001). Due to unregulated hunting and habitat loss, turkey numbers began to decline until the late 1930s, when populations were at an all-time low. After World War II, restoration efforts began, but were largely unsuccessful until the cannon net (Austin 1965) made it possible to capture and relocate wild birds. Now, the wild turkey occupies 49 states, including 10 states where it was not historically present.

In national surveys the total number of hunters has declined 7% from 1991 to 2001, but turkey hunters have increased 46% (http://library.fws.gov/nat_survey2001_trends.pdf). In Louisiana, there are an estimated 20,000 turkey hunters (Fred Kimmel, LDWF, pers. comm.), and many public wildlife management areas must hold turkey hunting lotteries because of hunting pressure. Due to the wild turkey's increased popularity, even in areas where they were scarce or extirpated as recently as the mid-20th century (Van Why et al. 2001), it is important to fully understand their ecology so that managers can implement the most effective population and habitiat management strategies.

The economic impact of increased turkey populations make further research into the ecology of this species a worthy investment. Grado et al. (1997) estimated that in 1996, turkey hunters spent over $16 million on supplies, equipment, taxidermists, magazines and National Wild Turkey Federation (NWTF) memberships in Mississippi alone. Additionally, over $11 million in revenue were generated in 1996 by turkey hunters in Mississippi. Due to the 1937 Pittman Robertson Act, which established an

11% excise tax on hunting equipment and ammunition, millions of dollars from these expenditures were generated for state wildlife restoration projects (Kennamer et al. 1992).

In Louisiana, hunting leases and publicly owned wildlife management areas are ecologically vital for both game and non-game species. Habitat managed specifically for turkeys on these lands also can benefit other wildlife species, because hunting indirectly benefits non-game species by preserving undeveloped habitat. Therefore, improved understanding of turkey ecology could lead to better management techniques, resulting in more beneficial habitats for other game and non-game species in addition to turkeys. On public land, increased attention gained from both consumptive and non-consumptive users of wildlife due to improved turkey management could increase revenues for conservation and future research through hunting licenses and conservation stamps.

Bottomland hardwood forests historically dominated alluvial areas of the Southeast. Conversion of land for agriculture, urbanization and hydrological alteration has eliminated most of these stands (Reinecke et al. 1989; Twedt and Loesch 1999; Stanturf et al. 2001). The Wetland Reserve Program (WRP) and Conservation Reserve Program (CRP) are increasing the amount of bottomland hardwood forest in Louisiana by creating incentives for landowners to reforest agricultural land (Mitsch and Gosselink 2000). Consequently more of this land-type will be available to wildlife, including turkeys, as stands mature. It is therefore imperative that managers have detailed information on turkey ecology in bottomland systems to make informed decisions in the future.

STUDY AREA

Research was conducted on a 17,243 ha tract (hereafter Sherburne) of bottomland hardwood forest in Iberville, St. Martin, and Point Coupee Parishes, Louisiana, located in the Atchafalaya floodway system. Soils were poorly-drained and alluvial in nature, consisting of occasionally flooded Convent, Fausse and Sharky series (Spicer et al. 1977, Murphy et al. 1977, Powell et al. 1982). Sherburne included Sherburne Wildlife Management Area (4,767 ha) owned by the Louisiana Department of Wildlife and Fisheries (LDWF), Bayou des Ourses (6,317 ha) owned by the United States Army Corps of Engineers, and the Atchafalaya National Wildlife Refuge (6,159 ha) owned by the U. S. Fish and Wildlife Service. Additionally, there were approximately 770 ha of private lands interspersed throughout the state and federal lands. Sherburne was bordered on the north by Highway 190, on the south by Interstate-10, on the west by the Atchafalaya River, and on the east by the East Protection Guide Levee.

Sherburne was approximately 87% forested, 11% openings and 2% open water. There were 4 primary stand types: cottonwood-sycamore, oak-gum-sugarberry-ash, willow-cypress-ash, and overcup oak-bitter pecan (http://www.wlf.state.la.us). Due to logging practices of previous landowners, specifically high-grading, relatively few hard mast producing species were found away from riparian zones or sites where persistent flooding makes logging practices difficult. Although much of the area was logged extensively in the 1950's, many areas have not received additional logging disturbance due to a change in land ownership (Walter Stokes, Bennett and Peters Inc., pers. comm.). More recent logging practices included seed tree cuts and individual selection cuts aimed at releasing dominant canopy species regeneration and increasing stand diversity (Wayne Higginbotham, LDWF, pers. comm.).

Individual overstory species most commonly found on Sherburne were eastern cottonwood (*Populus deltoids* Marshall; Plant nomenclature follows Godfrey and Wooten 1982), American sycamore (*Platanus occidentalis* L.), willow oak (*Quercus phellos* L.), water oak (*Q. nigra* L.), overcup oak (*Q. lyrata* Walter), delta post oak (*Q. similis* Ashe), Nuttall oak (*Q. texana* Buckley), live oak (*Q. virginiana* Miller), diamondleaf oak (*Q. laurifolia* Michaux), American elm (*Ulmus Americana* L.), winged elm (*U. alata* Michaux), sweetgum (*Liquidambar styraciflua* L.), sugarberry (*Celtis laevigata* Willd), green ash (*Fraxinus pennsylvanicus* Marshall), black willow (*Salix nigra* Marshall), baldcypress (*Taxodium distichum* (L.) Richard), bitter pecan (*Carya aquatica* (Michaux f.) Nuttall), water tupelo (*Nyssa aquatica* L.), and honey locust (*Gleditsia triacanthos* L.). Midstory was composed primarily of boxelder (*Acer negundo* L.), Drummond red maple (*A. rubra* var. drummondii (H. & A.) Sargent), black cherry (*Prunus serotina* Ehrhart), red mulberry (*Morus rubra* L.), tallowtree (*Triadica sebifera* (L.) Small) and rough-leaf dogwood (*Cornus drummondii* C. A. Meyer), with regeneration of the canopy species also present. Understory was relatively sparse because of shading and annual persistent flooding. Common understory species included jumpseed (*Tovara virginiana* (L.) Raf.), yellowtop (*Senecio glabellus* Poiret), rattan vine (*Berchemia scandens* (Hill) K. Koch), greenbrier (*Smilax spp*. L.), blackberry (*Rubus spp*. L.), bedstraw (*Gallium spp*. L.), horsetail (*Equisetum hyemale* L.), trumpet creeper (*Campsis radicans* (L.) Seemann), Virginia creeper (*Parthenocissus quinquefolia* (L.) Planchon), wild carrot (*Daucus carota* L.), stinging nettle (*Urtica chamaedryoides* Pursh), poison ivy (*Toxicodendron radicans* L.) and southern shield fern (*Thelypteris kunthii* (Desv.) Morton). Wildlife food plots dominated forest openings and were

comprised primarily of brown top millet (*Panicum ramosum* L.), wheat (*Triticum* spp. L.) or sunflowers (*Helianthus* spp. L.). The remaining openings consisted of rights-of-way, levees, or natural regeneration from forest cuts. Dominant species in these openings were Johnsongrass (*Sorghum halepense* (L.) Persoon), ragweed (*Ambrosia* spp. L.), black-eyed susan (*Rudbeckia* spp. L.), ryegrass (*Lolium multiflorum* Lam.), goldenrod (*Solidago* spp. L.), beefsteak (*Perilla frutescens* (L.) Britton), teaweed (*Sida rhombifolia* L.) and blackberry.

In addition to the diverse flora, 206 species of birds have been observed on Sherburne, which is managed in part for turkeys. This list includes many species of concern in Louisiana (http://migratorybirds.fws.gov/reports/BCC02/BCC2002.pdf), such as painted bunting (*Passerina ciris*), Swainson's warbler (*Limnothlypis swainsonii*), and swallow-tailed kite (*Elanoides forficatus*). The many water features on Sherburne made it desirable for a diversity of mammals and herpetofauna also.

METHODS

Female wild turkeys were captured at bait sites from mid June to mid August 2001 – 2004 using rocket nets (Bailey et al. 1980). Bait sites (n = 6 – 25) were established in openings and rights-of-way by mowing and laying a 1 x 2 m patch of river silt to facilitate detection of tracks 2m from the rear of the site where the net was placed. A strip along the rear of the plot was cleared to prevent snagging of the net. When the surrounding vegetation was open, obstacles were placed immediately behind the site to discourage turkeys from approaching from the rear of the site. Cracked corn was placed on the river silt, and sites were checked for activity at midday and in the evening. When it became evident that non-target species were responsible for bait removal, sites were checked in early morning. Bait sites were considered active after being visited by $\geq$1

turkey on 2 consecutive days. After the second visit, a net was placed at the rear of the site and camouflaged with grass clippings, or leaf litter from the surrounding area. An observation blind was then placed near the bait site and camouflaged with branches and other vegetation. Captured females were hooded to reduce capture stress, weighed, aged, and marked with a leg band on the left leg. Females also were fitted with 75-105g (≤ 3% body weight) radio-transmitters (Advanced Telemetry Systems, Insanti, Minnesota, USA) with a 12-hour delay mortality switch. Transmitters were affixed backpack-style (Chamberlain et al. 2000), using shock-cord (Roberts and Porter 1996). If multiple turkeys were captured, they were placed in appropriately-sized boxes until they could be processed. All birds were released at the capture site.

A hand-held 3-element Yagi antenna and a Telonics T-2 receiver (Telonics Inc., Mesa, Arizona, USA) were used to locate radio-marked females. Locations were obtained using triangulation (Cochran and Lord 1963) from 2 – 6 fixed telemetry stations (n = 115), within a 20 minute interval to minimize error from movement. Additionally, sightings of specific females were used as locations. Locations were recorded from 6 March 2001 – 12 June 2001 and from 11 February 2002 – 27 August 2004. Females were located ≥ 3 times a week from mid August to late December and ≥ 1 time each day the rest of the year. Universal Transverse Mercator (UTM) coordinates in map datum NAD83 were obtained with a global positioning system (GPS) when a female was sighted. LOCATE II (Pacer; P. O. Box 641, Truro, Nova Scotia B2N5E5) was used to obtain UTM coordinates on all other locations.

Telemetry error was estimated by comparing azimuths of "dummy" radios (n = 52) in known locations to the true azimuth. Dummy radios were placed at similar height

and orientation of a live female to minimize error. Observers locating dummy radios did not know their location, and average angle error was ± 7.7°.

Monitoring periods were divided into 4 biologically meaningful seasons: preincubation, incubation, brood-rearing and fall-winter (Chamberlain et al. 2000). Preincubation extended from the breakup of winter flocks until initiation of incubation for each reproductive female. The earliest recorded incubation was set as the end of preincubation for non-reproductive females. Incubation ended when broods left the nest, or 31 May for non-reproductive females. Brood-rearing and fall-winter were identical for both reproductive and non-reproductive females (Table 1).

Table 1. Season dates for reproductively active and inactive female wild turkeys on Sherburne Wildlife Management Area, Atchafalaya National Wildlife Refuge and Bayou des Ourses from 2001-04.

	Reproductively Active		Reproductively Inactive	
Season	Beginning	End	Beginning	End
Fall-Winter	1 October	14 February	1 October	14 February
Preincubation	15 February	Incubation	15 February	9 April
Incubation	Incubation	Nest Termination	10 April	31 May
Brood-Rearing	Nest Termination	30 September	1 June	30 September

CHAPTER 2
SPACE USE

Space use can index habitat quality for many species (Fisher 2000; Ratcliffe and Crowe 2001) and within populations. Individuals in low quality habitat generally require larger home ranges to obtain critical resources than individuals in high quality habitat (Pasinelli 1999). Space use can be explained by many factors, such as season (Smith and Teitelbaum 1986; Wiktander et al. 2001), food availability (Fisher 2000), and distribution of preferred habitat features (Marzluff et al. 2004). Additionally, natural events such as flooding can alter space use and drastically affect individual movements (Cobb et al. 1993; Cobb and Doerr 1997).

Bottomland hardwood forests (BLH) have been considered high quality habitat for wild turkeys (Dickson 1992). These systems are subject to various environmental extremes, such as flooding, that do not normally affect turkeys in other systems. It is important to document space use to better understand turkey ecology in BLH, and to make inferences about habitat quality across seasons for birds in BLH relative to other systems in the southeast. Although space use patterns of wild turkeys in upland areas are well understood little research has been conducted in BLH (Cobb et al. 1993; Cobb and Doer 1997), and estimates of space use in BLH are absent from the literature. Therefore the objective of this chapter was to assess seasonal space use of female wild turkeys in a bottomland hardwood forest.

METHODS

Radio telemetry was used to obtain locations, as described in chapter 1. Triangulated locations were imported into ArcView 3.2 (ESRI, Redlands, California USA) and converted to point themes. Area observation curves were performed on 5

females to determine the number of locations needed to obtain accurate estimates of space use. Only females with ≥ 20 locations in a season were used for space use analysis. Kernel density home ranges (95%) and core areas (50%) for eligible females in each season were calculated with the Animal Movement extension (Hooge and Eichenlaub 1997) in ArcView. One-way analysis of variance (ANOVA) was used to detect variations in space use across seasons using SAS V8 (SAS Institute 1996).

RESULTS

Ninety-nine home ranges and core areas were obtained on 32 females from 6 March 2001 to 12 June 2001, and from 11 February 2002 to 27 August 2004. The sample size and average size of seasonal home ranges and core areas detected (± standard error) are reported below (Table 2).

Table 2. Average seasonal home range and core area size (ha) from radio-marked female wild turkeys on Sherburne Wildlife Management Area (LDWF), Atchafalaya National Wildlife Refuge (USFWS), and Bayou des Ourses (USACE), Louisiana, USA, from 2001-04.

	n	HR[1] Size	HR Standard Error	CA[2] Size	CA Standard Error
Preincubation	24	902.87	146.48	145.69	35.19
Incubation	25	495.91	141.79	72.91	21.23
Brood-rearing	32	434.12	34.31	60.68	6.19
Fall-winter	18	621.84	103.43	102.62	18.19

[1] Home Range
[2] Core Area

Home ranges ($F_{3/92}$ = 4.06, P = 0.0093) and core areas ($F_{3/92}$ = 3.39, P = 0.0213) differed by season, with largest ranges during preincubation and smallest during brood-rearing. Ranges during preincubation were consistently larger than incubation and brood-rearing. Mean home range and core area for reproductively successful females during

incubation was 15.39 ± 12.95 and 2.456 ± 1.56 ha, respectively. Successful females were pooled with unsuccessful females due to small sample size (n = 3).

DISCUSSION

There are many inconsistencies in space use research. Results of space use estimations differ according to methods used, even when used on the same data set (Woodruff and Keller 1982). Additionally, many studies have only reported annual home range, examined space use in response to a condition or event, or had limited data that covered only part of the year (Cobb et al. 1993; Peoples et al. 1995; Badyeav et al. 1996*a*). Due to the lack of standardized seasonality and methodology in space use studies, the reader must exercise caution when making comparisons between this and previous studies.

Females consistently used the largest spaces during preincubation. Portions of Sherburne consistently flooded during spring, coinciding with flood pulses on the Atchafalaya River. A result of these floods was a sparse understory that likely compromised nesting habitat during preincubation. Since searching for suitable nest sites drives movement during preincubation (Hon et al. 1979), it is intuitive that space use would be increased in an area with understory conditions similar to Sherburne. Beletsky and Orians (1987) theorized that increased space use could be beneficial to individuals with poor nesting habitat within their home ranges, and Cobb and Doerr (1997) found supporting evidence of increased space use on an area with few quality nest sites in North Carolina. In contrast, Badyaev et al. (1996*b*), and Chamberlain and Leopold (2000) found that females tended to maintain smaller home ranges during preincubation in areas with quality nest habitat, but those that moved the most within these spaces had the highest nest success. Because quality nesting habitat at Sherburne was likely limited,

females appeared to maintain larger home ranges during preincubation, contrary to Badyaev et al. (1996*b*), and Chamberlain and Leopold (2000).

The biological seasons used in this study were meant to group periods of similar habitat use together. Many studies have not isolated incubation, but instead used a non-biological spring season, consisting roughly of preincubation, incubation, and part of brood-rearing. Bidwell et al. (1989) and Bowman et al. (1979) used such seasons, and spring space use was largest in both of these studies. Because their spring seasons included the mid-March dispersal from the winter range, the preincubation nest searching, and a portion of brood-rearing, their results do not necessarily agree with the findings of this study.

Similar to preincubation, females maintained relatively large spaces during fall-winter, consistent with other studies that noted increased space use in winter (Smith and Teitelbaum 1986; Miller et al. 1997), likely related to food availability (Smith and Teitelbaum 1986). In a pine-dominated landscape, Palmer et al. (1996) found female turkeys were mainly located in bottomland hardwood forests associated with drainages during winter, likely to exploit hard mast found in these habitats. In this study, there were few hard mast producing trees due to previous land use practices on Sherburne. Since hard mast is an important winter food (Dickson 1992), relative lack of hard mast would likely increase space use during winter, similar to what has been observed in pine dominated landscapes (Palmer et al. 1996). However, presence of succulent vegetation during winter could allow females to maintain small home ranges relative to other areas due to availability of usable forage.

Generally, females would be expected to maintain smaller spaces and move less during nesting periods (Smith and Teitelbaum 1986; Chamberlain and Leopold 2000). However, poor nest success prevalent on Sherburne likely contributed to fewer restrictions of movements. In fact, the second largest seasonal home range and core area observed was for a female that never incubated a nest. Successful nesters that hatched at least one egg had small home ranges (15.39 ha), but sample size (n = 3) was small. Regardless, space use during incubation was small, partially because of females that did incubate nests. Space use during incubation was lower than other seasons because a small number of females were successful, and their space use contributed to observations for the population. However, at the population level, space use was considerably larger than in many previous studies (Speake et al. 1975; Everett et al. 1979; Smith and Teitelbaum 1986; Kurzejeski and Lewis 1990).

Space use during brood-rearing was likely influenced by resource availability and parental care responsibilities for brooding females. Brooding females generally restrict daily movements when young poults are present and frequently restrict their activities to localized sites offering quality brood habitat (Miller et al. 1997). Space use during Brood-rearing included reproductive (n = 7) and non-reproductive females (n = 25), because sample size was too small to allow partitioning. Although non-reproductive females could be expected to have larger home ranges than brooding females, mean brood-rearing home range was within the range of those previously reported (111 ha – 455 ha: Speake et al. 1975; Pack et al. 1980; Porter 1980; Peoples et al. 1996; Godfrey and Norman 1999). Large brood-rearing space use relative to other studies could be explained by post nest loss movements. When nest loss occurred, females typically

moved to a different area, presumably looking for a place to renest. If nest loss occurred late in incubation, these movements could have inflated brood-rearing space use for some individuals.

Reduced space use for non-reproductive females during brood-rearing could have been an artifact of ubiquitous foraging resources on Sherburne. Succulent vegetation and early successional herbaceous communities were widely available, likely allowing females to use small areas containing quality foraging. Alternatively, some non-reproductive females may attempt to decrease likelihood of experiencing a mortality event by associating with flocks (Jullien and Clobert 2000) containing broods, thereby subjecting themselves to movement restrictions. Additional research on behavior and interactions of reproductive and non-reproductive females is needed to fully understand space use during Brood-rearing.

CHAPTER 3
HABITAT PREFERENCE

BLH have been considered high quality habitat for wild turkeys (Dickson 1992). Much of the BLH in the southeast has been eliminated due to altered hydrology, agriculture and urbanization (Reinecke et al. 1989; Twedt and Loesch 1999; Stanturf et al. 2001;). Restoration of BLH has been made possible through conservation efforts such as the Wetland Reserve Program and the Conservation Reserve Program (Mitsch and Gosselink 2000). As stands produced by these programs mature, it will become increasingly important to understand turkey habitat preference in BLH. For biologists to most effectively manage turkey populations in these areas, it is vital to understand seasonal habitat selection.

Habitat selection influences a variety of population parameters such as reproductive success (Seiss et al. 1990; Badyaev 1996*b*; Chamberlain and Leopold 1998; Miller et al. 2000) poult survival, and adult survival (Roberts et al. 1995; Vangilder and Kurzejeski 1995; Godfrey and Norman 1999). Many published habitat studies have treated BLH as a single habitat-type within a mixture of other habitats (Phalen et al. 1986; Williams et al. 1997). Notably, there have been few studies examining habitat selection of wild turkeys in bottomland hardwood forests (BLH), of which none have been published (Hyde 1970; Savage 1977; Kimmel 1984; Chamberlain 1995). Hence there is a poor understanding of habitat selection of wild turkeys in BLH.

Compositional analysis is a common method of assessing resource use in wildlife populations (Aebischer et al. 1993) by examining percent use of habitat-types relative to their availability. It has become an important tool because it can be used to differentiate resource use at multiple scales or among groups such as sex or age cohorts. Recently,

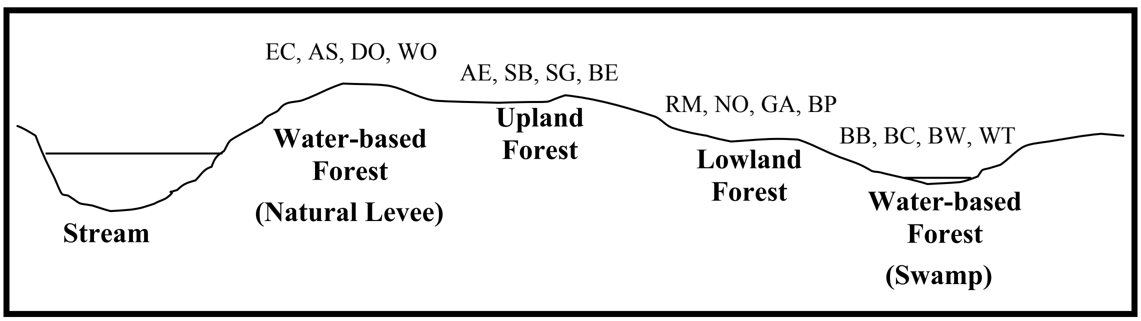
there has been some debate over the validity of this method of resource use analysis due to possible inflation of type I error (Bingham and Brennan 2004). The objectives in this chapter were to gain an understanding of seasonal habitat use in female wild turkeys in a bottomland hardwood forest, and to perform a base-line evaluation of compositional analysis on wild turkey females in Sherburne using recommendations intended to minimize risk of type I error.

METHODS

A land cover was developed for Sherburne using ArcView 3.2 (ESRI, Redlands, California USA) from 1998 digital orthophoto quarter quadrangles (DOQQs) obtained from the Louisiana State University atlas website (http://atlas.lsu.edu). Due to lack of detailed inventory data on all of the lands involved and concern for the possibility of type I error, habitats were delineated into broad categories from visual characteristics of the landscape on the DOQQs (Figure 1). Habitat types included Water-based forests (forest associated with water, such as cypress-tupelo swamps or riparian areas), Lowland Forest (low elevation, wet forests that lack standing water most of the year), Openings (areas where most of the ground was exposed to direct sunlight) and Upland Forest (forests that were relatively dry and higher in elevation than other forest types). Home range, core area and point themes were intersected with the land cover, using the XTools extension (DeLaune 2003) in ArcView, to quantify habitats used by each female seasonally. Compositional analysis was used to examine habitat selection at 3 scales: home ranges vs. habitats available in the study area (1st order), core areas vs. habitats available in the home ranges (2nd order), and locations vs. habitats available in the home ranges (3rd order) (Chamberlain and Leopold 2000). When a habitat-type was not represented in a turkey's space use in a given scale, the small non-zero value of 0.1 was substituted for

purposes of analysis. Additionally, 0.3 and 0.7 were substituted for 0, as suggested by Bingham and Brennan (2004), to determine if the value 0.1 produced increased type I error and changed inferences derived from the findings.

Differences of log-ratio habitat use and availability percentages were examined using a multivariate analysis of variance (MANOVA). Since significant differences between habitat availability and selection were found, a ranking matrix of *t*-tests was constructed to determine order of habitat preference. Statistical analysis was performed with SAS (SAS Institute 1996).



AE = American elm; AS = American sycamore; BB = buttonbush; BC = baldcypress; BE = boxelder; BP = bitter pecan; BW = black willow; DO = delta post oak; EC = eastern cottonwood; GA = green ash; NO = Nuttall oak; RM = red maple; SB = sugarberry; SG = sweetgum; WO = water oak; WT = water tupelo

Figure 1. General plant assemblages of forest-types located on Sherburne Wildlife Management Area, Atchafalaya National Wildlife Refuge, and Bayou des Ourses, Louisiana, USA.

RESULTS

Habitat Selection

Thirty-one females were observed with 99 seasonal home ranges to estimate habitat selection. Of the 99 seasonal home ranges, 96 contained all available habitat-types located on Sherburne. Two of the 3 home ranges lacking one or more habitat-types belonged to females incubating a nest. Additionally, 51 of the 99 core areas contained every habitat-type.

Females selected habitats seasonally within their home ranges relative to habitats available (first order selection); ($F_{3,93}$ = 14.45, $P < 0.001$; Table 3). Upland forest was consistently selected relative to other habitat-types. The composition of core areas relative to home ranges (second order selection) differed seasonally; ($F_{3,93}$ = 3.82, P = 0.0125). Openings were selected in fall-winter and brood-rearing, whereas upland forest and water-based forest were selected in preincubation and incubation. Lastly, females used habitats differentially by season [Third order selection]; ($F_{3,93}$ = 23.89, $P < 0.0001$). Females consistently used water-based forest, and openings to a lesser extent (Table 3).

Compositional Analysis

Using 0.3 and 0.7 as a small non-zero substitute for 0 habitat use, the 3 habitat selection scales were re-examined. In 1st order selection, females selected habitats seasonally (0.3: $F_{3,93}$ = 14.61, $P < 0.001$; 0.7: $F_{3,93}$ = 13.99, $P < 0.001$). Upland forest was consistently selected with both small non-zero values. In 2nd order selection, females also selected habitats seasonally (0.3: $F_{3,93}$ = 4.59, P = 0.005; 0.7: $F_{3,93}$ = 5.51, P = 0.002). Females used openings in fall-winter and brood-rearing, whereas upland forest and water-based forest were selected in preincubation and incubation regardless of whether 0.3 or 0.7 were used. Females also were selective at the 3rd order (0.3: $F_{3,93}$ = 28.54, $P < 0.001$; 0.7: $F_{3,93}$ = 29.63, $P < 0.001$). Water-based forest was consistently used, whereas openings were used to a lesser extent.

DISCUSSION

Upland and lowland forests were important to females when selecting home ranges. In the fall-winter, lowland forest was used most. Since food drives habitat selection at this time (Healy 1992; Hurst 1992), it appears turkeys moved to lowland forest to take advantage of a food resource such as herbaceous vegetation. During fall,

Table 3. Seasonal and mean ranks (1 = lowest, 3 = highest) of habitat preference across three spatial scales (Habitat selection in home ranges vs. habitat availability across study area [1st order], habitat selection in core areas vs. habitat availability across home ranges [2nd order], and habitat used vs. habitat availability across home ranges [3rd order]) based on compositional analysis of female wild turkeys at Sherburne Wildlife Management Area, Atchafalaya National Wildlife Refuge, and Bayou des Ourses, Louisiana, USA, 2002-04.

	1st order					2nd order					3rd order				
	Season[1]					Season					Season				
Habitat Type	FW	PI	I	BR	Mean	FW	PI	I	BR	Mean	FW	PI	I	BR	Mean
WB[2] Forest	1	1	0	1	0.75	2	2	3	1	2.00	3	3	3	3	3.00
Lowland Forest	3	2	1	2	2.00	1	1	0	0	0.50	1	0	0	0	0.25
Opening	0	0	2	0	0. 50	3	0	1	3	1.75	2	2	2	2	2.00
Upland Forest	2	3	3	3	2.75	0	3	2	2	1.75	0	1	1	1	0.75

[1] Seasons are Fall-Winter (FW), Preincubation (PI), Incubation (I) and Brood-Rearing (BR)
[2] Water-based

there is a shift in diet as turkeys move from openings to forested areas (Savage 1977). In winter, green herbaceous material found in these forested areas became important food items (Bittner 1973; Savage 1977). Normally, hard mast is an important food source in fall and winter (Hurst 1992), but relative lack of hard mast on Sherburne likely forced turkeys to select other food items. These alternate food items can easily be found in abundance in the lowland forests of Sherburne in fall-winter due to the mild climate. During preincubation, nest searching can take precedence over forage quality (Thogmartin 2001). Because of the flood-prone nature of Sherburne, elevated areas were desirable for nest sites, so it is intuitive that females would search these areas for suitable nest habitat. Relative safety from flooding and abundant herbaceous vegetation also would make upland forest appealing to both reproductive and non-reproductive females in incubation and brood rearing.

Water-based forest, upland forest, and openings were important in the selection of core areas. Females preferred openings in fall-winter, perhaps to take advantage of forage in food plots and rights-of-way. Upland forest was preferred in preincubation, which could indicate females searched upland forest intensively during this time. Water-based forest was selected in incubation, suggesting females were close to water features while nesting. While water-based forest includes cypress-tupelo swamp, they also included natural levees near bayous, which are some of the more elevated land features on Sherburne. In flood-prone landscapes, elevated areas are selected by females for nest sites (Kimmel 1984). Openings were important during brood-rearing (Savage 1977; Ross and Wunz 1990; Swanson et al. 1994; Peoples et al. 1996). High protein and energy demands of poults make abundant insects and grass seed in openings valuable during

early development. As poults mature, their dietary needs change, and brood females move to more upland forested areas (Ross and Wunz 1990). This study's findings support that notion, because upland forest ranked just under openings in brood-rearing, possibly indicating such a move later in Brood-rearing.

Females consistently used water-based forests and openings throughout the year, possibly due to high production in these areas. In Mississippi, creek drainages were used by females in an upland forest system (Palmer 1990; Palmer and Hurst 1996; Chamberlain 1999). Since most hard mast producing trees are associated with waterways on Sherburne, use of water-based forest in fall-winter could indicate turkeys are using these areas for hard mast. Additionally, quality roost sites were found in this habitat-type, because mature oaks and baldcypress have horizontal branches that are favorable for perching (Flake et al. 1996), and turkeys prefer roosting over water (Chamberlain et al. 2000). Observations made during this study supported these findings because 8 marked and 2 unmarked turkeys were seen roosting in baldcypress, near or over water. Since some of the more elevated areas on Sherburne are natural levees associated with bayous, increased use of water-based forest in preincubation could be linked to nest searching or foraging on succulent vegetation while searching for suitable nest locations. Succulent forage located in water-based forest also would be attractive to non-reproductive females in preincubation and incubation. Kimmel (1984) also found females to use waterfront hardwoods in spring in northeast Louisiana.

The validity of compositional analysis has recently come under criticism. Bingham and Brennan (2004) stated that compositional analysis had unacceptable type I error rates when there were 0% use rates for resource types, and call into question the

results of studies using this resource selection technique. They suggested a value of 0.3 - 0.7% be used for the small non-zero value substituted for 0% use when it occurred, claiming those values minimized type I error. Although similar habitat-types were grouped to minimize 0% use for habitat-types in home ranges and core areas of turkeys in this study, there were still 3 home ranges and 48 core areas without all possible habitat-types available in the respective home range. Two of the 3 home ranges with 0% use in ≤ 1 habitat-types were those of incubating females. Nesting females are more limited in movement than non-reproductive females (Smith and Teitelbaum 1986; Chamberlain and Leopold 2000), so exclusion of habitats located far from the nest is expected. Additionally, core areas are the areas turkeys are using more intensely, and it is intuitive they would be more selective in habitat choice, and would be more likely to exclude certain habitats. Analysis was conducted on females at Sherburne using 0.1, 0.3, and 0.7 as substitutions for the small non-zero value. No difference was found in habitat preference at either 1st or 2nd order selection. On the 3rd order, in preincubation, openings were selected over water-based forest when 0.3 and 0.7% were substituted. It has been observed that female turkeys select openings and water-based forest in spring (Smith and Teitelbaum 1986; Palmer 1990; Swanson et al. 1994; Palmer and Hurst 1996), so this reversal is not entirely surprising.

CHAPTER 4
SURVIVAL

Wild turkey populations are thought to be controlled by 3 main factors: nest success, poult survival, and adult survival (Roberts et al. 1995; Vangilder and Kurzejeski 1995; Godfrey and Norman 1999). These 3 factors are closely related; the effect of nest success is intuitive in that turkeys must successfully produce offspring to sustain a population, poults must live to adulthood (a reproductively viable age), and adults must survive to propagate, especially females. Longer-lived individuals of a species will have more opportunities to breed, leading to more offspring, and therefore increased fitness. For this reason, understanding adult survival is important for understanding dynamics of turkey populations.

Predation is the primary cause of turkey mortality and nest failure (Vangilder and Kurzejeski 1995; Chamberlain et al. 1996; Thogmartin and Johnson 1999). Other factors, such as communicable disease or food resource availability, also can play a role in limiting population size and growth. Additionally, environmental variation can explain some differences in survival for ubiquitous species such as turkeys. Turkeys in northern climes typically have lower winter survival than their southern counterparts due to relatively harsh winters and scarce food resources (Roberts et al. 1995; Porter and Gefell 1996; Nguyen et al. 2003). Due to this latitudinal gradient, favorable conditions can only be extrapolated from survival rates of resident individuals, relative to their neighbors. Although survival of wild turkeys has been extensively studied in a variety of forested systems in the south, little research has been conducted in bottomland hardwood forests (Chamberlain 1995). The objectives of this chapter were to estimate annual and

seasonal survival and to quantify cause-specific mortality in female wild turkeys on Sherburne.

METHODS

Females were located ≥ 3 times a week from the time of capture until their radio failed, they died, or the study ended. When a mortality signal was detected, a walk-in was performed to determine fate of the bird. A walk-in consisted of following the mortality signal with the telemetry receiver and yagi antenna on foot. When the signal was strong enough to be detected by the receiver without the antenna, a systematic search of the area was conducted. The search consisted of walking circles around the estimated center of the area the signal could be heard from, at 5m intervals until the remains and radio were found. Walk-ins were conducted immediately after observation of a mortality signal, except during incubation when nest-related inactivity was believed to be the cause of the mortality signal. When nest-related inactivity was suspected, walk-ins were conducted later in the day after usual periods of activity, or the next day to prevent nest disturbance.

Dead females were grouped into 4 categories based on cause of death: bobcat, canids (i.e. coyote and/or domestic dog), unknown predator and unknown. Canids were grouped due to difficulty in separating the responsible species. Females were classified as being killed by a bobcat if the female was cached, or if bobcat tracks, scat and/or fur were found at the kill site. Females were classified as being killed by a canid if tracks, scat and/or fur from a canid was found at the kill site. If no sign was detected and depredation was evident, or if sign from multiple predators was detected, cause of death was classified as unknown predator.

PROC LIFETEST (Allison 1995) in SAS (SAS Institute 1996) was used to test differences in survival across seasons. For seasonal survival analysis, individuals that lived to the end of one of the established biological seasons were censored and reintroduced into the analysis at the beginning of the next season. Seasons were pooled to determine annual survival. Females that died ≤ 7 days after capture were excluded from the analysis to minimize error from capture-related mortality (Miller et al. 1998*a*).

RESULTS

Females (n = 39) were monitored from 6 March 2001 to 12 June 2001, and from 11 February 2002 to 27 August 2004. Survival differed among seasons and was greatest during preincubation (1.00) and lowest during incubation (0.80; $\chi^2_3 = 14.1550$, P = 0.0027; Table 4). Mean annual survival was 0.5852 ± 0.0874 (mean ± standard error). Sixteen dead females were recovered, whereas 23 were censored due to transmitter-failure or loss after variable lengths of monitoring. Causes of death were bobcat (n = 2), canid (n = 4), unknown predator (n = 7), and unknown (n = 3).

Table 4. Seasonal survival rates for female wild turkeys on Sherburne Wildlife Management Area, Atchafalaya National Wildlife Refuge, and Bayou des Ourses, Louisiana, USA, 2001 – 2004.

Season	n	Survival	Standard Error
Fall-Winter	35	0.9535	0.0321
Preincubation	31	1.0000	0.0000
Incubation	26	0.7965	0.0746
Brood-rearing	39	0.8534	0.0494

DISCUSSION

Most studies examining seasonal survival have used the 4 standard calendar seasons, but in many cases biological seasons are more useful for management purposes.

The biological seasons in this study overlap or encompass multiple calendar seasons. For example, a "Spring" season would have included preincubation and incubation, during which females are subjected to different factors influencing their survival. Obviously the Fall-winter season in this study encompassed the two respective calendar seasons. Due to this difference among studies, some seasons will be discussed together.

Spring survival rates have varied from 0.72 to 0.983 (Palmer et al. 1993; Chamberlain 1995; Roberts et al. 1995; Vangilder and Kurzejeski 1995; Wright et al. 1996; Hubbard et al. 1999; Nguyen et al. 2003). In this study, preincubation survival rates (1.00) exceeded those previously reported (Palmer et al. 1993; Chamberlain 1995; Roberts et al. 1995; Vangilder and Kurzejeski 1995; Wright et al. 1996; Hubbard et al. 1999; Nguyen et al. 2003). High survival during preincubation could have been linked to the mild winters on Sherburne, which made abundant herbaceous forage available nearly year round, thus improving condition of birds at the end of fall-winter. Annual flooding suppressed understory vegetation, which likely increased females' chance of detecting predators, thus bolstering survival. Alternatively, since it has been found that survival increases with larger home ranges, presumably because of increased habitat sampling (Badyaev et al. 1996*b*; Hubbard et al. 1999), another possible explanation is that large preincubation space use (Chapter 2) positively affected survival. Closure of ATV trails at the end of deer season (January 31) limited access to areas used by turkeys in this study, and therefore limited poaching activity, which has played a role in many previous survival studies (Roberts et al. 1995; Vangilder and Kurzejeski 1995; Chamberlain et al. 1996; Lopez et al. 1998; Miller et al. 1998*a*; Chamberlain 1999; Hubbard et al 1999; Thogmartin and Schaeffer 2000; Nguyen et al. 2003).

Reduced survival during the nesting season relative to other seasons was not surprising because of increasing risks of predation associated with incubation (Little et al. 1990). Specific to Sherburne, persistent annual flooding resulted in relatively sparse understory vegetation throughout many forested stands. Topographically higher stands with suitable vegetation for nesting were restricted, possibly concentrating females during nest initiation. Concentrations of nests could promote increased predator activity in these systems (Kimmel 1984, Chamberlain et al. 1996) and increased female mortality during incubation. However, it is of note that survival estimates for the nesting period in this study were relatively high compared to previous studies (Chamberlain 1995; Vangilder and Kurzejeski 1995; Miller et al. 1998*a*; Miller et al. 1998*b*; Hubbard et al. 1999). Relatively low nest initiation rates in this study contributed to lower proportions of the female population incubating nests, and hence likely reduced the susceptibility of some females to depredation. Constricted movement for brief periods in many females during preincubation could indicate nests were being depredated before incubation. This type of nest failure would limit the time females were exposed to increased risk of predation due to reproductive behavior. Additionally, low nest success may be explained by a plant community consisting of wild carrot and bedstraw that is prevalent during preincubation. These plants form dense stands that appear to provide concealment for nests, but quickly die back, leaving the area exposed. Females nesting in areas dominated by these plants soon find themselves exposed, and I've witnessed birds in these open areas flush from 50m away, abandoning the nest. This early flushing behavior combined with predation of nests before incubation could increase survival of females.

Low reproduction may have contributed to observations of higher survival during brood-rearing on Sherburne than most previous studies.

Reduced survival for brood-rearing females is prevalent in wild turkeys, attributable to costs associated with parental care, a loss of security from roosting on the ground during initial stages of brooding, and increased susceptibility of females to predation while foraging broods (Healy 1992; Porter and Gefell 1996; Miller et al. 1997). Survival during brood-rearing was relatively low in this study (0.853), but fell within the range of previously reported rates. Summer survival rates, which are roughly equivalent to brood-rearing, ranged from 0.701 to 0.967 (Palmer et al. 1993; Chamberlain 1995; Roberts et al. 1995; Hubbard et al. 1999; Nguyen et al. 2003). Again, survival estimates on Sherburne could have been high due to low nest initiation, which would have reduced risk for non-reproductive females.

Fall-winter survival was high (0.954) on Sherburne, compared to previous studies that reported survival rates from 0.67 to 0.938 (Palmer et al. 1993; Chamberlain 1995; Roberts et al. 1995; Hubbard et al. 1999; Nguyen et al. 2003). One possible explanation for increased survival is that foraging conditions are relatively stable on Sherburne, even in winter. Though hard mast is relatively scarce on Sherburne, the mild winters enable green vegetative material to grow all year in areas not subject to flood, ensuring food is seldom a limiting factor. Additionally, since food drives movement and space use at this time of year (Dickson 1992), it is logical that abundance relative to more northern climes would increase survival rates and decrease space use (Chapter 2).

CHAPTER 5
CONCLUSION

While turkey ecology is well understood in upland areas, there is a lack of knowledge in bottomland hardwood forests (BLH) of the southeast. I found that ecology of turkeys in BLH was similar to other landscape types, but contained some important ecological differences. One difference was during preincubation, when females maintained noticeably larger home ranges and core areas than in any other seasons. Insufficient nesting habitat could be a reason for inflated space use during preincubation. While vegetation seemed to be present in quantities sufficient to satisfy forage requirements, annual flooding kept understory vegetation too sparse for adequate nest cover on a large portion of Sherburne. Some studies have reported that females maintain largest home ranges during fall-winter (Smith and Teitelbaum 1986; Chamberlain 1999), but mild winters and herbaceous forage available throughout the year on Sherburne seem to be a mitigating factor during this season. Inflated space use during incubation also is unusual due to movement restrictions from incubating nests. Females on Sherburne had low nest success due to a combination of nest predation and a dearth of suitable nest sites, so in many cases, there was no restriction on movement during incubation. Despite the fact that my sample contained relatively few females with broods during brood-rearing, space use was consistent with previously reported findings. Although most females had no young, and therefore, no restrictions on movement, abundant and available resources likely enabled females to reduce space use during this period.

As with most species, wild turkeys can benefit from habitat management that tailors to their specific needs. Mature bottomland hardwoods are important for forage and roost sites during fall-winter, but on Sherburne mature hard mast producing stands

are rare. Hard mast producing species tolerant to wet conditions, such as water hickory and water oak, should be encouraged to provide fall-winter food resources. Individual and group selection cuts could be used to release these species, which are already present in the understory. Food plots with winter crops would be important as these stands mature, and in mast-failure years.

Large preincubation home ranges indicate nest habitat management also could be improved on Sherburne. Since most timber management has occurred in a relatively small portion of the western edge of Sherburne, expanding these practices to other areas could benefit turkey nest habitat. Maintaining at least 10% of the area in early successional stages, created with selective cuts, or small clear cuts, and maintained by a 2-3 year prescribed fire rotation is important for increasing the amount of herbaceous vegetation (Russell et al. 1999), and therefore available nesting habitat. Scattering these openings across Sherburne would make suitable nest habitat more widely available, possibly decreasing space use and increase nest success during preincubation and incubation, respectively. It is important to have openings, maintained with prescribed fire, in an alternating mosaic pattern to offer turkeys a variety of habitat choices ranging from more densely vegetated nesting habitat to arthropod-attracting herbaceous communities for developing poults in brood-rearing. Selective herbicide applications also could be used to set back succession in these openings.

I found turkeys on Sherburne selected different habitats than their upland counterparts. During preincubation, upland forest was preferred in 1st and 2nd order selection, but water-based forest was selected at the 3rd order. It appears females concentrated their nest searching in elevated areas due to the potential of flooding, and

natural levees associated with bayous and upland forest are some of the most elevated landscape features on Sherburne. Habitat use changed little during incubation: nesting females chose elevated nest sites and non-reproductive females took advantage of abundant forage in these areas. Habitat preference changed on the 2^{nd} scale during brood-rearing as females shifted from upland and water-based forest to openings. This is consistent with other studies that have reported brood hens select openings so poults can forage easily on insects found in these areas (Hurst and Stringer 1975; Martin and McGinnes 1975). Females preferred lowland forest at the 1^{st} order, openings at the 2^{nd} order, and water-based forest at the 3^{rd} order during fall-winter, indicating that females were staying near bodies of water and openings. Use of water-based forest is consistent with previous studies that found females used creek drainages during winter for food and roost resources (Palmer 1990; Palmer and Hurst 1996; Chamberlain 1999).

BLH can support healthy turkey populations with proper management. Encouraging hard mast producing trees is important for providing adequate food resources and improving condition in restrictive seasons (fall-winter). Food plots also can contribute to improving foraging resources during fall-winter, especially in years of mast failure. Elevated areas such as natural levees or upland forest should be managed for nest habitat to encourage females to nest in areas not subject to flooding. Small food plots and fallow openings in these areas would be beneficial in Preincubation and Incubation. In preincubation, concentration of food near nest habitat would potentially shorten time spent searching for a nest site and improve females' condition before nesting. It could also reduce both the distance traveled from the nest to the food resource and the time females spend away from the nest. In Brood-rearing, succulent insect

attracting vegetation should be encouraged in forest openings to facilitate nutritional needs of poults by initiating a 2-3 year burn rotation in an alternating mosaic pattern (Porter 1992). Burns should occur in preincubation to avoid nest loss and allow vegetation time to sprout and mature in time for broods to benefit from them. Food plots near riparian areas and in upland forest should be maintained for non-reproductive females and older broods whose nutritional requirements have changed.

Although I found nest success on Sherburne to be low, the wild turkey population appears to be stable, likely due to high survival of females. Mild winters and herbaceous forage available throughout the year could be a positive factor affecting turkey survival, but relative lack of suitable nest and brood-rearing sites may increase mortality events during incubation and brood-rearing. The lowest seasonal survival was during the reproductive period (incubation and brood-rearing) when reproductive efforts have been shown to decrease survival (Little et al. 1990). Mortality events were virtually non-existent the rest of the year with survival rates equaling 0.953 for fall-winter and 1.000 during preincubation. One explanation for these high survival rates is there is no fall hunting season on Sherburne, and females may never be harvested legally. Additionally, I found no evidence of poaching at any time during this study. A possible explanation for high survival during preincubation is females' high space use decreased likelihood of a mortality event due to increased habitat sampling (Badyaev and Faust 1996; Hubbard et al. 1999). Additionally, repressed understory vegetation could increase a turkey's chance of detecting and avoiding predators.

Preincubation appeared to be a crucial time on Sherburne. Survival during this season was 100%, but large space use suggests lack of suitable nest habitat in the

elevated areas they frequent. As previously mentioned, nest success, poult survival and adult survival are the 3 main factors influencing turkey population dynamics (Roberts et al. 1995; Vangilder and Kurzejeski 1995; Godfrey and Norman 1999), so improving habitat to optimize those factors is critical in turkey management. Since many females restricted their movement for a short time during preincubation, without incubating a nest, it appears nest predation may occur prior to the onset of incubation. Additionally, several nests were lost due to flooding in the duration of this study. For these reasons, it appears managing for nest habitat would be most beneficial for the turkey population on Sherburne. I have observed turkeys using slash in logged areas for nest sites during incubation. Therefore, creating forest openings, using group or individual selection cuts, dispersed in elevated areas could improve overall nest habitat quality, thereby improving survival and nest success during Incubation. Fire can be used in wetlands to maintain openings and stimulate herbaceous vegetation (Russell et al. 1999), thus prescribed fire on a 2 – 3 year rotation in some openings after hatch should be used to encourage herbaceous, insect-attracting vegetation, thus improving poult survival. Hard mast producers should be encouraged, because they are an important food source during Fall-winter. Winter crops planted in some of the forest openings would provide an alternate food source in years of mast failure. It is important that these practices be dispersed in the area they are implemented in because habitat management for a large, mobile animal needs to be large in scale to benefit the population. Specific to Sherburne, managers must inventory the entire area so beneficial management plans can be implemented. Habitat management must occur in the center and eastern portions of Sherburne to increase survival and nesting on a larger scale.

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APPENDIX
NEST ECOLOGY

There was very low nest initiation and success in this study, likely from poor nesting habitat quality. Of the 24 females monitored from 2002 to 2004, only 8 initiated a nest, and 3 were successful in hatching at least 1 poult. Additionally, one female (151.007) was killed 2 days after hatch. Since poult rely on their mother for survival during the first 2 critical weeks of life, it is easy to assume that brood didn't survive.

Table 5. Nest initiation and fate of female wild turkeys on Sherburne Wildlife Management Area, Atchafalaya National Wildlife Refuge, and Bayou des Ourses, Louisiana, USA, 2002 – 04.

Year	Female ID	Nest Fate	Renest	Renest Fate
2002	150.128	Flood	No	NA
	150.201	Successful	NA	NA
	150.559	Flood	No	NA
	150.576	Flood	No	NA
	150.756	Flood	No	NA
2003	NA	NA	NA	NA
2004	150.013	Successful	NA	NA
	150.955	Raccoon	Yes	Unknown Predator
	151.007	Successful	NA	NA

VITA

Walker Blake Wilson was born on January 29, 1974 in Baton Rouge, Louisiana. He lived there until 1986 when his family moved to Sioux City, Iowa. In 1989, Walker moved to Port Hudson, Louisiana, where he attended Zachary High School until his graduation in 1993. He enrolled in Louisiana State University that fall and received a Bachelor of Science degree in Zoology in December, 1999. Walker continued his education at Louisiana State University and received a Bachelor of Science degree in Wildlife and Fisheries, with a minor in Chemistry in May, 2001. To further his professional career, Walker began working on wildlife graduate student projects as a technician. In August, 2002, he was accepted into graduate school at Louisiana State University, and is currently a candidate for a Master of Science in Wildlife.