

**SANDHILL LAKES MITIGATION BANK  
(FITZHUGH CARTER TRACT)  
OF  
ECONFINA CREEK WILDLIFE MANAGEMENT AREA  
ANNUAL REPORT 2016-2017**



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## INTRODUCTION

The Sand Hill Lakes Mitigation Bank property (referred to hereafter as the Carter Tract) is a 2,175-acre parcel located in south-central Washington County, approximately five miles north of State Road 20 and one mile west of State Road 77. The Carter Tract was purchased by the Northwest Florida Water Management District (NFWFMD) in October 2003, and established by the Florida Fish and Wildlife Conservation Commission (FWC) as a tract of the Econfina Creek Wildlife Management Area (WMA). A mitigation bank permit from the Florida Department of Environmental Protection (DEP) was issued to the NFWFMD in August 2005 to manage the property. Management objectives identified by the NFWFMD include wetlands restoration, preservation, and management; aquatic habitat preservation; erosion control; and uplands restoration and management. In June 2005, FWC entered into a cost-share agreement with the NFWFMD to develop and implement a comprehensive fisheries and wildlife management program for the Carter Tract. Following nine years of successful partnership, in May 2014 this agreement was renewed for an additional five years through 2019. In support of this cost-share agreement, this annual report is a comprehensive summary of the biological surveys, management activities, public use, and law enforcement monitoring conducted from July 1, 2016 - June 30, 2017.

## HABITAT

### Ecological and Land Cover Classification

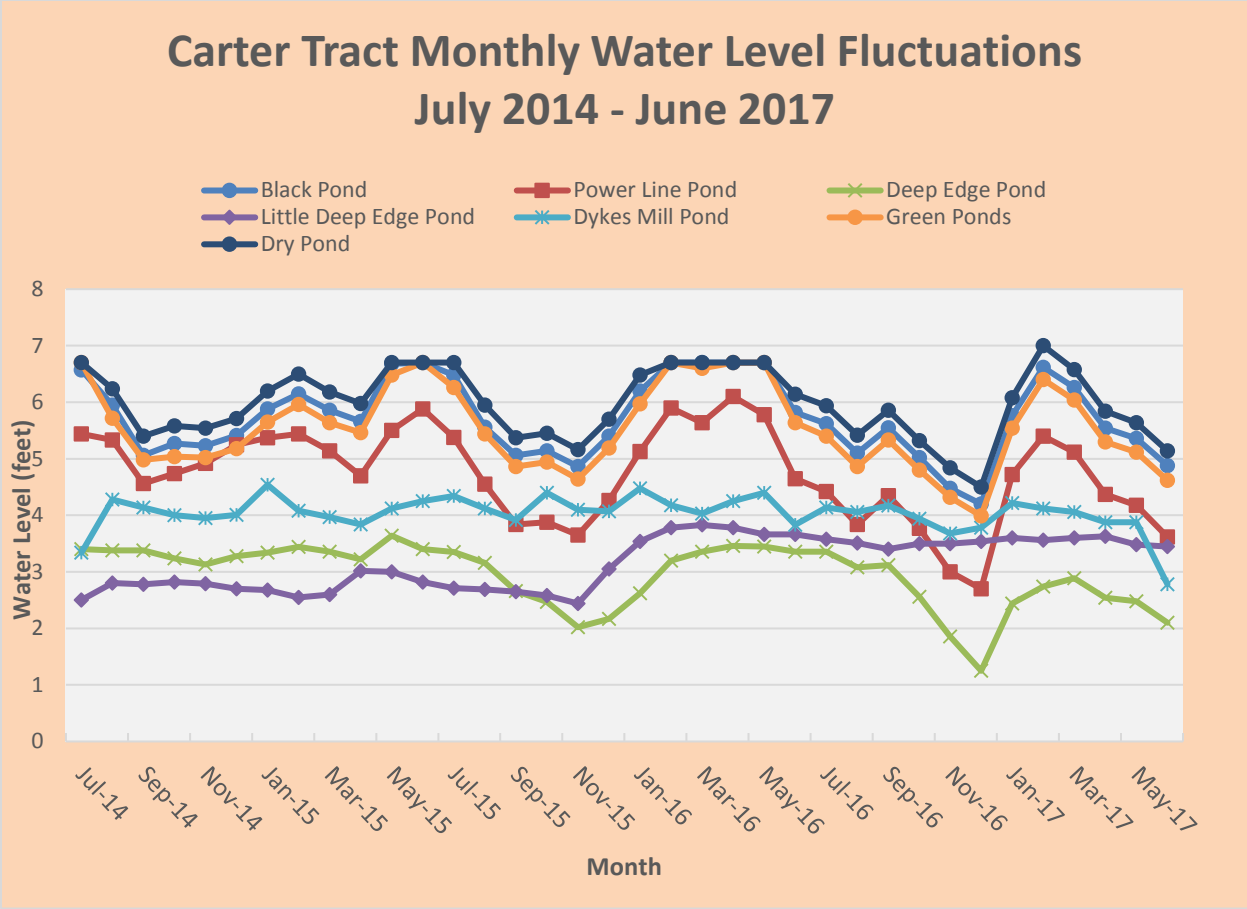
The Carter Tract harbors several distinct ecological communities. The largest single community on the property is upland sandhill habitat (approx. 1,150 acres), which was historically logged for longleaf pine (*Pinus palustris*) and re-planted in pine plantation or left to regenerate with pine (*Pinus* spp.), live oak (*Quercus virginiana*), and scrub oaks (*Quercus* spp.). Interspersed within the uplands are approximately 875 acres of mesic and hydric habitats comprised of Swamp Lakes, Basin Swamps and Marshes, Seepage Streams, isolated Depression Marshes, Mesic Flatwoods, Baygalls, Wet Prairie, and Seepage Slopes. The remaining 150 acres are natural Sinkholes and Sinkhole lakes (isolated, steep-sided karst ponds and shallow, gently-sloping lakes).



NFWFMD has led restoration efforts of the natural communities on Carter Tract that were degraded by timber operations and suppression of natural fire regimes. Restoration management has included mechanical reduction/herbicide of hardwoods and sand pine (*Pinus clausa*), native groundcover plantings, slash pine (*Pinus elliotii*) plantation thinning, and prescribed burning. There are many benefits of prescribed fire and selective herbicide application, including control of exotic invasive plants, increased plant community diversity, and restoration and/or maintenance of plant communities in an early successional state. These results are beneficial for both game and nongame wildlife species.

### **Water Levels**

Water levels on Carter Tract ponds and creeks have historically fluctuated in cycles lasting several years. Water gauges were installed on the Carter Tract by NFWFMD in 2005, and readings have been recorded monthly by FWC field staff since January 2006. Public fishing opportunities require adequate water levels on the area ponds. For example, extremely low water levels forced the closing of Green Ponds to fishing from June 2011 until mid-July 2013 when heavy rains recharged the aquifer and refilled all area ponds. Water levels on Carter Tract have remained relatively stable since the last recharging event (notwithstanding the typical seasonal fluctuations) and throughout FY 2016-17. Figure 1 graphically illustrates the change in water level of area water bodies over the last three years. The Area Map included within the Fitzhugh Carter Tract Hunting and Fishing Regulations Summary brochure (Appendix I) shows the location of primary water bodies.



**Figure 1. Monthly fluctuations in water levels from July 2014 - June 2017 on major water bodies within the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

### FISH AND WILDLIFE POPULATIONS

Working in cooperation with the NFWMD, the responsibilities of FWC-Division of Habitat and Species Conservation on the Carter Tract are to conduct fish and wildlife population surveys/assessments, collect/analyze biological data, evaluate results, administer public fishing and hunting programs, provide recommendations for adjustments in harvest designed to optimize fish and wildlife populations, and oversee other fish and wildlife-based recreational opportunities. The following are monitoring and management programs developed to address targeted species and public opportunities. Appendix I presents the 2016-17 Fitzhugh Carter Tract Hunting and Fishing Regulations Summary and Area Map. Appendix II presents the FWC Annual Work Plan and Accomplishment Report for July 1, 2016 – June 30, 2017.

## **Freshwater Fish**

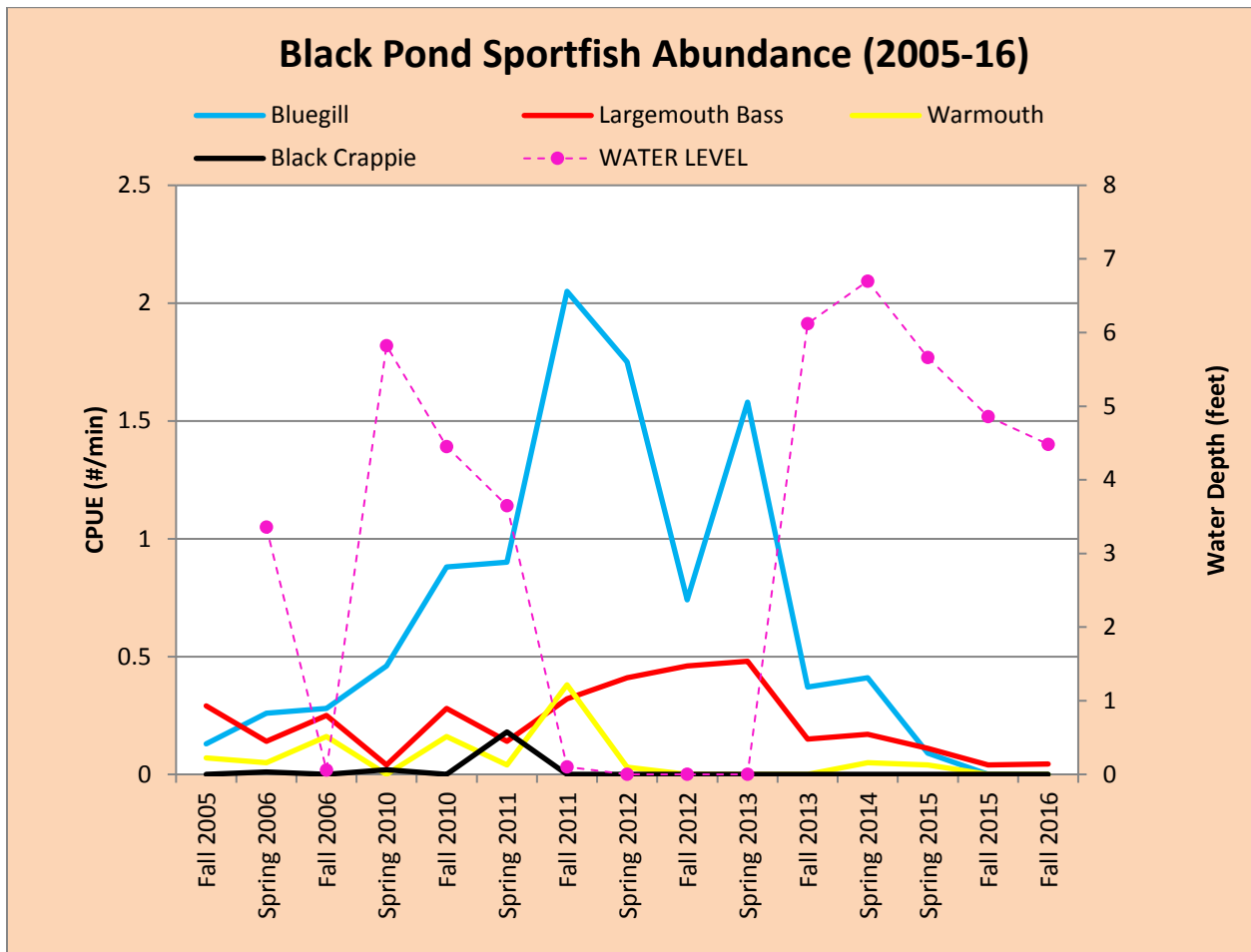
### Fish Population Assessment

Given adequate water levels, fish population assessments have historically been conducted twice a year during spring and fall. FWC staff have used a variety of methods, from Wegener rings, fyke nets, and electrofishing to survey sportfish and baitfish populations at Carter Tract. Electrofishing continued during fall 2016 on Black, Dry, and the Green Ponds to assess sportfish and baitfish populations, measuring catch-per-unit-effort (CPUE). Conditions at Carter Tract make electrofishing difficult and less effective (low conductivity combined with sometimes deep and tannic water). The low conductivity yields less current to shock the fish making them less susceptible to capture or being seen at all (Katie Woodside, pers. comm.). Electrofishing efforts on Black, Dry, and Green Ponds in fall 2015 revealed that these ponds have conductivity measurements between 23-25 microsiemens/cm; this is likely due to the sandy nature of the soil making up the watershed that surrounds the Carter Tract (McElhone 2016). FWC fisheries biologists have determined that the information gathered from angler creel surveys is more reliable for fisheries management decisions on the area than the data acquired via electrofishing (Katie Woodside, pers. comm.) Therefore, FWC plans to discontinue the electroshocking sampling on the Carter Tract. We will continue to analyze creel survey data to examine trends in sportfish species composition and size.

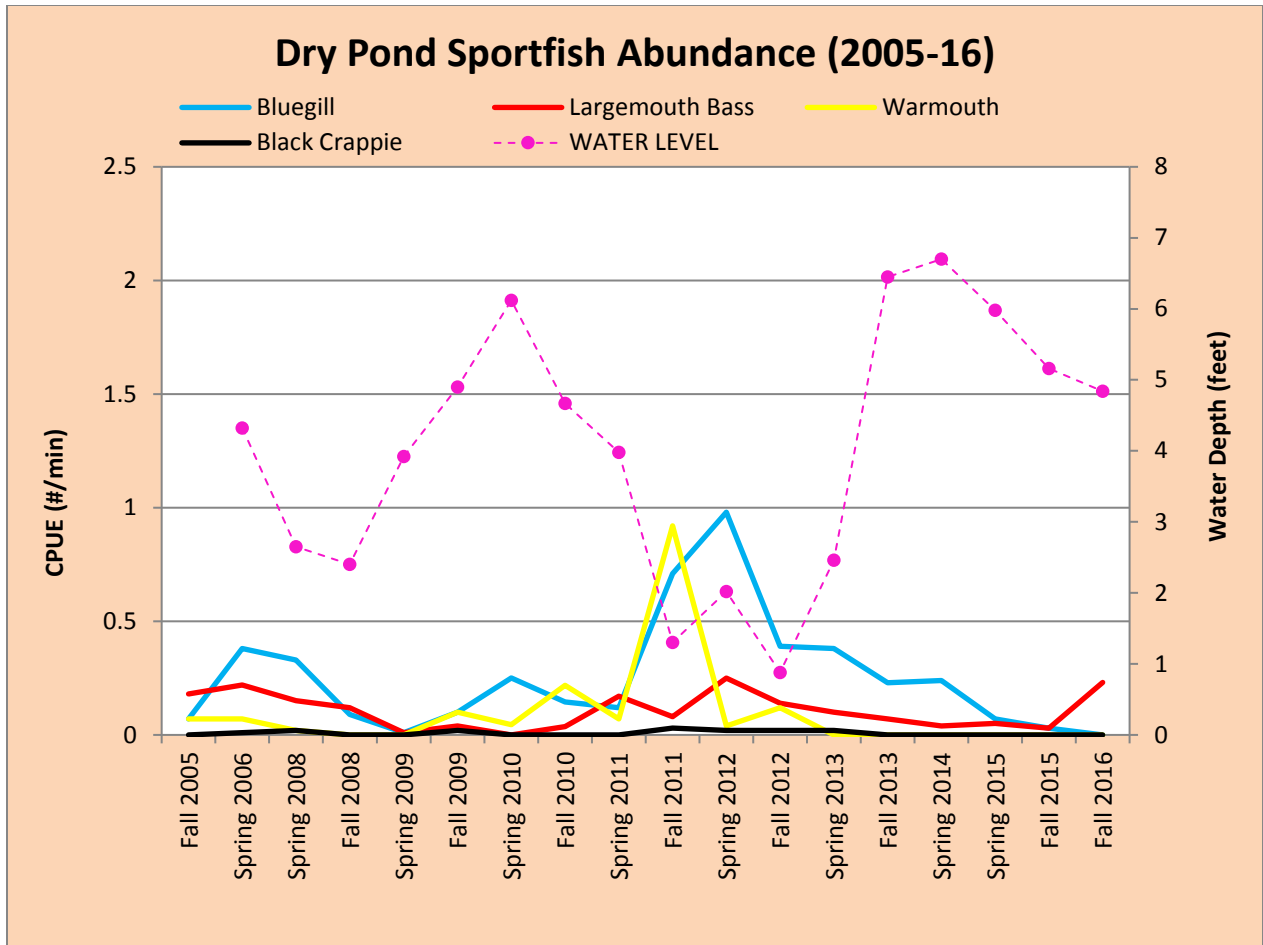
### Electrofishing

In November 2016, electrofishing was performed using an 18-foot aluminum vessel with Smith-Root<sup>®</sup> generator-powered pulsator electrofisher and two six-foot shocking booms on Black, Dry, and the Green Ponds. Direct current power settings were 120 pulses per second and 680 volts; average amperage generated was between 1-2 amps. Staff using ½-inch mesh dipping nets captured, measured, and weighed all affected fish. Sportfish abundance for each pond was calculated as catch-per-unit-effort (CPUE), or the number of fish sampled per minute. A breakdown of the CPUE for each species captured per pond during fall 2016 is presented in Appendix III. Graphs illustrating sportfish abundance trends from 2005 – 2016 for each pond sampled are presented in Figures 2 through 4 (also illustrated are associated water depths during

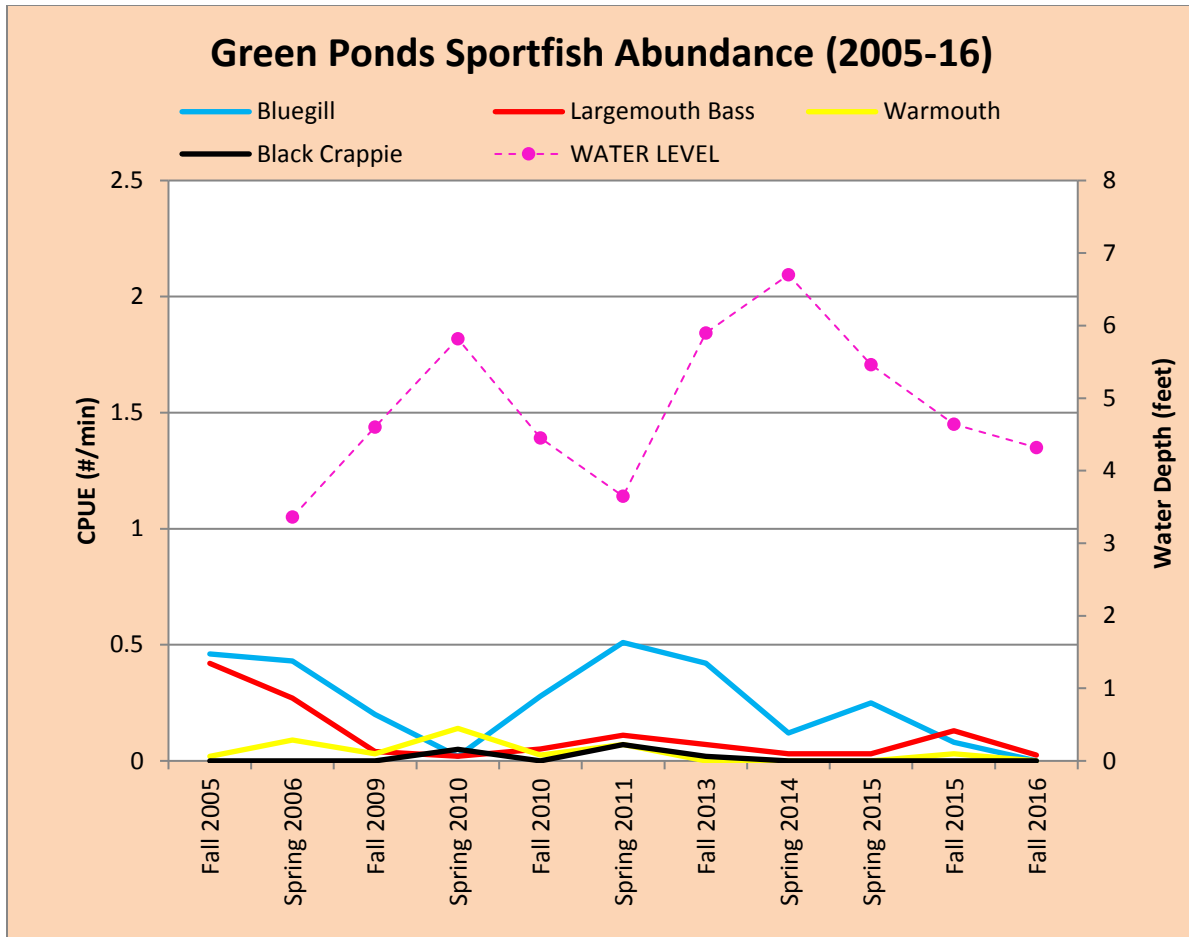
each sample season). Note that not all seasons were sampled for each pond every year due to water level restrictions.



**Figure 2. CPUE results from Fall 2006 - Fall 2016 sampling efforts on Black Pond of Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**



**Figure 3. CPUE results from Fall 2006 - Fall 2016 sampling efforts on Dry Pond of Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**



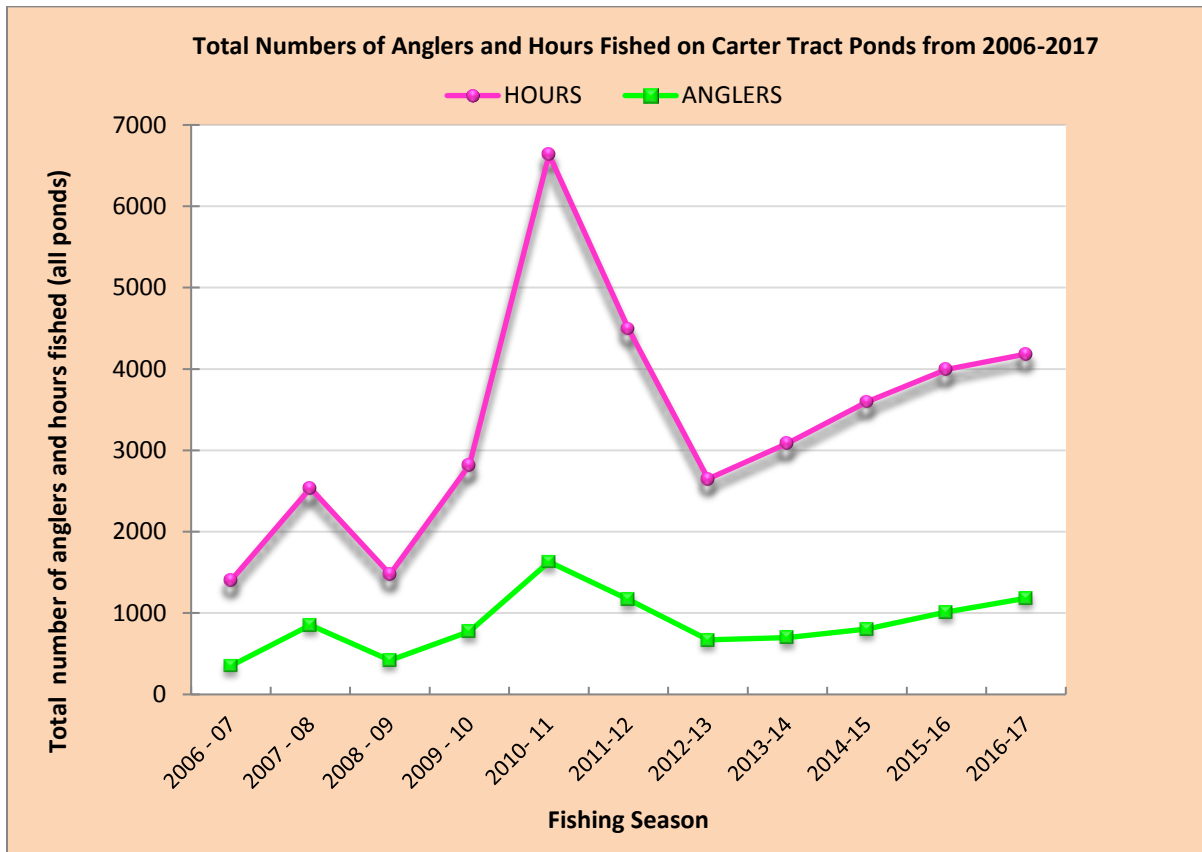
**Figure 4. CPUE results from Fall 2006 - Fall 2016 sampling efforts on Green Ponds of Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

Bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*) were the two most abundant sportfish captured on all ponds during the fall 2016 sample (Figures 2-4). However, CPUE numbers on all ponds continued a recent trend of being very low, illustrating the difficulties that our fishery biologists encounter when electrofishing the low conductivity ponds on the Carter Tract. We surmise that this method of sampling likely underestimates actual sportfish densities on the area ponds and in the future we will put more emphasis on angler creel data as an index of sportfish populations.

### Public Fishing

The Special Opportunity public fishing program on the Carter Tract continues to provide anglers with the unique opportunity to fish smaller bodies of water with low fishing pressure. Creel surveys from July 2016- June 2017 resulted in 1,182 anglers logging 4,184 fishing hours

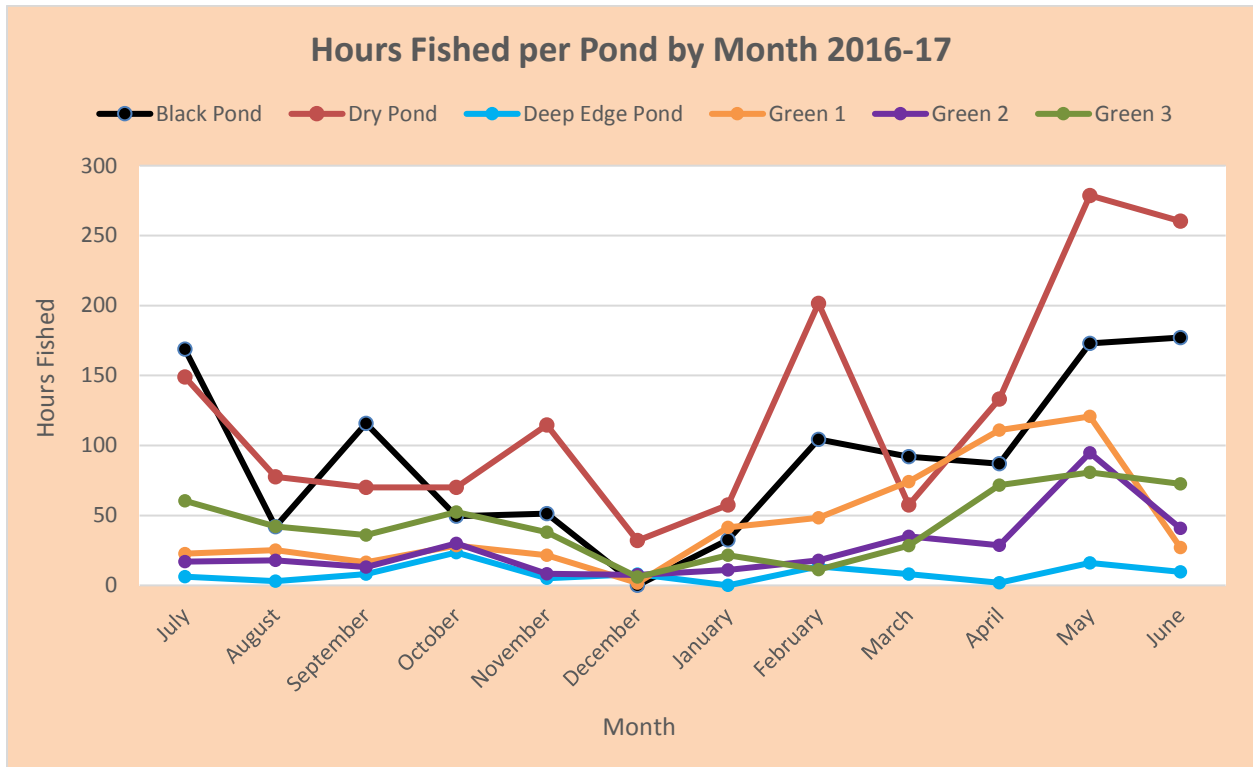
(Figure 5). This represents a 16.5% increase in the increase in the number of anglers and a 4.1% increase in the number of hours fishing compared to the 2015-16 fishing season. These numbers continue an upward annual trend in angler participation the last few years since drought conditions imposed a reduction in fishing opportunity in the 2012-13 season (Figure 5). Water levels remained relatively stable at all the fishing ponds throughout the 2016-17 reporting year, allowing anglers year-round access to all area ponds open to fishing.



**Figure 5. Total number of hours fished from 2007 - 2017 on all area ponds combined at the Fitzhugh Carter Tract of Econfinia Creek WMA, Washington County, Florida.**

The 2015-16 annual report indicated that fishing pressure is not evenly distributed among area ponds, with Dry Pond being the most fished pond (1,849 hours) followed by Black Pond (1,096 hours), Green Pond 3 (498 hours), Green 1 (254 hours), Green 2 (240 hours), and Deep Edge Pond (84 hours) (McElhone 2016). Our numbers for 2016-17 were remarkably similar, with Dry Pond (1502 hours) being the most fished pond again, followed by Black Pond (1093 hours), Green Pond 1 (539 hours, a big jump from the previous year), Green Pond 3 (522 hours),

Green Pond 2 (322 hours), and Deep Edge Pond (103 hours). Most time spent fishing was in the month of May while December showed the least participation, due to the number of days the area is closed to fishing due to hunting (Figure 6).



**Figure 6. Hours fished per month on Dry, Black, Deep Edge, and Green Ponds in 2016-17 at the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

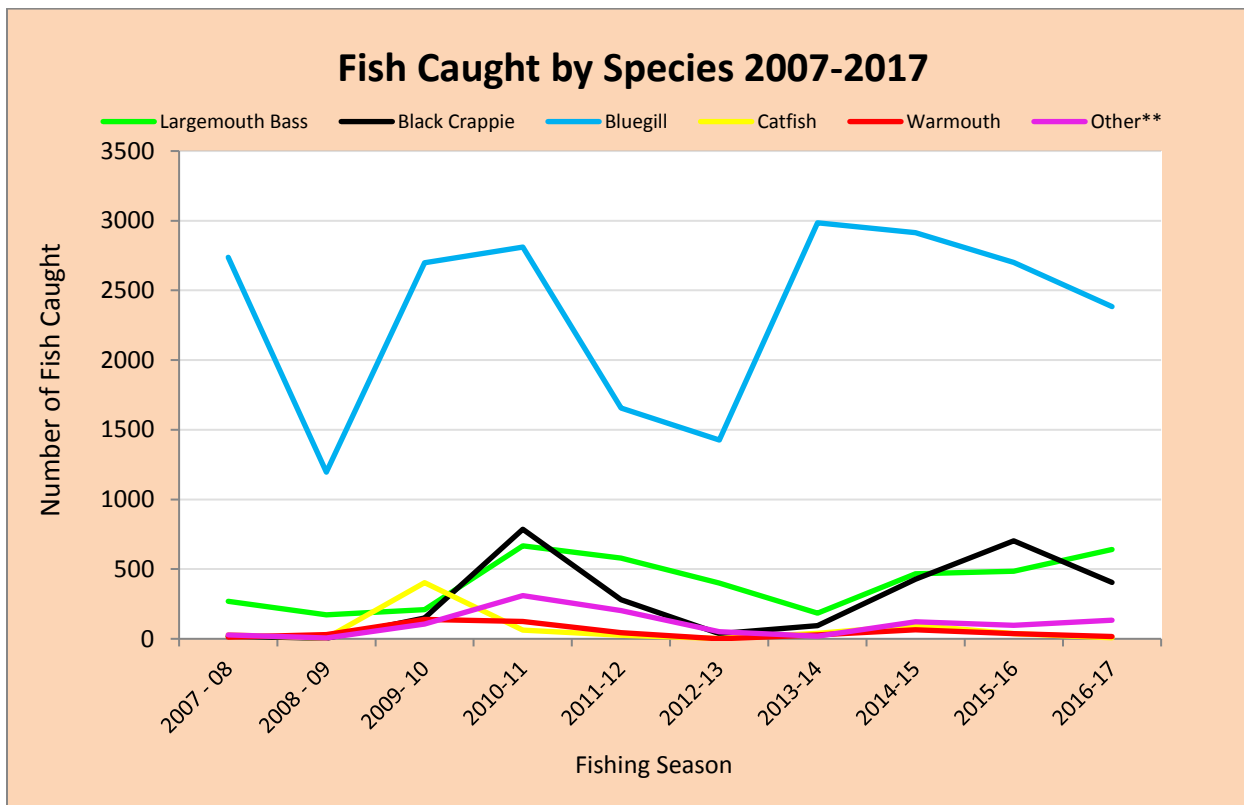
A total of 4,063 fish representing ten species were caught on Carter Tract ponds during 2016-17. This is nearly the same as the 4,093 fish caught during 2015-16. Table 1 illustrates the number of fish caught per species for each pond. Bluegill comprised 66.5% of fish caught, followed by black crappie (*Pomoxis nigromaculatus*), largemouth bass, and bullhead catfish (*Ameirus nebulosus* and *Ameirus natalis*) with 17.3%, 12%, and 0.9%, respectively. The remaining 3.3% of fish caught were warmouth (*Lepomis gulosus*), chain pickerel (*Esox niger*), spotted gar (*Lepisosteus oculatus*), redbreast sunfish (*Lepomis auritus*), flier (*Centrarchus macropterus*), and redear sunfish (*Lepomis microlophus*).



**Table 1. Number of fish caught by species per pond at the Carter Tract of Econfina Creek WMA, Washington County, Florida, July 2016 - June 2017.**

Species	Dry Pond	Black Pond	Deep Edge Pond	Green 1	Green 2	Green 3
Bluegill	1295	436	8	298	116	230
Largemouth Bass	173	169	70	84	54	92
Black Crappie	231	115	0	25	10	24
Catfish	6	1	0	0	0	0
Other	34	28	2	29	20	37

Figure 7 illustrates angler creel trends from 2007-17 for all water bodies fished. Bluegill was again the most common species caught, followed by largemouth bass; with black crappie these species make up the Carter Tract “Big 3”. Compared to the previous year, bluegill catch was down -11.8%, largemouth bass catch was up 32.1%, and black crappie catch was down -42.5%. The 642 largemouth bass caught on the Carter Tract this year represents the second highest total ever recorded on the area.



**Figure 7. Angler creel trends from 2007 - 2017 on all area ponds of the Carter Tract of Econfina Creek WMA, Washington County, Florida. \*\*= Other species include Bowfin, Chain Pickerel, Spotted Gar, Redbreast Sunfish, Redear Sunfish, Flier and Shellcracker**

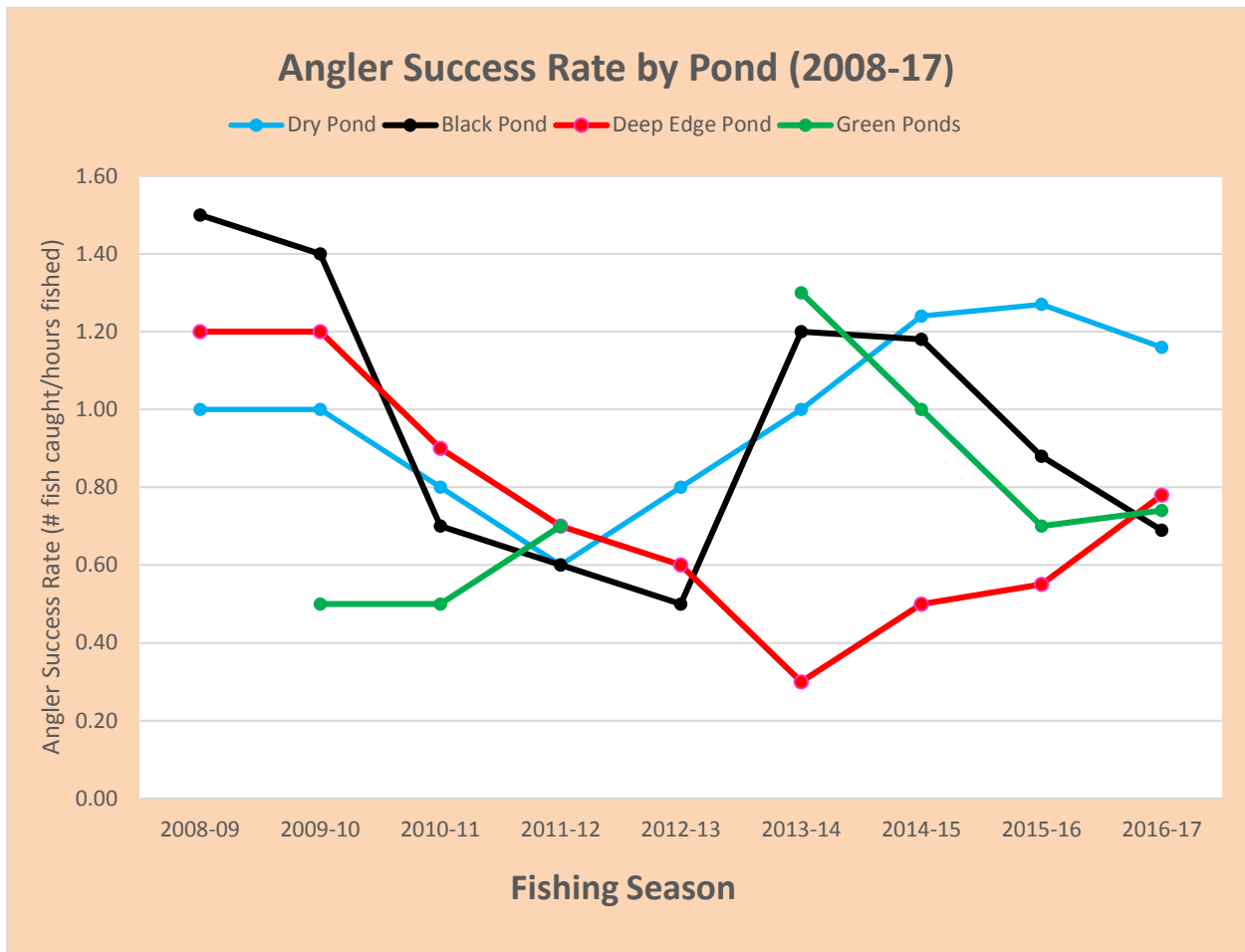
Furthermore, 88% of all fish caught on Deep Edge Pond were largemouth bass (up from 61% the prior year), the highest proportion of any pond on the area. The data suggest that Deep Edge Pond is an up and coming largemouth bass fishery that may be of interest to largemouth bass anglers. A detailed table of all fish caught and released per pond is presented in Appendix IV.

Angler success rate, defined as the number of fish caught per hour of fishing effort, was calculated for each pond and all water bodies combined for the 2016-17 fishing season. Dry Pond was again the most productive water body, followed by Green Pond 1, Deep Edge Pond and Green Pond 3 (tie), Black Pond, with Green Pond 2 having the lowest success rate. The overall success rate of 0.88 fish/hour was down slightly compared to the 2015-16 fishing season (Table 2).

**Table 2. Fishing success rate (fish caught/hours of fishing effort) on area ponds at the Carter Tract of Econfina Creek WMA, Washington County, Florida, July 2016 - June 2017.**

<b>Pond</b>	<b>Angler success rate (fish/hour)</b>
<b>Dry</b>	1.16
<b>Black</b>	0.69
<b>Deep Edge</b>	0.78
<b>Green 1</b>	0.81
<b>Green 2</b>	0.62
<b>Green 3</b>	0.78
<b>All Ponds</b>	0.88

Figure 8 shows the trend in angler success rate for area ponds over the last nine years. Looking at short term trends (since the 2013-14 fishing season), angler success has increased for Dry Pond and Deep Edge Pond, and decreased for Black Pond and the Green Ponds. These data will continue to be collected annually as an index of fishing success rates per pond.



**Figure 8.** Angler success rate (# fish caught/hour of fishing effort) from 2008 - 2017 on area ponds of the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida. Green Ponds were closed to fishing during the 2008-09 and 2012-13 fishing seasons due to drought conditions.

## WILDLIFE POPULATIONS

### White-tailed Deer

#### Management Objectives

The primary white-tailed deer (*Odocoileus virginianus*) management objective for the Carter Tract is to provide quality hunting opportunities while managing optimal herd health. Specific objectives are to attain a herd density of 16-26 deer/mi<sup>2</sup> (25-40 acres/deer). With limited hunting dates and a conservative hunt format, our goal is to attain a harvest consisting of antlered deer predominantly in the 3.5+ year old age classes. In addition to offering a quality buck harvest, we plan to bolster and maintain a high degree of hunter participation with the implementation of limited antlerless deer harvest, dependent upon herd expansion. Achieving these objectives requires active monitoring and management of the population

#### Line-Transect Distance Sampling

Reliable annual indices of population size are fundamental to successful deer herd management. Indices provide an estimate of relative abundance, rather than true population size. However, because the specific relationship between the index and population density is not known, the real value of population surveys is to evaluate trends over time. Deer density on the Carter Tract is estimated using data collected from line-transect distance sampling (LTDS) surveys, which utilizes modeling to account for deer detectability. Precision seems to be higher using the LTDS method compared to standard spotlight surveys.

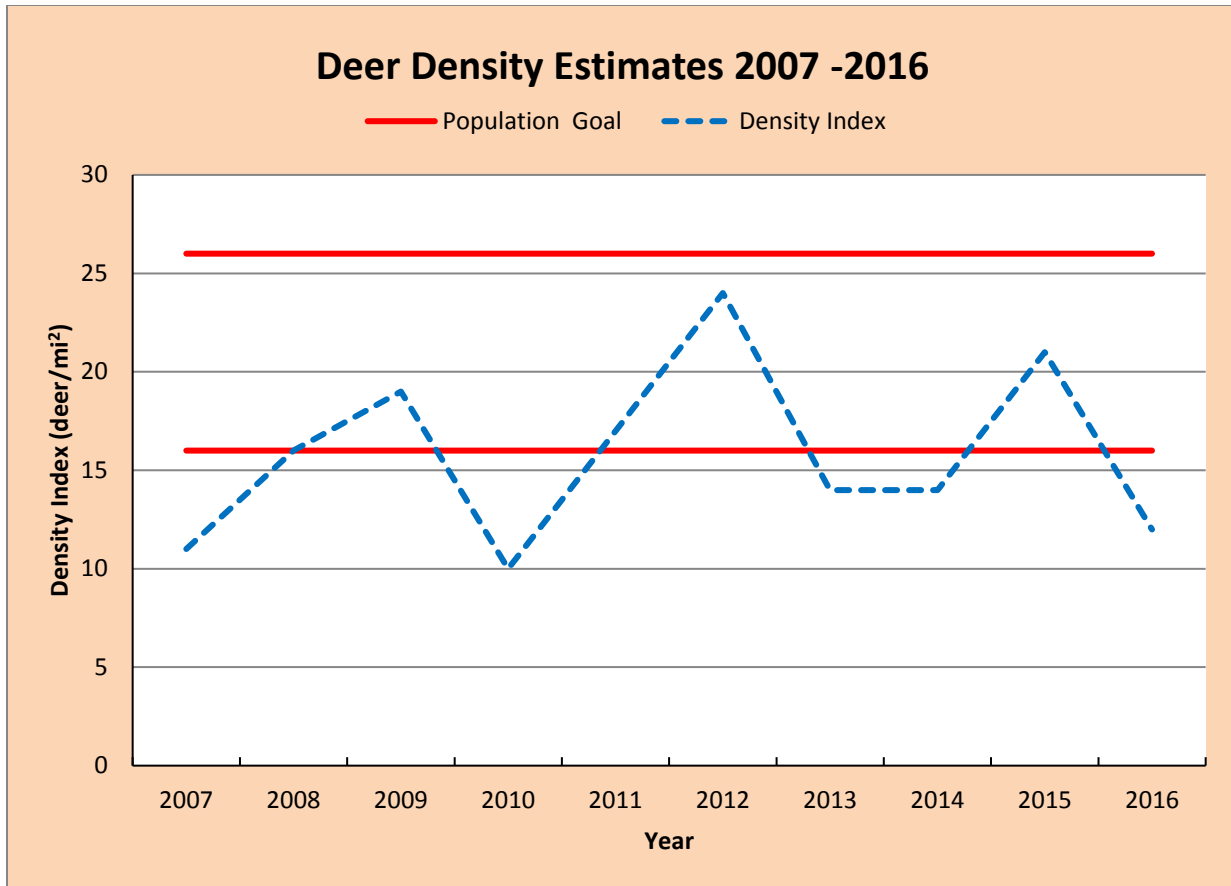
LTDS on the Carter Tract was conducted along two routes, both 2.9 miles long and were replicated six times in September 2016. Surveys began approximately one hour following official sunset, and were driven along the pre-selected routes via pickup truck with two observers in the back, each equipped with a one-million candlepower Q-beam® spotlight. Routes were driven at a speed of roughly 3-5 mph. Deer were detected by eye shine and the following data were recorded: number of deer, distance to deer, direction/bearing from vehicle, age (adult versus fawn), and gender (if determinable). Distance and bearing data were calculated using a Leupold® RXB-IV digital rangefinder/binocular. Figure 9 depicts the line transect routes used on the Carter Tract, along with locations of deer observed during 2016 surveys.



**Figure 9.** Survey routes and locations of deer observations during the September 2016 line-transect distance sampling conducted on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.

The preseason deer density estimate for 2016 was estimated at 11.8 deer/mi<sup>2</sup> (95% CI: 7.6, 17.5), or 54 acres/deer, using the software DISTANCE 5.0 Release 2 (Thomas et al., 2006). The Cramér-von-Mises goodness-of-fit test performed on these data produced a *p*-value of .500. This index was 43% less than the 20.8 deer/mi<sup>2</sup> calculated in 2015, and fell below the desired population density index goals for the Carter Tract (Figure 10). However, this index has fallen below the desired 16 deer/mi<sup>2</sup> before (2007, 2010, 2013-14) and appears part of a normal cyclical fluctuation in the deer density estimate exhibited on the area over the last 10 years (Figure 10). It is important to remember that many factors can influence deer detectability during spotlight transect surveys, and may create what appear to be contradictory or confusing population estimates. Typically, variance estimate in DISTANCE has three components: variance due to observers' ability to detect animals along a transect (detection probability); variability between transect lines (encounter rate); and variance due to group size (cluster size). Further, vegetation composition and height, weather variables, recent burning activity, hunting pressure, etc. can all influence deer activity. Although the density estimate varies annually, continued habitat management (prescribed burning, native groundcover restoration, exotics removal) should improve habitat quality for deer in Carter Tract. Several subsequent years of surveys should produce a clearer relative abundance, from which stronger inferences of trends in population size can be drawn.

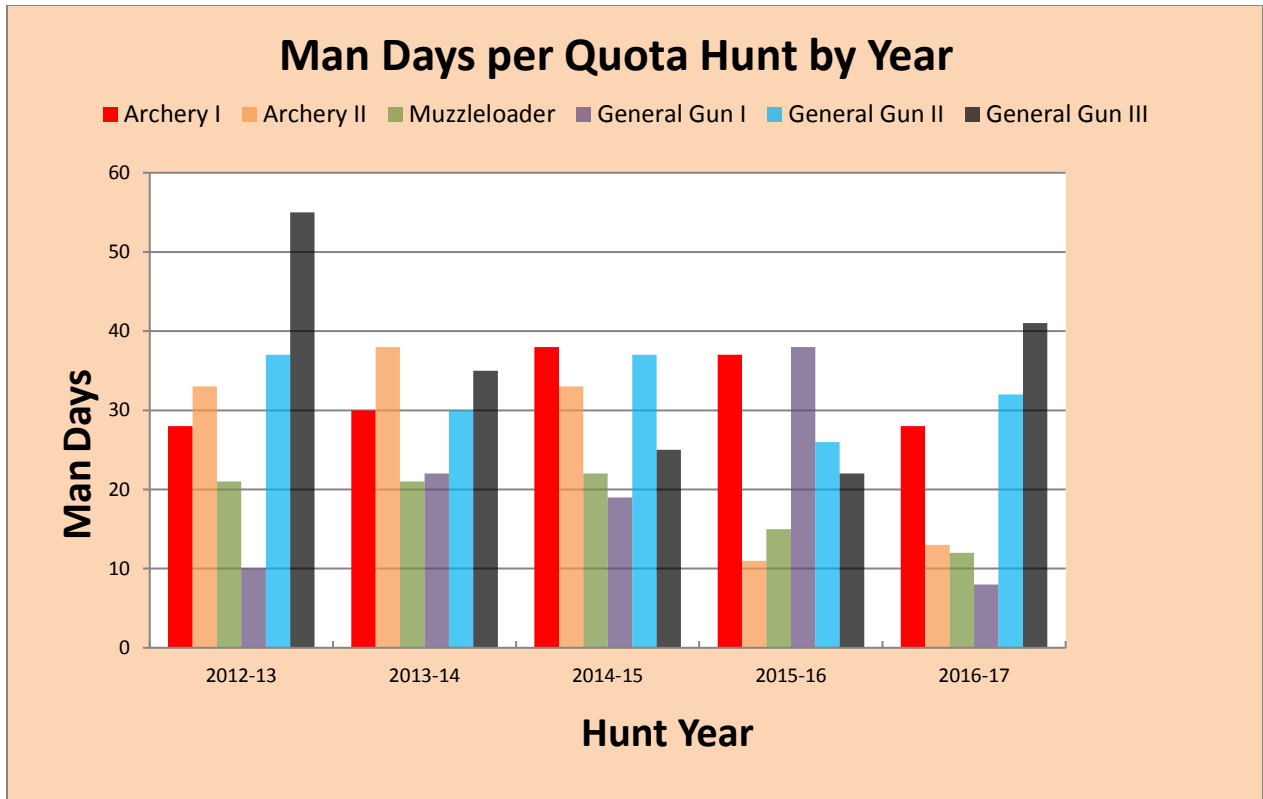




**Figure 10. Trend in White-tailed deer density as estimated using line transect distance sampling at the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida, 2007 - 2016.**

### Hunting Pressure and Harvest

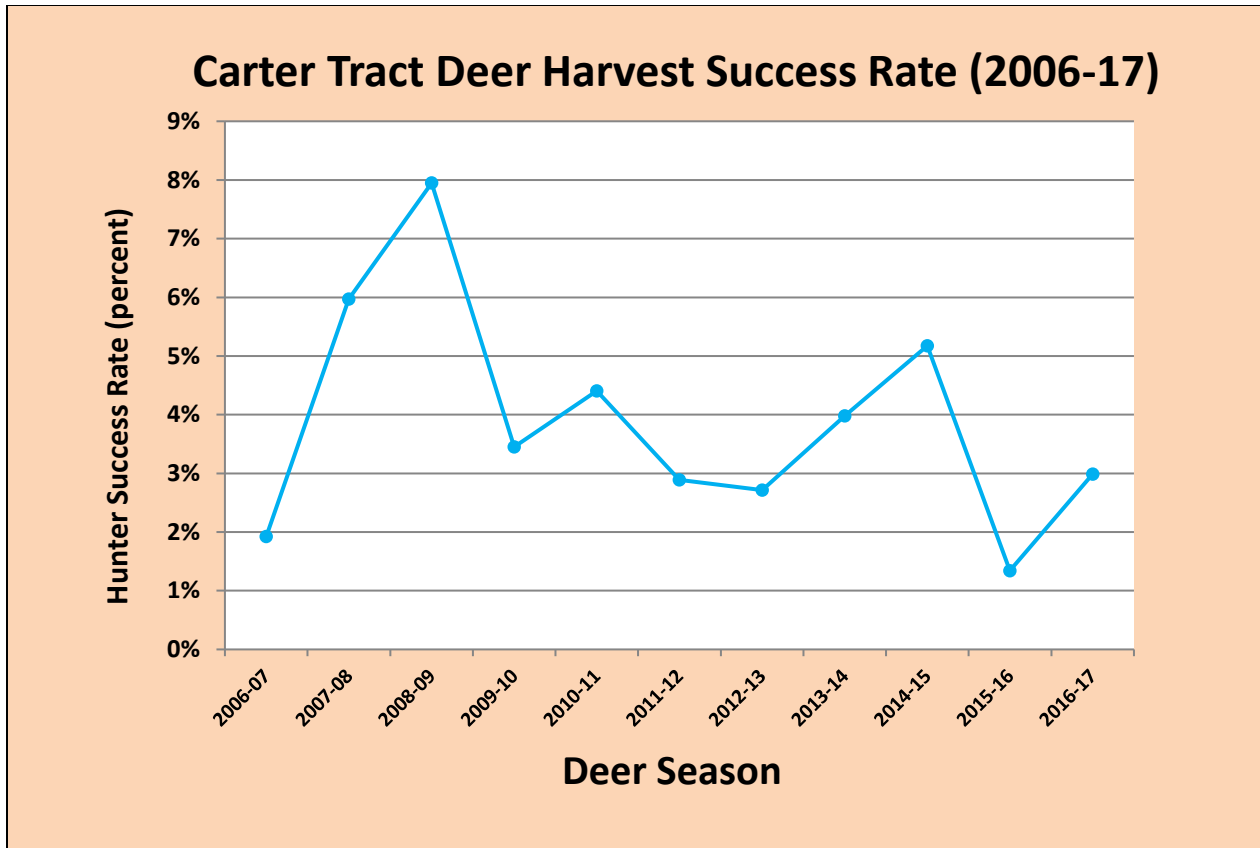
Deer hunters and their guests logged a total of 134 man-days of hunting during the 2016-17 season, compared to 149 man-days for the 2015-16 season. There is a 16-day archery season (divided into two consecutive hunts), a three day muzzleloading gun season, and a thirteen day general gun season divided into three hunts, one in November and two in January. A non-transferable quota permit is required for each of these hunts, and numbers are capped at 15 hunters allowed on the area on any given hunt day. All quota permit hunters were required to check-in/out at the Carter Tract check station to monitor hunter pressure and collect biological data from harvested deer. The most popular hunts were the general gun hunts in January (73 man-days) followed by the archery hunts (41 man-days). A distribution of harvest pressure by hunt for the last five hunting seasons is depicted in Figure 11.



**Figure 11. Comparison of hunter participation by quota hunt from 2012 - 2017 on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

Four deer were harvested on the Carter Tract during the 2016-17 hunt season, two does during archery season and two bucks during the general gun season yielding a hunter success rate of 3.0% (1 deer/33.5 man-days of hunting pressure), more than double the success rate recorded for the 2015-16 hunting season. Overall hunter success rate (calculated as the number of deer harvested per man-days hunted) is depicted in Figure 12, and is compared over the last eleven deer seasons.





**Figure 12.** Overall hunter success rate from 2006 - 2017 at the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.

Mean physical parameters of all deer harvested per quota hunt season are presented in Table 3.

**Table 3. Morphometric parameters of deer harvested during 2016-17 quota hunts on the Carter Tract of Econfina Creek WMA, Washington County, Florida.**

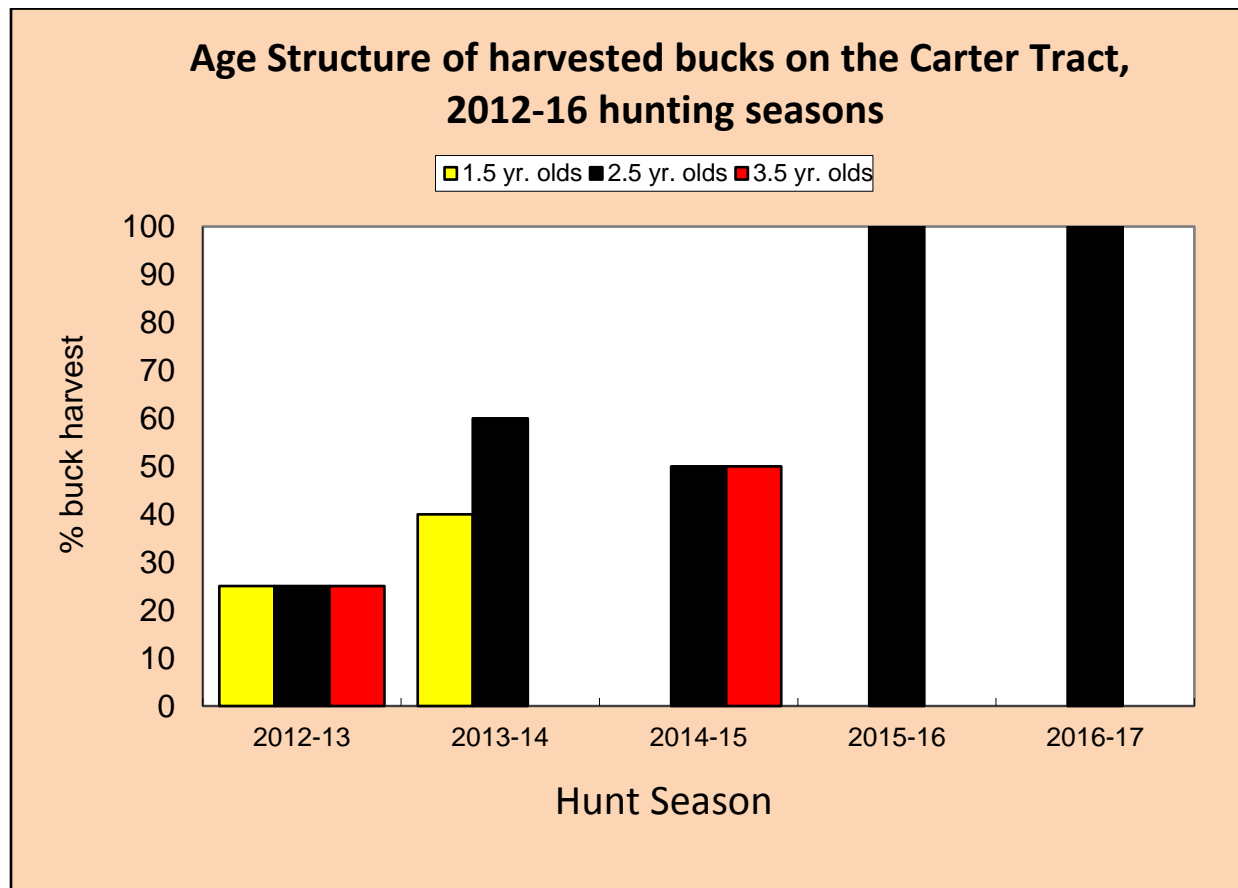
Mean Physical Parameters 2016-17							
Quota Hunt	Gender	Age (yrs)	Weight (lbs)	Antler points	Avg beam length (in)	Avg beam circum. (in)	Inside spread (in)
Archery I	Doe	2.5	91*	N/A	N/A	N/A	N/A
General Gun II & III	Buck	2.5	109	5	9.7	3.0	9.0

\*= estimated, one doe was weighed dressed at 60 pounds

The recent trend is for area bucks to be harvested primarily during the General Gun II & III hunts. These two hunts occur annually during the last week and a half of January. This coincides with the primary rutting activity and mean conception dates for white-tailed deer in southern Washington County (Garrison et al., 2009). The two bucks harvested were small in body weight

and antler size compared to the two bucks harvested in 2015-16; while the two does harvested were quite a bit bigger than those harvested the previous year. Also, similar to last year, all deer harvested were estimated to be in the 2.5 year old age class, and no bucks older than the 3.5 year old age class have been harvested off of the Carter Tract in the last five years (Figure 13).

We believe the full potential for deer hunting opportunities on the Carter Tract has yet to be realized, but we do expect continued improvement in conjunction with active habitat management. Considering herd management objectives, additional antlerless harvests are not presently needed to control population levels as a higher density is desirable to meet our population goal and improve hunter success rates. The continued protection of does (outside archery season) is necessary to further bolster recruitment and expedite achievement of herd objectives. Limiting the harvest of does will facilitate increases in herd size and improvements in overall age structure, which should in turn positively affect hunter success.



**Figure 13. Age structure of bucks harvested during the 2012-13 through the 2016-17 seasons at Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, FL.**

Chronic Wasting Disease (CWD) is a contagious neurological disease that has been found in captive and wild mule deer (*Odocoileus hemionus*), white-tailed deer, moose (*Alces alces*), and Rocky Mountain elk (*Cervus elaphus*) within 24 states and three Canadian provinces in North America. The disease causes degeneration of the brains of infected animals, resulting in emaciation, abnormal behavior, loss of bodily functions, and death.

Currently the only practical method for diagnosing CWD is through analysis of brain stem tissue or lymph nodes from dead animals. There is no practical live-animal test. In 2002, the FWC initiated a comprehensive surveillance and monitoring program for CWD. Staff continues to collect and test tissue samples from hunter killed deer from the Carter Tract and surrounding counties as part of this statewide monitoring program. The presence of any CWD-positive deer would be cause for concern, so we plan to continue CWD surveillance for the foreseeable future.

## **Wild Turkey**

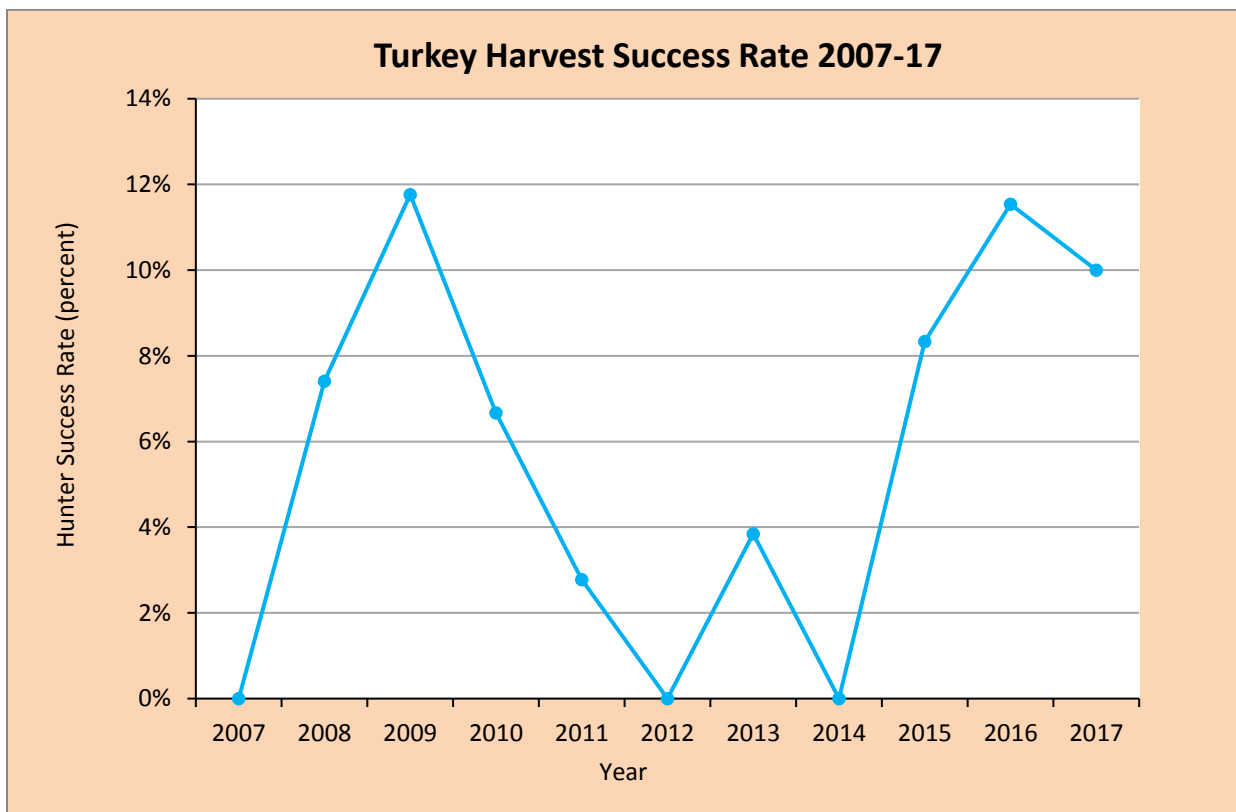
### Management Objectives

FWC personnel desire to encourage and maintain a strong population of wild turkey (*Meleagris gallopavo*) on the Carter Tract, in order to provide a high quality hunting experience for the public. We will continue to provide and enhance high quality habitat for wild turkeys by maintaining an open understory and encouraging herbaceous groundcover via habitat improvement activities such as prescribed burning.

### Harvest

Spring turkey season on the Carter Tract consists of three quota hunts, each three days in length, and a two-day youth quota hunt. Permit holders for all turkey quota hunts were afforded one day prior to each hunt for scouting. Twenty hunters participated in the 2017 spring turkey hunts, however we did not have any hunters for the youth turkey hunt. Two gobbler turkeys were harvested during the first quota hunt in 2017. The turkey harvest success rate (defined as a percentage, calculated as the number of gobblers harvested/man-days of effort) for the Carter Tract from 2007 – 2017 is illustrated in Figure 14. For the last three spring turkey hunting seasons, hunter success rate has hovered around 10%. Weather conditions, experience level of hunters, and hunting pressure on surrounding/adjacent properties can all affect harvest success rates. Turkey harvesting opportunities on the Carter Tract have and should continue to improve

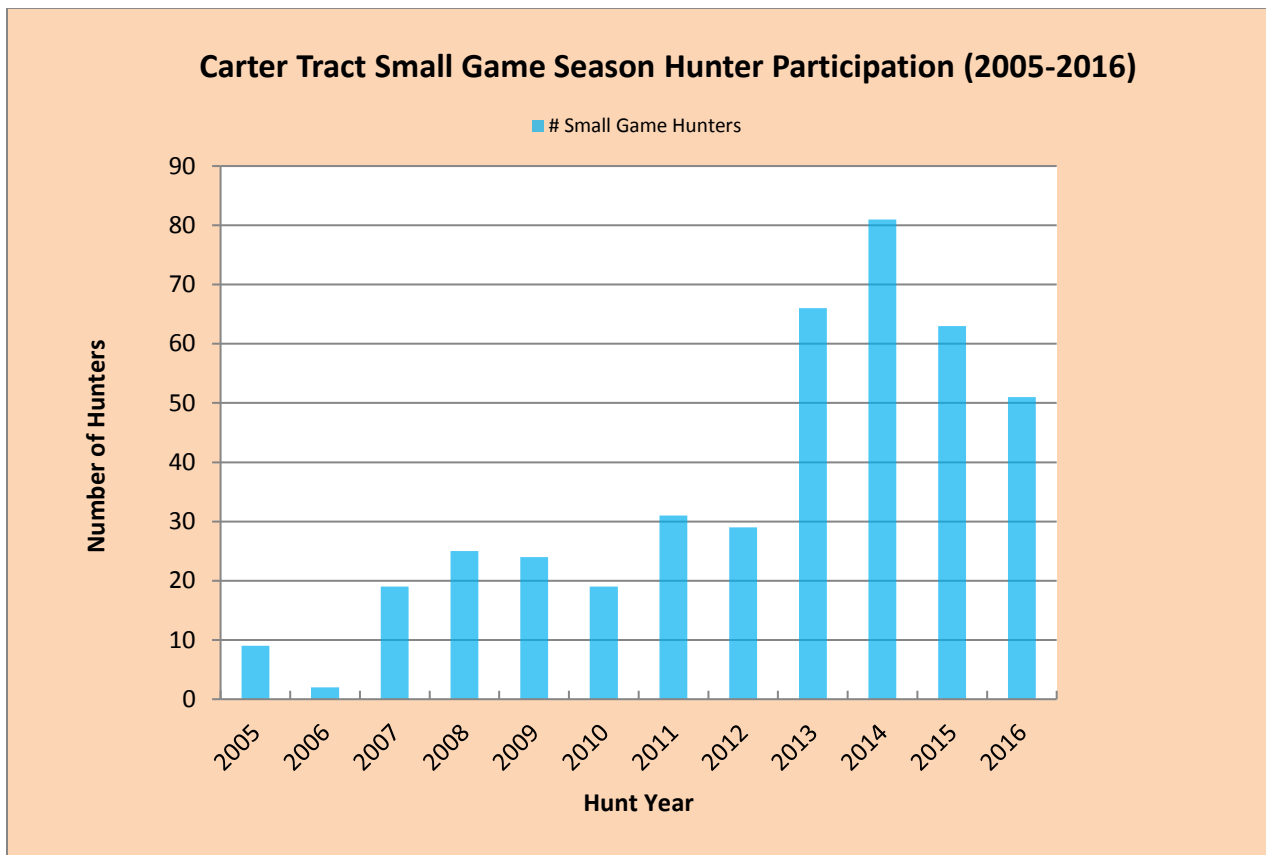
as a more frequent burn regime is maintained for controlling scrub oaks and producing open grassy/herbaceous areas for nesting and feeding. Further, more frequent mowing of powerline right-of-ways at strategic times of the year (just post nest-hatching) can provide better insect habitat for poults. Turkey poults have a high protein demand during the first four weeks of life (Hurst, 1992), and are incapable of flight until approximately ten days old (Williams, Jr. and Austin, 1988). During this flightless period poults are extremely vulnerable to predation. Increasing the amount of protein available (in the form of insect abundance) should help achieve maximum poult growth and improve survival.



**Figure 14. Turkey harvest success rate from 2007 - 2017 on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

## Small Game

The Carter Tract is open annually to small game hunting during a 16-day non-quota season each December. The area is open first-come first-served to a maximum of 20 hunters on the area on any given time. Gray squirrel (*Sciurus carolinensis*), northern bobwhite (*Colinus virginiana*), wild hogs (*Sus scrofa*), and various waterfowl species are the primary species hunted. Check station operators record how many hunters pursue each type of game for the duration of the small game season. Small game hunters devoted 5 days to squirrel hunting, 7 days to quail hunting, and 39 days to hog hunting during the 2016 small game season. Overall small game hunter participation (51 man-days) was down for the second straight year, but it is important to note that hunters pursuing waterfowl were more than half of all hunters counted during the small game season and are not included in the above calculation (Figure 15). A list of all species and their harvest is listed in Table 4. We note that overall hunter participation is very strong during the small game season and we are encouraged by its recent popularity with the hunting public.



**Figure 15. Small game hunter participation on the Carter Tract of Econfina Creek WMA, Washington County, Florida, 2005 - 2016.**

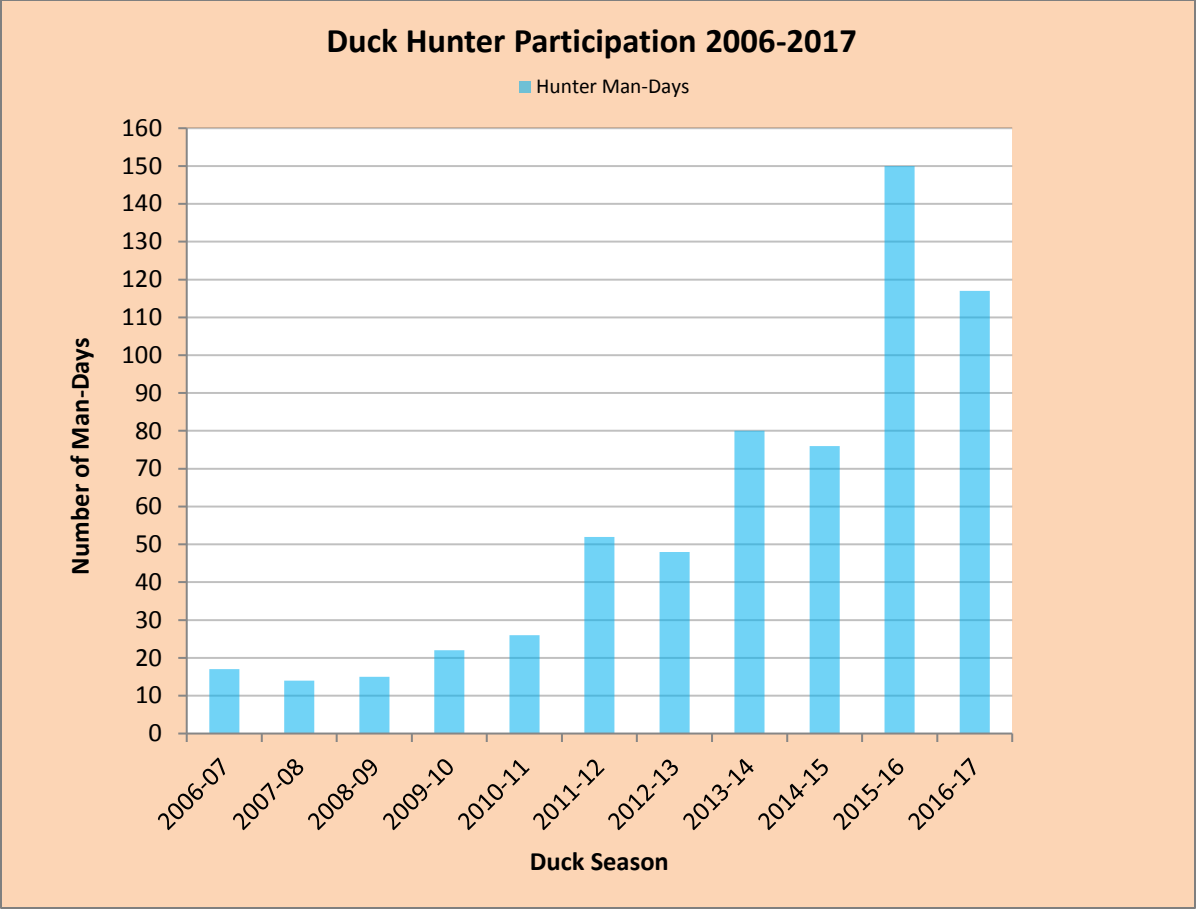
**Table 4. Game species and number harvested during the 2016 small game season on the Carter Tract.**

Species	Wild Hog	Gray Squirrel	Dove	Bobwhite Quail
<b>Number Harvested</b>	5	12	3	3

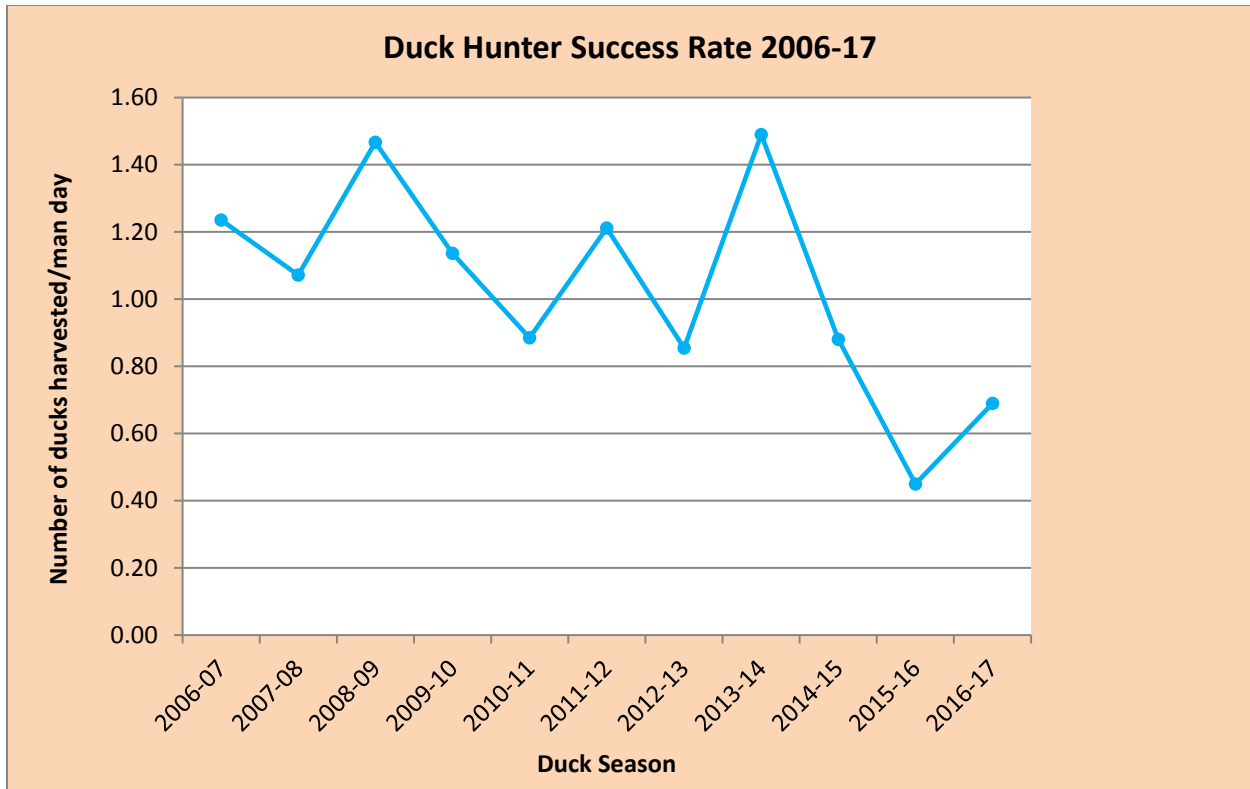
## **Waterfowl**

### Harvest

The Carter Tract provides duck hunting opportunities during a special early duck season each September and portions of the general gun and small game seasons coinciding with the phase I and II waterfowl seasons as determined by the U.S. Fish & Wildlife Service (USFWS). For the 2016 season duck hunters spent 117 man-days hunting and harvested a total of 81 ducks, representing six species. Twenty-four wood ducks (*Aix sponsa*) and twelve teal (*Anas spp.*) were harvested during the September early duck season. Twenty-two wood ducks, seventeen ring-necked ducks (*Aythya collaris*), one bufflehead (*Bucephala albeola*), and one greater scaup (*Aythya marila*) were harvested during the small game season. Two wood ducks and two mallard ducks (*Anas platyrhynchos*) were harvested during the general gun season. Duck hunter participation trends from 2006-17 on the Carter Tract are represented in Figure 16. Hunter participation was the second highest ever recorded on Carter Tract. Figure 17 depicts harvest success (number of ducks harvested/man-days of hunting effort) on the Carter Tract from 2006-17. Duck hunters realized a harvest rate of 0.69 ducks/man-day during the 2016-17 hunting season, which represents a 53% increase in success rate compared with the previous season. The high man-days and large number of ducks harvested continues a positive trend in both hunter participation and duck numbers on the Carter Tract.



**Figure 16. Duck hunter participation from 2006 - 2017 at the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**



**Figure 17. Duck hunter success rate (ducks harvested/man-day) on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida, 2006 - 2017.**

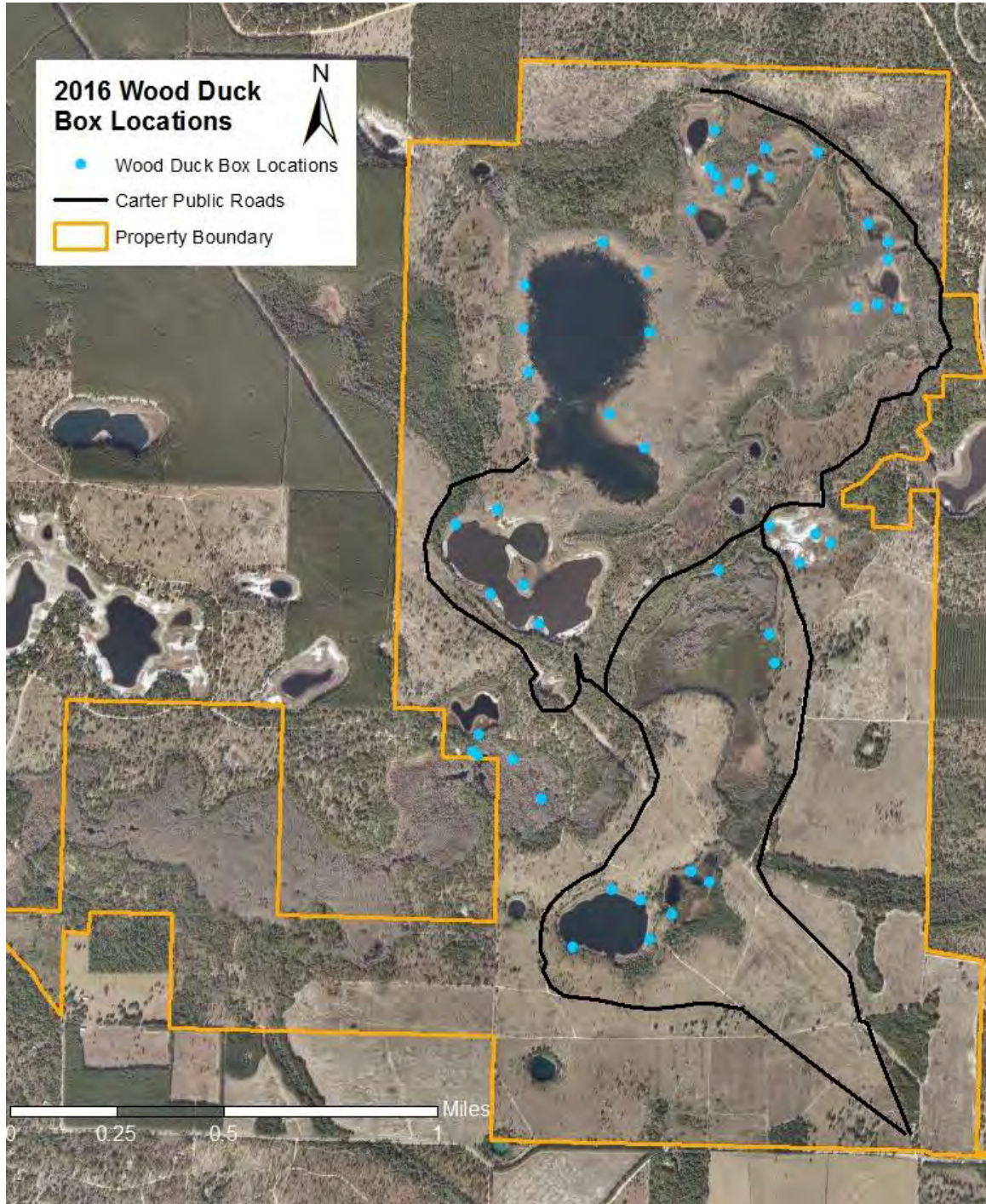
### Wood Duck Nest Boxes

There are currently 50 Wood Duck (*Aix sponsa*) nest boxes erected on the Carter Tract. Figure 18 shows the current location of these nest boxes. Ideally, the nest boxes are checked, cleaned, repaired (if necessary) and replenished with fresh wood shavings each December and then a breeding season check is conducted in the spring, usually March. Unfortunately, due to staff shortages, we were unable to complete these tasks for the 2016-17 breeding season. However, for the 2017-18 breeding season we are fully staffed and will resume these tasks for the benefit of this species on the Carter Tract.

It is worthwhile to examine data from previous years and provide a snapshot on the success of the wood duck nest box program. Data examined from 2008 through spring 2016 indicate that on any given year, about half (46%) of the nest boxes are utilized by wood ducks. Mean number of eggs per clutch is seven, and mean nesting (hatching) success is 58% (McElhone 2016). These numbers indicate that, on average, just under a hundred wood duck ducklings are successfully hatched annually on the Carter Tract via the nest boxes. We fully



expect this number to climb in the future and we are excited about the potential of this program to enhance local wood duck populations.



**Figure 18. Current wood duck box locations across the Fitzhugh Carter Tract of Econfinia Creek WMA, Washington County, Florida.**

## Avifauna

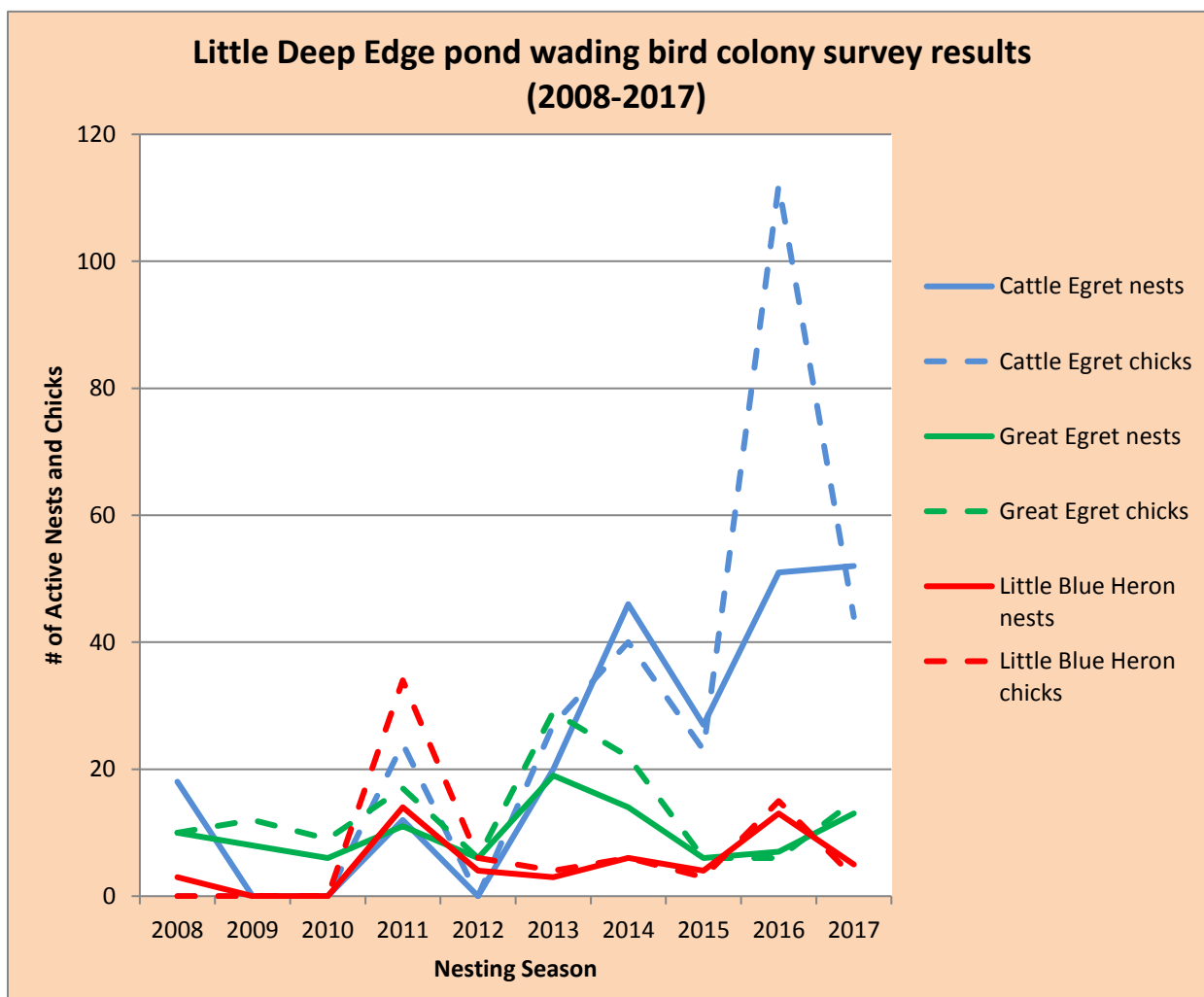
The Carter Tract supports a mosaic of unique habitat types that tend to harbor a diversity of bird species. As such, multiple survey types designed to document this diversity are conducted annually. For example, surveys of Little Deep Edge Pond and Dykes Mill Pond document their use as wading bird colonies. Passerine point counts note species change over time in relation to habitat restoration. Kestrel boxes are used to determine possible residency status of the Southeastern American Kestrel (*Falco sparverius paulus*). The Bachman's Sparrow (*Peucaea aestivalis*), identified as a species of greatest conservation need by FWC (FWC 2012), was first observed on Carter Tract in 2015 and is monitored through spring playback surveys. Gamebird populations are monitored using summer whistle counts for Northern Bobwhite (*Colinus virginianus*) and Mourning Doves (*Zenaida macroura*) are banded each summer as part of a national banding program.

### Wading Birds

Most wading birds nest semi-colonially along the edges of lakes or creeks, or in trees and shrubs growing out of water bodies. Little Deep Edge Pond on the Carter Tract has supported a wading bird colony each summer since surveys began in 2007 and a new colony was found on Dykes Mill Pond in 2015. Great Egrets (*Ardea alba*), Cattle Egrets (*Bubulcus ibis*), and Little Blue Herons (*Egretta caerulea*) have historically been the most common species documented, with Tricolored Herons (*Egretta tricolor*), Snowy Egrets (*Egretta thula*), Great Blue Herons (*Ardea herodias*) and Anhinga (*Anhinga anhinga*) also observed. Many species of wading birds are locally affected by wetland drainage associated with urbanization and agricultural expansion. The resulting loss of suitable foraging and breeding habitat in conjunction with increased predation are key threats to Florida's wading birds (FWC 2013). These issues highlight the importance of conservation of unspoiled wetland habitat such as that found on the Carter Tract.

Wading bird surveys are conducted annually from April – July. Adult birds and nest contents are observed at a distance using binoculars and a spotting scope to avoid disturbing the nests. Checks are completed every four weeks, during which time, nestlings get large enough to accurately be counted using two observers. Nest locations are marked on an image of the rookery to follow the same nest throughout the breeding season.

At the Little Deep Edge colony, 13 Great Egret nests produced 15 chicks. Five Little Blue Heron nests produced three chicks. 52 Cattle Egret nests produced 44 chicks. One Tricolored Heron nest produced zero chicks. One Snowy Egret nest produced zero chicks. Figure 19 illustrates active nests and chick production of wading birds at Little Deep Edge Pond from 2008-2017. Great Egrets more than doubled the number of chicks produced in 2016, while Cattle Egret and Little Blue Heron chick production decreased from 2016. A detailed summary of species observed from 2008-2017 using the Little Deep Edge Pond wading bird colony can be found in Appendix V.



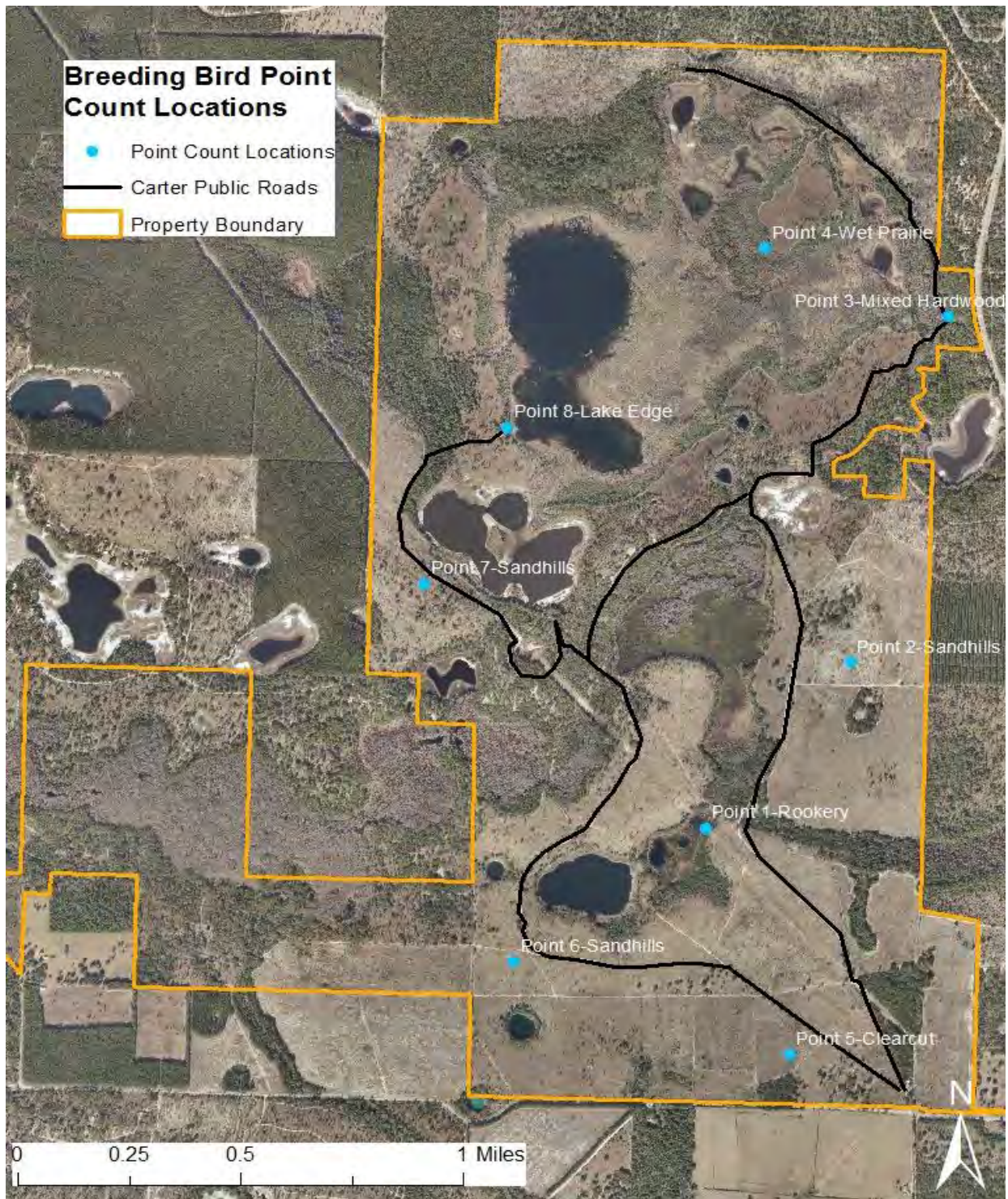
**Figure 19.** Active nests and chicks observed on Little Deep Edge wading bird colony from 2008 - 2017, Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.

The Dykes Mill pond colony was first discovered in January 2015 while out scouting for potential Wood Duck box nest sites. During the 2017 breeding season, 6 Great Blue Heron nests produced 4 chicks and 9 Anhinga nests produced 7 chicks. This colony is on the southern edge of a cypress dome in the western portion of Dykes Mill Pond. FWC will continue to monitor this colony annually to track nesting success and species composition.

### Passerines

Breeding bird point count surveys are conducted on the Carter Tract annually. Point counts document bird species presence and can be used to calculate relative abundance among habitat types (Bibby et al., 1992). Point count surveys are most effective during the breeding season when calling activity is at its peak (Hamel et al., 1996). Location of point counts are listed in Figure 20. Point count locations are distributed among the different habitat types as follows: sandhill habitat (Points 2, 6, and 7), wetland/wading bird colony (Point 1), lake edge (Point 8), wet prairie (Point 4), mixed-hardwood forest (Point 3), and early successional grassland habitat (Point 5) (Figure 20). Except for Points 3, all locations have undergone significant habitat enhancement and restoration efforts.





**Figure 20. Location of breeding bird point count surveys conducted in May 2017 on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

Point count surveys were conducted in four consecutive days in May 2017. Surveys were conducted in the early morning, when bird activity is typically highest (Hostetler and Martin

2001). Counts began at dawn and ended by 0830. The order in which each point count location was surveyed was alternated among the four survey days. This was done to ensure that counts were conducted in early-, mid-, and late-morning periods for each location, thus accounting for any bias from birds potentially calling more frequently at certain hours during the count period (Hostetler and Martin, 2001). Following arrival at each count location, observers refrained from movement or sound for two minutes prior to the start of the count. Count duration was ten minutes, during which time all birds seen and/or heard within a 75-meter radius were recorded. Birds observed/heard outside of the 75-meter plot were also noted.

Point count results indicated a decline in species richness across all habitat types when compared to the previous year (Table 5). Slight variations in richness will occur year to year depending on the weather conditions and other factors that affect the singing rate of passerines. Species found at each point were indicative of the habitat type. Over the long term, this database will provide a platform for how the habitat management occurring on Carter Tract has shaped the avian diversity on the property.

**Table 5. Species richness and most common species per habitat types at breeding bird point count stations in 2017 on Fitzhugh Carter Tract, Washington County, FL.**

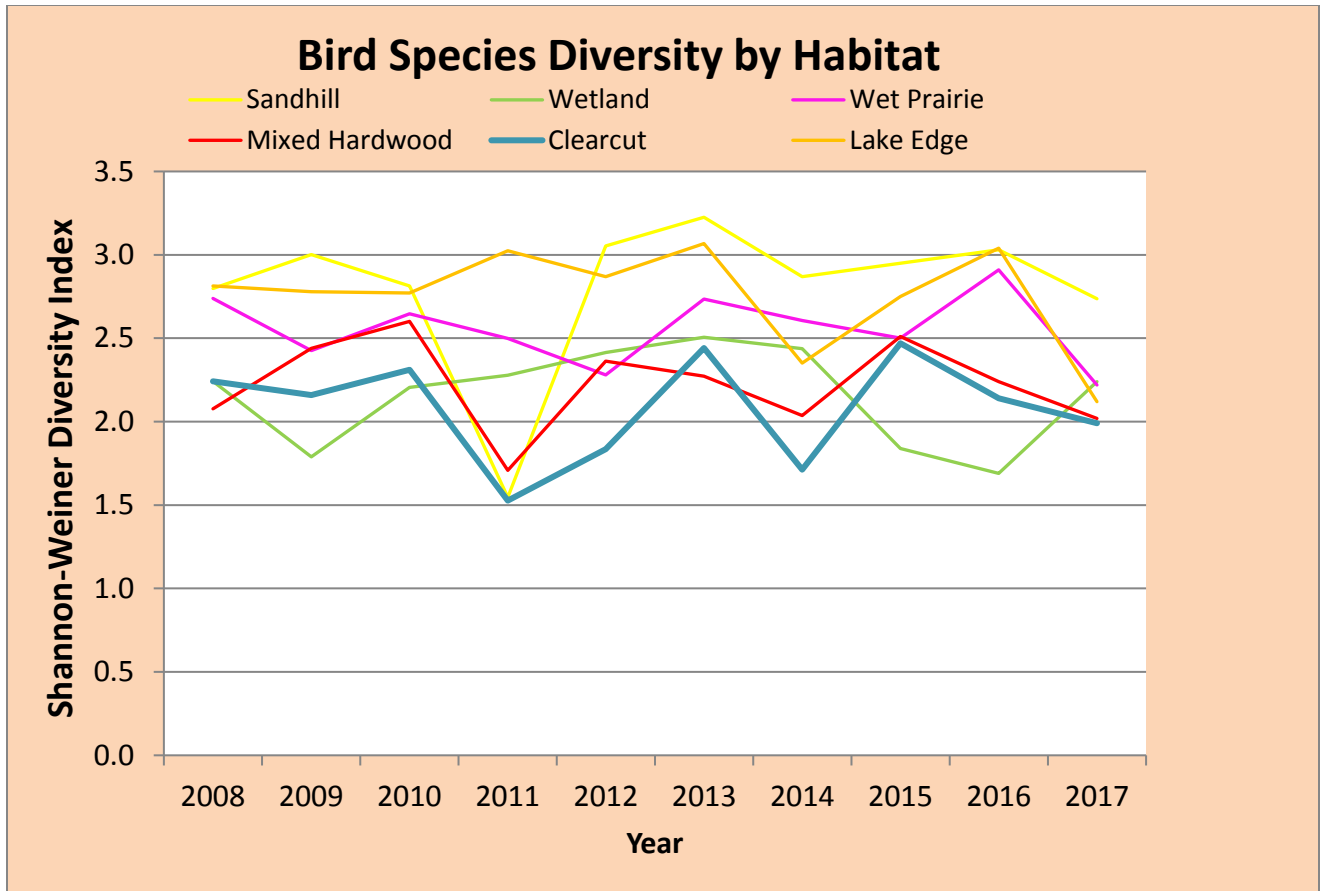
<b>Habitat Type</b>	<b># of Species within 75m</b>	<b>Most Common Species</b>
Clearcut	8	Blue Grosbeak, Eastern Towhee, Eastern Bluebird
Sandhill	19	Eastern Bluebird, Mourning Dove, Eastern Towhee
Lake Edge	11	Great Crested Flycatcher, Yellow-throated Warbler, Eastern Kingbird
Wetland Rookery	11	Red-winged Blackbird, Common Yellowthroat, Northern Cardinal
Mixed Hardwood	10	Blue -gray Gnatcatcher, Northern Parula, Northern Cardinal
Wet Prairie	12	Northern Parula, Blue-gray Gnatcatcher, Yellow-throated Warbler

Landscapes comprised of a mosaic of habitat types generally yield higher species diversity than landscapes dominated by a single habitat type. The Carter Tract is a unique combination of freshwater ponds, marshland, uplands, and transitional hardwood hammocks. The inherent habitat diversity of the Carter Tract, combined with the intensive habitat restoration efforts of the NFWFMD, have resulted in a property representing multiple habitat types, each of which contribute to the overall high diversity of avian life which utilizes the property. As each habitat type continues to be maintained within the recommended fire return interval and the longleaf pine continue to mature, we expect this high diversity of avian species to remain on the area.

To date, 128 species of bird have been documented as occurring on the Carter Tract (Appendix VI).

Point count data over the last ten years was used to calculate bird species diversity within the six habitat types represented during annual surveys. Simply counting the number of species observed during a given survey yields species richness. Species richness does not equate to species diversity because it does not account for species evenness (how many individuals of each species are counted). The Shannon-Weiner Diversity Index was used to incorporate species evenness as well as richness into a comparable diversity measure (Shannon 1948, Zar 2010).

Microsoft Excel® was used to calculate the diversity index from 2008 – 2016 for the six habitat types sampled to determine which habitat types harbor the highest diversity and how they may have changed over the years in response to habitat restoration improvements. The results are graphically depicted in Figure 21. Of the six habitat types surveyed during the spring 2017 point counts, the sandhill, wetland, and wet prairie point counts yielded the highest species diversity. The sandhill point counts have supported the highest diversity of bird species in seven of the nine years point count surveys have been completed. All habitat types saw a decrease in species diversity from last year with exception of the wetland habitat.



**Figure 21. Shannon Wiener Diversity Index ( $H'$ ) compared from 2008 - 2017 among habitat types at the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

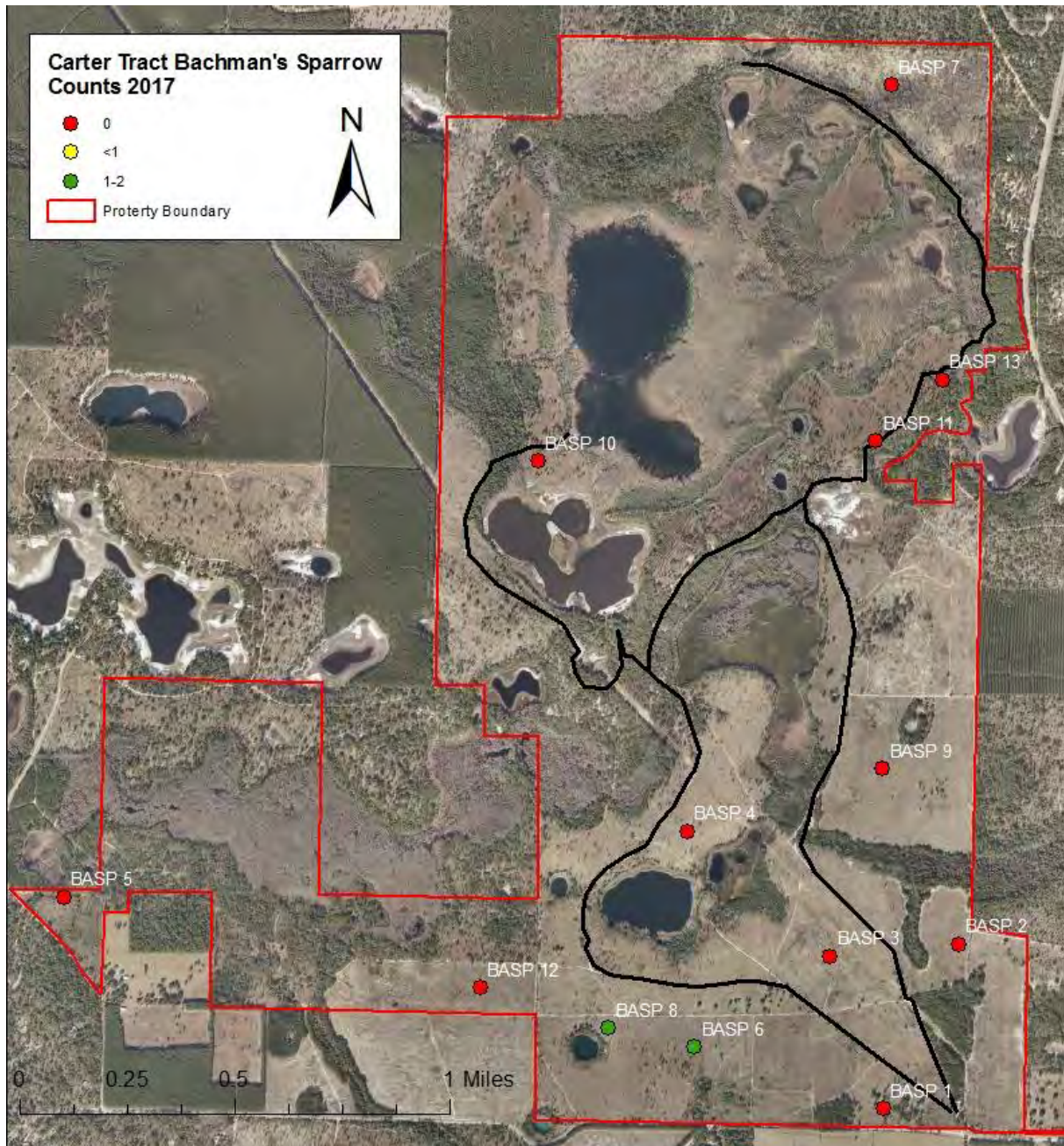
Bachman’s Sparrow playback survey

Bachman’s Sparrows (*Peucaea aestivalis*) were first documented on Carter Tract during the spring of 2015. This species has been identified as a species of greatest conservation need by FWC. Bachman’s sparrow was once a common species in the southeastern longleaf pine forests, but has undergone dramatic population declines in recent decades (Cox 2014). An indicator of southern pine forests, Bachman’s sparrows nest and forage on the ground, and are closely associated to areas with diverse, healthy ground cover conditions maintained by frequent prescribed fire. This survey will allow FWC to determine the presence and distribution of Bachman’s sparrow on Carter Tract, and track it over time.

Survey sites selection and protocols closely follow those established by Cox (2014). Sites needed to be at least 250m apart and cover potential breeding habitat (sandhills, flatwoods, scrubby flatwoods, and prairie) to be included. From these criteria, thirteen sites were randomly



selected using ArcMap 10.3® GIS (Geographic Information Systems) software (Figure 22). Surveys were conducted under favorable weather conditions in April and May 2017 and began at sunrise and ended by 0900 hours. Three replicates of the survey were completed. At each station, the observer played a sequence of Bachman's Sparrow vocalizations (45 sec) and silence (15sec) that was repeated three times for a three-minute sampling period.



**Figure 22. Bachman's Sparrow survey sites on Fitzhugh Carter Tract WMA, Washington County, Florida.**

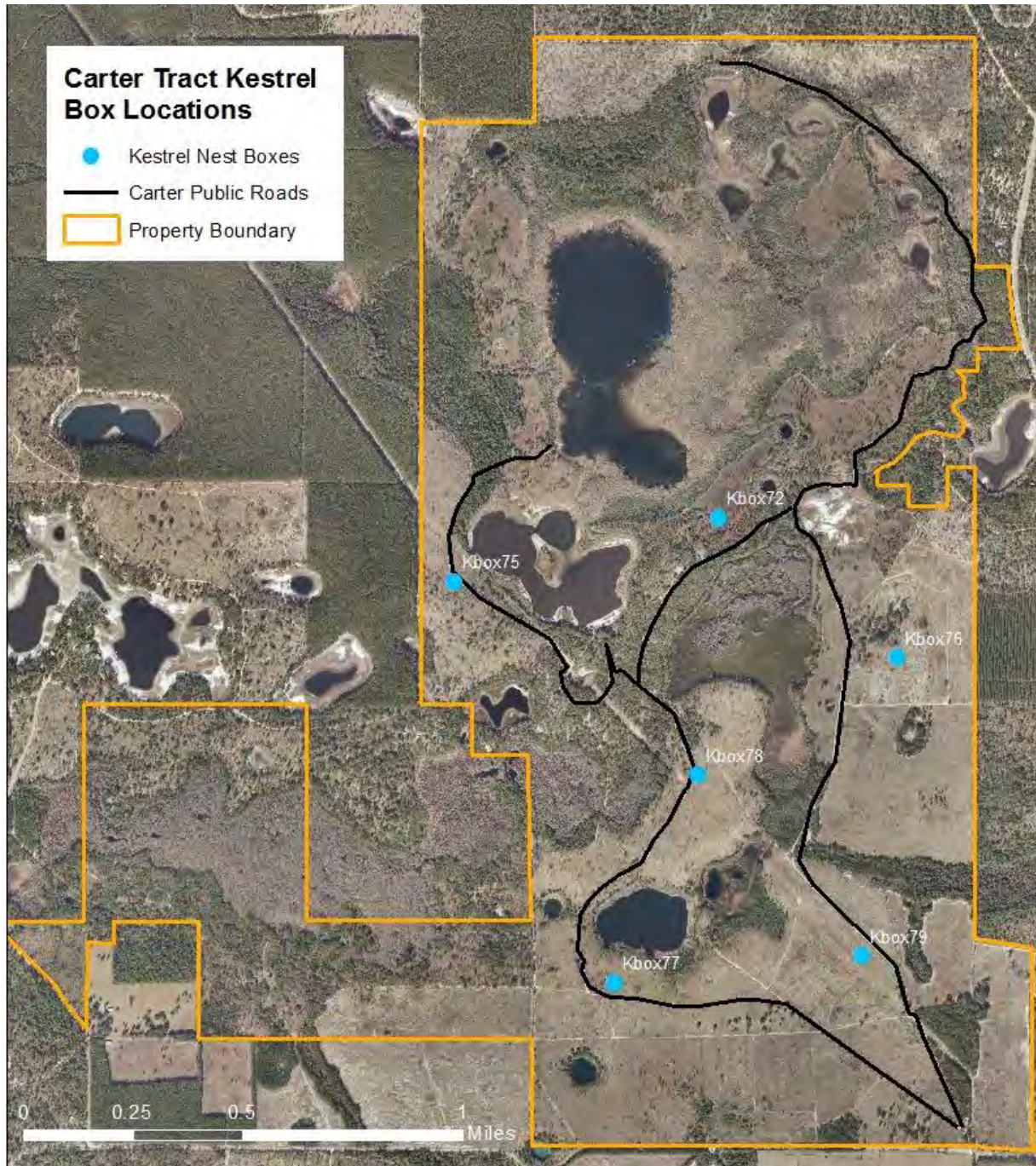
Bachman's Sparrows were documented at two of the thirteen survey sites (Figure 22). This represents a difference compared to last year when birds were heard on five of the sampling points (McElhone 2016). All the birds counted were clustered near the southern portion of Carter Tract, with stations 6 and 8 recording multiple Bachman's sparrow at each point (Figure 22). These two stations are characterized as sandhill habitat, with a dense wiregrass groundcover and longleaf saplings dominating the landscape. With the continued two-year fire return interval, we expect Bachman's sparrows to continue to use Carter Tract, and expand into northern portions of the property.

### Kestrel Boxes

The Southeastern American Kestrel is a subspecies of the American Kestrel (*Falco sparverius*) found in open pine habitats, woodland edges, prairies, and pastures, with a preference for sandhill habitats. The smallest falcon in the U.S., and a threatened species in the state of Florida, the southeastern American kestrel relies on suitable cavity trees as a key habitat feature necessary for breeding (Rodgers, Jr. et al., 1996). However, because kestrels are secondary cavity nesters, suitable nest sites are thought to be the most limiting factor and a major contributor to declining populations in Florida (Hoffman and Collopy 1988). The decline of natural nesting and foraging habitats in recent years has prompted the use of nest-box programs to help augment populations. Kestrel boxes can also provide important winter cover for other avian species, such as the Eastern Screech Owl (*Megascops asio*) (Hipes et al. 2001; U.S. Department of Agriculture 1999).

FWC staff consistently observe kestrels annually at the Carter Tract during winter and early spring. However, it is unknown whether the birds are migratory/wintering American Kestrels or resident Southeastern American Kestrels. Although southeastern American Kestrels are slightly smaller than American kestrels, the two species cannot be reliably distinguished in the field. Because the Southeastern American Kestrel is the only subspecies of kestrel that breeds in Florida, erecting nest boxes is one method of determining which species is present on the Carter Tract. Therefore, in February 2011 eight nest boxes were installed throughout the Carter Tract following protocol outlined by the U.S. Department of Agriculture (USDA) (1999). Currently, six of the eight nest boxes are still on the area (Figure 23).





**Figure 23. Location of kestrel nest boxes at the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

Nest boxes were installed on mature longleaf pine trees, approximately 15 ft from the ground facing a southeast orientation. Trees chosen were those in open areas, far enough away from surrounding trees to discourage squirrels from accessing nest boxes. Boxes were located at least 0.5 miles from the next nearest nest box. Boxes were filled with cedar shavings as nesting

material. Aluminum flashing was wrapped around the base of trees to discourage rat snake (*Elaphe* sp.) predation. Nest box monitoring followed protocol outlined by FWC's Fish and Wildlife Research Institute.

Five out of the six nest boxes showed signs of use by kestrels but no productive nests were recorded during spring 2017. A similar kestrel box project on Blackwater WMA has documented breeding kestrels one year following box installation; the 2015 nesting season resulted in Southeastern American Kestrels nesting in seven out of 21 boxes and the 2016 nesting season indicated nesting in six out of 24 nest boxes (Blackwater WMA data courtesy Barbara Almario). Because Blackwater WMA is located just 75 miles west of the Carter Tract, we feel there is a good chance Southeastern American Kestrels will utilize nest boxes in the future. Kestrel boxes will continue to be monitored again during the 2018 nesting season (February – June).

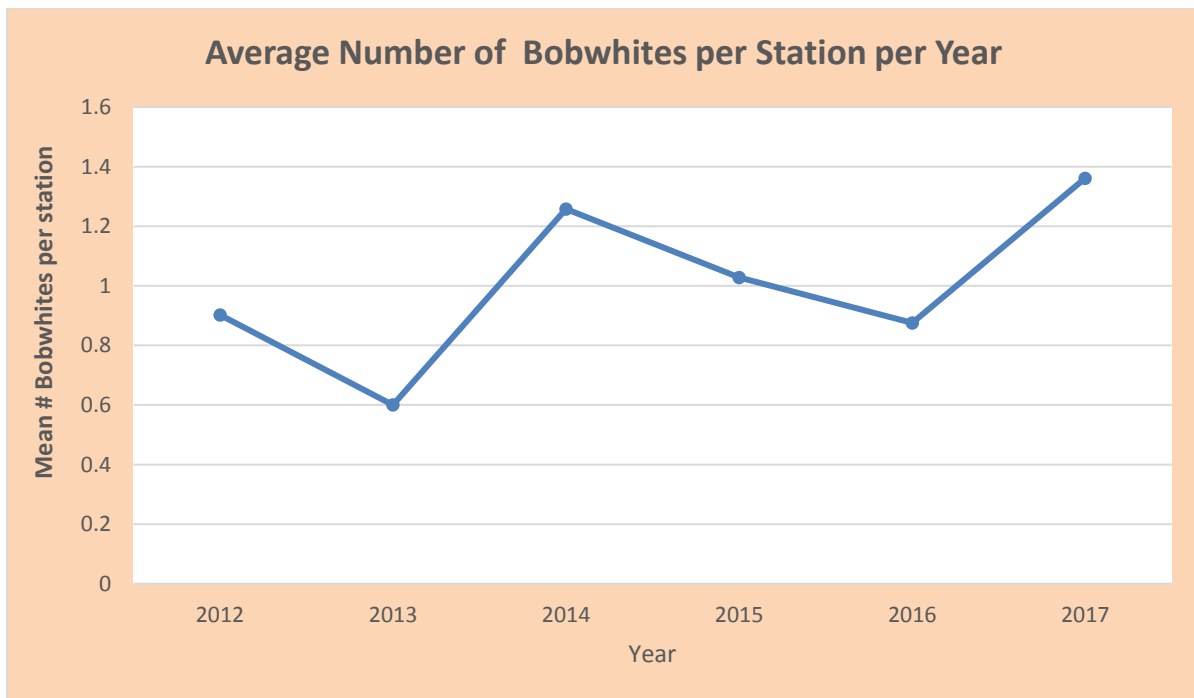
#### Northern Bobwhite Summer Whistle Counts

Summer whistle counts for the northern bobwhite were used to obtain a population index for this popular gamebird. It has been shown that there is a strong positive relationship between the number of bobwhites whistling in the summer and the number of coveys established the following fall (Rosene 1984; Terhune et al. 2009). Beginning in 2012, we instituted annual summer whistle counts for northern bobwhites in order to obtain a population index of this species and follow subsequent harvest success on the Carter Tract.

Whistle count surveys were conducted from June 8 - 28, 2017. Most surveys fell within the June 15-July 10 calling peak suggested by Rosene (1984) and the mid-June to late-July peak suggested by Terhune et al. (2009). It was important to conduct surveys during peak whistling dates as intensity of whistling is thought to correspond closely with nesting and hatching activity (Terhune et al. 2009), and thus should be a more robust indicator of overall population estimates. Rosene (1984) and Terhune et al. (2009) also suggested that the best time to conduct whistle counts is during the 'calling optimum' that takes place during the two hours following sunrise. We followed this protocol, beginning surveys promptly at sunrise and completing all surveys within the two hours following official sunrise. Surveys lasted for five minutes per station and 12 total stations were chosen that maintained adequate spatial coverage of the upland habitats of the Carter Tract. One-half mile buffers were maintained between stations to decrease the

possibility of double-counting birds. Surveys were not conducted when cloud cover was >50%, wind speed exceeded 12 mph, or under rainy conditions.

Figure 24 illustrates the trend in the mean number of bobwhites heard per station annually during summer whistle count surveys for the past six years at Carter Tract. Mean number of bobwhite heard per station this year (1.36) was the highest recorded on the Carter Tract, exhibiting a healthy rebound from the previous two years. This was likely aided by the 700+ acres of upland habitat burned in June 2016. However, the overall low number of male bobwhites leaves the health of the population on Carter Tract vulnerable to declines due to weather events like hurricanes or disease. Continuing to keep the upland habitat on a two-year or less burn interval will reduce hardwood encroachment, keep wiregrass from becoming too thick, and provide open areas for quail to feed.



**Figure 24. Trend in the mean number of northern bobwhites counted per station during 2012-2017 surveys on the Fitzhugh Carter Tract of Econfin Creek WMA, Washington County, Florida.**

Because of the relationship to the number of calling birds, total calls per station were also recorded. By recording calls, an attempt is made to avoid observer errors in distinguishing the number of individual calling birds as this number increased. Ellis et al. (1972) and Snyder (1978) both noted that the relationship between the numbers of calls and number of calling quail deteriorated rapidly when more than 7 birds per station were heard. It was more difficult for

observers to distinguish between individual quail at higher densities. Curtis et al. (1989) and Robinette (1991) observed increased variability in calling when the mean exceeded 4 birds per station. On the Carter Tract, the mean number of different quail heard per station didn't exceed four birds regularly. When this level is surpassed more frequently, it may be appropriate to use mean number of calls rather than the number of whistling bobwhites as the count index. Moreover, Snyder (1978) also noted 3 replicates were needed to project within 20% of the actual mean 80% of the time, when the call rate averaged 1 quail per station. When the index rate averaged 4 quail per station, 7 replicates were needed. It appears that the 6 replicates on the Carter Tract should be adequate for sufficient sampling of the bobwhite population.

We are encouraged to see more widespread use of the entire Carter Tract property by northern bobwhites and feel that maintaining an aggressive burning regime is the most important management activity NFWMD can do to continue to improve the population on the Carter Tract. Simply put, to manage for northern bobwhite populations, one is essentially managing for the integrity of the forest system that supports this bird; specifically, the sandhills longleaf-turkey oak-wiregrass association with its dendritic pattern of watersheds.

### Mourning Dove Banding

As part of a national long-term mourning dove banding program, FWC's Small Game Management Program solicited WMAs throughout the state to participate in this banding work. Since 2007, Carter Tract staff have participated and contributed to Florida's statewide dove-banding project in cooperation with the U.S. Fish and Wildlife Services and Bird Banding Lab. These efforts are integral components in the development and implementation of a long term national harvest management strategy for mourning doves. Hunters play an important role in the success of the program and are encouraged to report leg bands either via telephone or internet.

Trapping was conducted July 6-29, 2016 with traps set in the early morning. Traps were checked after 1-2 hours, depending on weather conditions. Doves were banded using USFWS metal identification bands, and age (HY = hatch year; AHY= after hatch year), sex, and molt sequence data were collected for each bird (Figure 25). Fifteen mourning doves (8 HY; 7 AHY) were successfully banded during the 2016 capture/banding effort, and there were two recaptures of birds banded in previous years (Table 6). This represents the same number banded as in 2015.





**Figure 25.** Mourning doves were trapped (left), banded with U.S. Fish and Wildlife identification bands, and age, sex, and molt sequence (right) were recorded in July 2016 on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida (arrow denotes the emergence of new primary feather #06 on a hatch year mourning dove).

**Table 6.** Dove banding results from 2007 - 2016 on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.

Year	# HY (hatch year) birds banded	# AHY (after hatch year) birds banded	# unknown age birds banded	Total # birds banded
2007	29	7	2	38
2008	40	9	1	50
2009	10	9	1	20
2010	11	13	1	25
2011	11	9	0	20
2012	12	14	0	26
2013	14	11	0	25
2014	34	12	0	46
2015	9	6	0	15
2016	8	7	0	15

## Herpetofauna

FWC staff employ several methods for surveying and monitoring the herpetofauna population at the Carter Tract. Methods used include box-style snake traps, pitfall traps, and incidental observations. A comprehensive list of all herpetofauna species (n=62) identified on the Carter Tract from 2005 to present has been compiled (Appendix VII). Sandhill and scrub habitats, as well as seasonal isolated wetlands and small ponds are among the most important and imperiled habitats for southeastern herpetofauna. Most amphibians that rely on seasonal wetlands or ponds for reproduction also require upland habitats (Bailey et al. 2006). The Carter Tract is an example of a good mix of both permanent (e.g. Dry Pond) and intermediate (e.g. Pine Log Creek and Garrett Pond) aquatic habitats interspersed with adjacent upland sandhills.

### Gopher Tortoise

The presence of the gopher tortoise (*Gopherus polyphemus*) in the sandhill habitat of the property is significant not only because it is a state Threatened species, but also because their burrows (both active and abandoned) are used by a host of commensalistic species for shelter and foraging (Jackson and Milstrey 1989). Specifically, the federally Threatened eastern indigo snake (*Drymarchon coureus couperi*), in addition to the gopher frog (*Rana capito*) and Florida pine snake (*Pituophis melanoleucus*), both imperiled species, are known to use gopher tortoise burrows (Moler 1992; Ashton and Ashton 2008). In previous years, a detailed report on the *Annual Survey and Monitoring of the Gopher Tortoise on the Carter Tract* was submitted by FWC staff separate from this comprehensive annual report. However, in March 2017 the annual gopher tortoise monitoring was contracted with the Florida Natural Areas Inventory (FNAI). After a pilot survey to determine sampling intensity needed to adequately survey for the species on the Carter Tract, three surveys were conducted in March, April, and May of 2017. Twenty-five burrows with seventeen tortoises were encountered. Utilizing a form of LTDS, a population of approximately 86 tortoises was estimated. Over half of the tortoises sampled were subadult or younger, indicating high recruitment to the local population. The complete report is attached as Appendix IX. Future plans are to survey and monitor the local gopher tortoise population via contract LTDS as necessary.



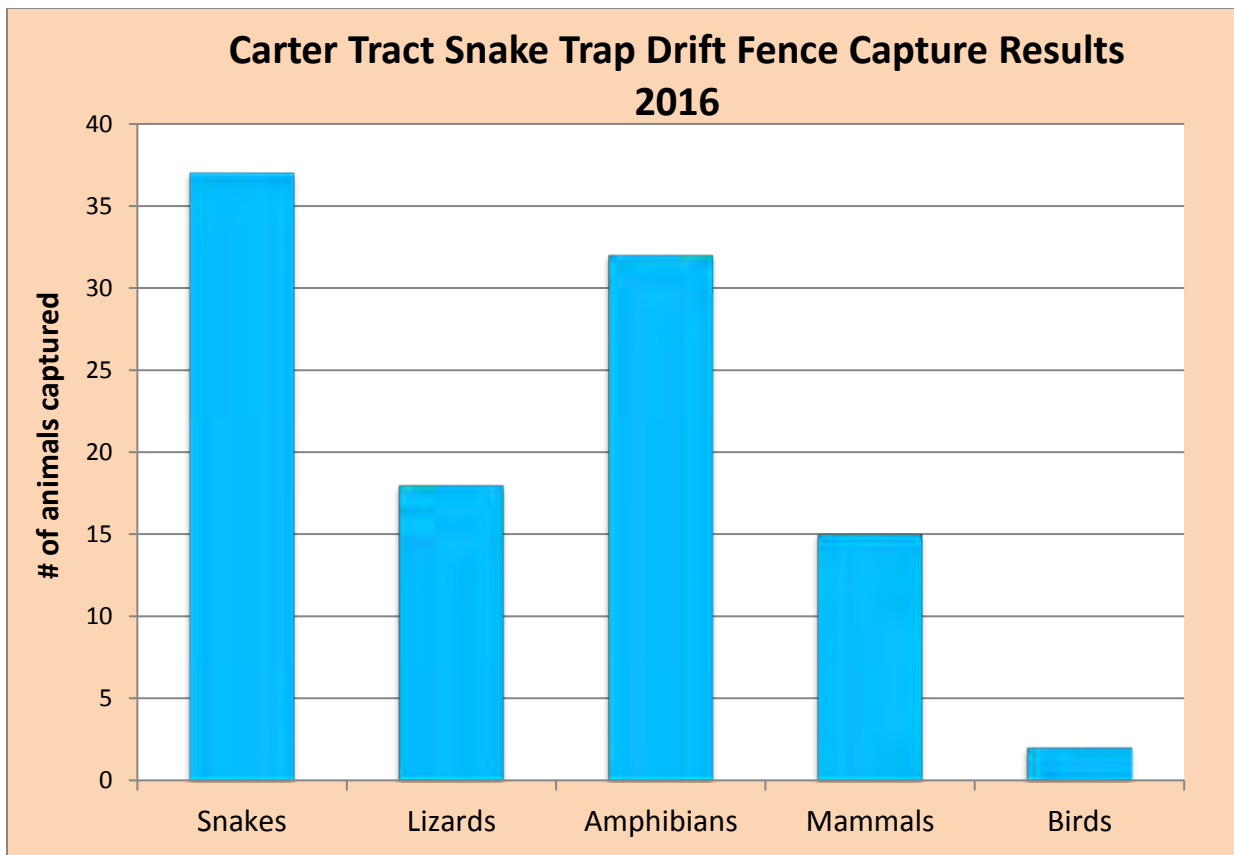
## Snake Traps

Because of their size, large terrestrial snakes can be difficult to capture using traditional survey methods. Use of traps specifically designed to capture these large terrestrial species is the most effective method for documenting their numbers on the Carter Tract. Four spatially distinct upland sandhill habitats were chosen based on their vegetative composition and structure, as well as proximity to mesic habitats (Figure 26). Snake traps were initially implemented during FY 2008-09, and the 2016 survey followed the methods outlined in McElhone (2014).



**Figure 26. Location of upland snake traps used for sampling herpetofauna on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida**

Across 160 trap nights, 104 individual animals representing 16 species were captured from September-November 2016 (Figure 27). Fifty-seven percent of animals were captured in buckets while the remaining 43% were captured in box traps. Snakes were the most captured taxa group with 37 captures, followed by amphibians, lizards, small mammals, and birds, with 32, 18, 15, and 2 captures, respectively. Southern black racers (*Coluber constrictor priapus*) was the most captured snake, accounting for 27% of the captures. Eastern fence lizards (*Sceloporus undulates*) made up 50% of the lizards captured. The Eastern narrowmouth toad (*Gastrophryne carolinensis*) was the most captured amphibian and the oldfield mouse (*Peromyscus polionotus*) was the most captured mammal. Appendix VIII details the number of individuals of each taxa captured in the snake trap arrays.



**Figure 27. Snake trap capture results from September - November 2016 on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

Based on data collected to date and observed capture trends, opening traps in spring during March and April should maximize the capture of snakes emerging from winter hibernacula in search of mates. Fall trapping during September and October should capture the majority of



snakes dispersing across the landscape (including young of the year born during late summer) before cooler weather forces them underground for the winter. Staff will continue to deploy snake traps on this schedule, adjusting trapping efforts as dictated by weather patterns (i.e. drought conditions ambient temperature, etc.) and incidental snake activities observations.

### **Bat Houses**

In January 2016, FWC staff installed two bat houses, one near Garrett Pond and the other between Dry and Black Ponds (Figure 28). Each site contains two houses installed on opposite sides of the supporting pole and can hold up to 200 roosting bats, or 400 at each site. FWC staff installed the houses in response to the previously occupied roosting sites (two hollow cypress trees on Dry Pond) no longer being used.



**Figure 28. Two bat houses were installed on Carter Tract in January 2016. One house was installed between Dry Pond and Black Pond (left) and the other was installed at Garrett Pond (right).**

Because many bat species occur in human habitations in Florida, they are particularly vulnerable to intentional eviction, roost destruction, vandalism, harassment, and large-scale

colony destruction, thus efforts should be made to preserve known roost sites (Humphrey 1992). Bat boxes were checked in November and December of 2016 and June of 2017 during daylight hours. During these checks two of the four houses were occupied by one or more bats, which represents the first time we have documented their use on the Carter Tract. One bat was identified as the Evening Bat (*Nycticeius humeralis*), a common colonial species in Florida. We will continue to monitor these houses periodically throughout the year to assess their use.

### **Wild Hog Management**

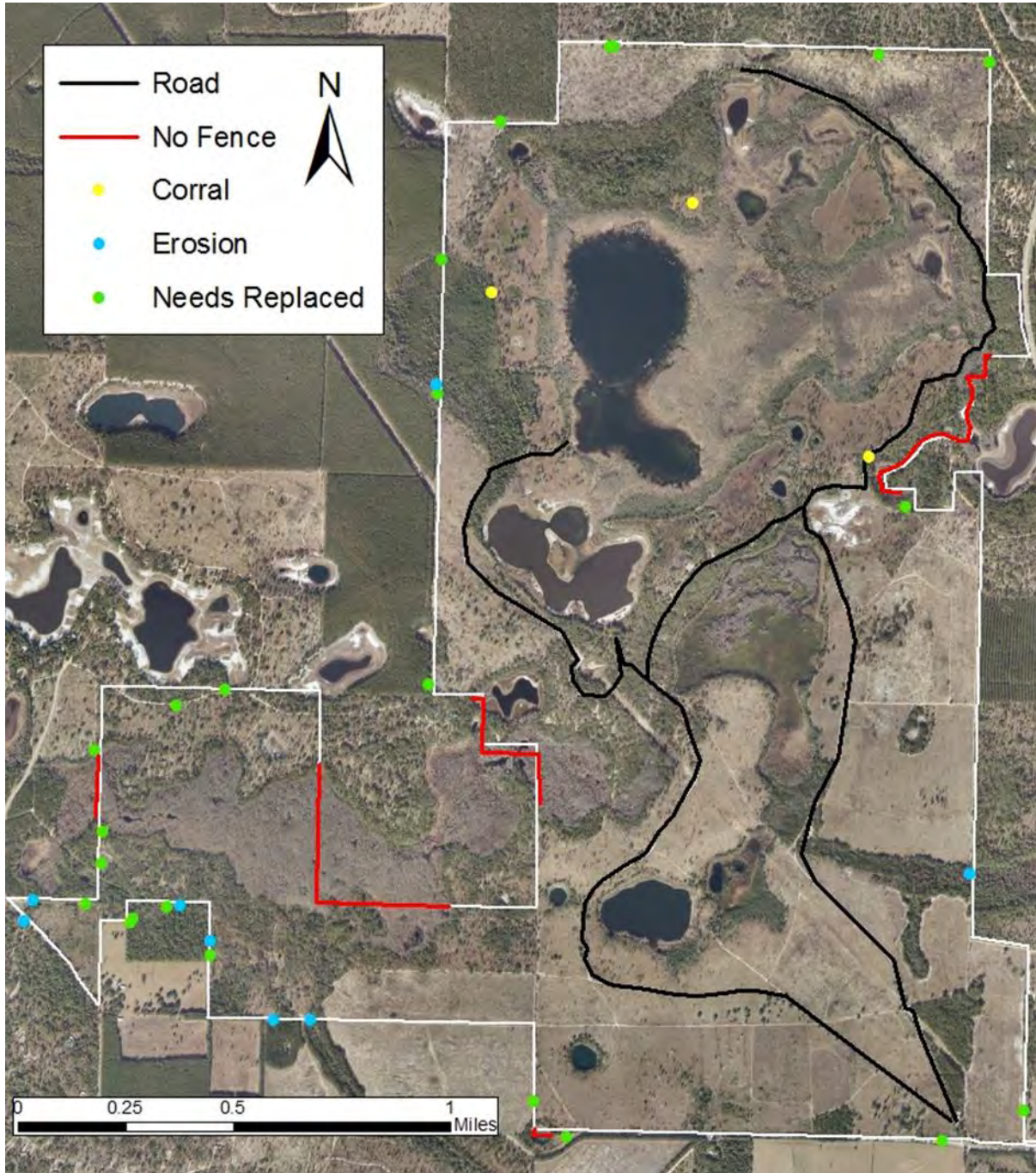
At the request of NFWFMD, FWC staff began assisting with trapping wild hogs on Carter Tract in the summer of 2014. Hogs have been documented on Carter Tract in the past, but not until recently have they had much impact on the understory vegetation that is undergoing restoration management on this mitigation bank property. Trapping efforts were concentrated from May through August. Public hunting opportunities run from September through April each year on Carter Tract (Appendix I). However, FWC staff utilized several breaks between hunts to trap hogs. Two Jager Pro® corrals were deployed during the summer of 2016; one in the flatwoods southeast of Dry Pond, and the other in the flatwoods west of Dry Pond. By the end of June 2017, one corral trap had to be relocated to the northeast quadrant of the property. This is the area where the hogs are now accessing Carter Tract regularly. Our efforts yielded a capture of 29 hogs, as well as 11 hogs harvested during hunting for a total of 40 hogs removed from Carter Tract in 2016-17.

### **Boundary Fence Breach Management**

The main point of access for hogs onto Carter Tract historically has been the wet flatwoods section west of Dry Pond, where the original boundary fence was in poor condition and not structurally sound enough to deter the ingress of hogs on the property. However, in the spring of 2016, NFWFMD replaced the defective portion of that fence with new and secure fencing that provided an effective barrier to hog movements onto the property. FWC currently monitors for breaches there and along the entire boundary of the WMA throughout the year. Figure 29 illustrates where we currently have challenges to the integrity of the boundary fence on the Carter Tract. These challenges include sections of fence that need repair/replacement, portions that are undermined via erosion, and portions where the fence is completely missing from the



boundary. Figure 29 also illustrates the location of the three hog corral traps during 2016-17 on the Carter Tract.

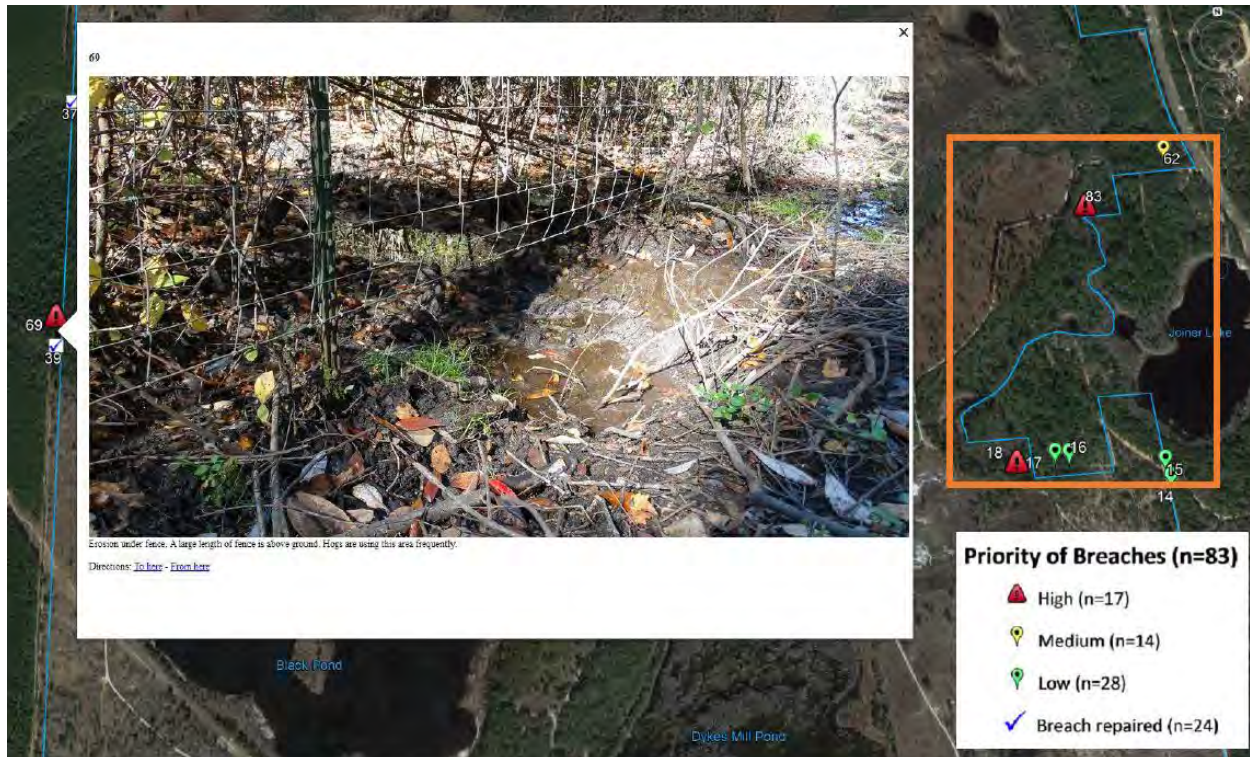


**Figure 29. Boundary fence compromises on the Carter Tract as of June 2017. Location of hog corral traps for the year highlighted in yellow.**

Area inspections suggest the current preferred access for hogs on the Carter Tract is the portion of the eastern boundary of the WMA where there is no fence, northeast of Garrett Pond (Figure 30). Installing fence at this location would effectively seal off the eastern perimeter and make access for hogs on the area much more difficult. In the meantime, FWC personnel will continue to patrol the boundary fence, identifying breaches and repair such with rebar, wire, and any other means necessary. We will continue trapping efforts and encourage hunters to harvest hogs at every available opportunity in continuing efforts to manage the population.

Figure 30 is also a snapshot of the Google Earth Boundary Breach Catalog (KMZ file) that has been created for tracking the condition of the entire boundary fence on the Carter Tract. Breaches in the fence are visually verified, GPS tagged, and then a picture is taken. The resulting data is converted into a KML file which precisely locates the breach point with an interactive marker on a satellite image of the area. Clicking on the marker accesses the photo of the breach for reference purposes (inset Figure 30). The utility of this file is that it provides a real time spatial snapshot of the condition of the fence, with both new breaches and recent repairs being mapped and catalogued. Examples of breaches include erosion under the fence, vandalism, missing portions of fence, and damage by fallen trees/debris (Figure 31).





**Figure 30. Closeup of the northern portion of the Carter Tract showing an example of an erosion breach (inset) on the boundary fence west of Dry Pond and the northeastern portion (highlighted with the orange square) where wild hogs currently access the property.**



**Figure 31. Examples of Carter Tract boundary fence breaches (clockwise from top left) fence cut (vandalism), erosion under fence, downed tree, and missing (incomplete) fence.**

Hog Management Recommendations

We recommend continued hog trapping and harvest concomitant with addressing boundary fence breach issues as part of an integrated hog management approach, as either activity alone will likely produce less than desired results.

Consideration for a hog-dog hunting season during the summer months may be another effective tool for the management of hogs on Carter Tract. Whether or not such a hunt results in successful harvest of hogs, the presence of dogs and the pressure they put on the hogs has the potential to limit the impact of hog grazing on native vegetation during the critical summer growing season, which in turn supports the management objectives of this mitigation bank property. Given the cooperative efforts by FWC and NFWMD in addressing the boundary fence breach issues, a hog-dog hunting season on Carter Tract would likely prove successful.



## LAW ENFORCEMENT ACTIVITIES



### FWC Law Enforcement Activities Lieutenant Warren Walsingham

Florida Fish and Wildlife Conservation Commission Officers patrol the Fitzhugh Carter Tract of the Econfina Wildlife Management Area providing policing to include wildlife, fisheries, and general law enforcement. This FY 2016-2017 officers provided approximately 112 hours of patrol directed to the Carter Tract. There were approximately 72 user contacts for the area with no citations and written warnings issued.

Officers conducted foot patrol and all-terrain vehicle patrols of the interior roads and perimeter of the Carter Tract throughout the year. Officers targeted illegal hunting, trespassing, baiting violations, and night hunting during the hunting season. They focused on possession of alcohol, licensing, bag limit and size limit violations during the allowed fishing season.

Officers responded to and worked several complaints in reference to possession of alcohol, tree stands being abandoned after season, damage to exterior fencing, illegal entry, improper check in, unauthorized vessel use, a suspicious person, fishing in an unpermitted area, and illegal use of ATV's.

With relationships being built between biologists, check station staff, and officers most illegal activity was stopped prematurely through education, as the popularity and activity increases in the area.

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# Appendix I. Fitzhugh Carter Tract of Econfina Creek WMA Regulations Summary and Area Map, July 1, 2016 – June 30, 2017.

2016-2017  
Hunting  
Season

**Fitzhugh Carter  
Tract  
Econfina Creek  
Wildlife Management Area**

Regulations Summary and Area Map  
July 1, 2016 - June 30, 2017

A cooperative public wildlife and recreational area

Northwest Florida Water  
Management District

Florida Fish and Wildlife  
Conservation Commission

MyFWC.com

This brochure is designed to provide the public with information and a summary of regulations pertaining to hunting, fishing and other recreational use on the Fitzhugh Carter Tract of Econfina Creek Wildlife Management Area. **Regulations that are new or differ substantially from last year are shown in bold print.** Area users should familiarize themselves with all regulations. For exact wording of the wildlife laws and regulations, see the Florida Fish and Wildlife Conservation Commission's wildlife code, on file with the Secretary of State and state libraries. This brochure, the Florida Hunting Regulations handbook, and quota permit worksheets should provide the information necessary for you to plan your hunting and fishing activities. These publications are available from any Commission office, county tax collector and at MyFWC.com.

Persons using wildlife management areas are required to have appropriate licenses, permits and stamps. The following persons are exempt from all license and permit requirements (except for quota permits when listed as "no exemptions," recreational use permits, antlerless deer permits and the Migratory Bird Hunting and Conservation Stamp [federal duck stamp]): Florida residents who are 65 years of age or older; residents who possess a Florida Resident Disabled Person Hunting and Fishing Certificate; residents in the U.S. Armed Forces, not stationed in Florida, while home on leave for 30 days or less, upon submission of orders; and children under 16 years of age. Children under 16 years of age are exempt from the duck stamp. Anyone born on or after June 1, 1975 and 16 years of age or older must have passed a Commission-approved hunter-safety course prior to being issued a hunting license, except the Hunter Safety Mentoring exemption allows anyone to purchase a hunting license and hunt under the supervision of a licensed hunter, 21 years of age or older.

Licenses and permits may be purchased from county tax collectors, license agents, at MyFWC.com/license or by telephone at 888-486-8356 (hunting) or 888-347-4356 (fishing). A no-cost Migratory Bird Permit is available when purchasing a hunting license. Any waterfowl hunter 16 years of age or older must possess a federal duck stamp.

#### Quota Permit Information:

Archery - 15, no-cost, quota permits (no exemptions) for each of 2 hunts.  
General Gun - 15, no-cost, quota permits (no exemptions) for each of 3 hunts.  
Muzzleloading Gun - 15, no-cost, quota permits (no exemptions).  
Youth Turkey - 3, no-cost, quota permits (no exemptions).  
Spring Turkey - 5, no-cost, quota permits (no exemptions) for each of 3 hunts.

Daily Fishing Permits: 20 anglers are allowed on the area per day. 10 daily permits are available first-come, first-serve at the check station; 10 daily permits can be reserved in advance by calling 850-773-2631. If reserved permits are not filled by 11 a.m., they will become available at the check station first-come, first-serve. Permits are issued with specific lake designations, and anglers are allowed to fish only at the lake for which the permit is issued and must have the permit in their possession at all times.

Permit applications: Hunters must submit electronic applications for quota and special-opportunity permits through the Commission's Recreational License

Issuance Services (RLIS). Worksheets listing hunts, application periods, deadlines and instructions are available at county tax collector's offices, FWC offices or MyFWC.com. Quota application periods occur throughout the year beginning April 1; please refer to the hunting handbook or MyFWC.com for specific dates. Worksheets will be available about 2 weeks prior to each application period.

Guest hunters: For each non-transferable archery, muzzleloading gun, general gun, wild hog, spring turkey and mobility-impaired quota permit issued through the Commission's RLIS, a quota permit holder (host) may take a guest hunter by obtaining a guest permit. Guest hunters are not allowed during youth turkey hunts. A guest hunter must possess a completed guest permit while hunting except the following persons may be a guest hunter without a guest permit: a youth under 16 years of age, a youth supervisor, a mentor license holder or a mentor license supervisor. A host may only bring 1 guest hunter at a time and may only use 1 guest permit per day. The following persons are not considered to be guest hunters: other quota permit holders, non-hunters and exempt hunters (on areas and during seasons that allow exemptions). The host must share the bag limit with the guest hunter and the host is responsible for violations that exceed the bag limit. The guest hunter and host must enter and exit the area together and must share a street-legal vehicle while hunting on the area. The guest hunter may hunt only while the host is on the area. Refer to the quota hunt worksheets for additional information.

Youth and mentor license holders: A youth hunter (less than 16 years of age) must be supervised by a person at least 18 years of age. A mentor license holder must be supervised by a licensed hunter at least 21 years of age. Unless exempt, only those supervisors with proper licenses and permits may hunt. If the supervisor is hunting during any hunt for which quota permits are issued, at least 1 person in the party must be in possession of a quota permit. A non-hunting supervisor is allowed to accompany a youth or mentor license holder during any hunt.

Transfer of permits: Quota and guest permits are not transferable. A positive form of identification is required when using a non-transferable permit, except for youth under 16 years of age. The sale or purchase of any quota permit or guest permit is prohibited.

#### General Area Regulations:

All general laws and regulations relating to wildlife and fish shall apply unless specifically exempted for this area. Hunting or the taking of wildlife or fish on this area shall be allowed only during the open seasons and in accordance with the following regulations:

1. Any person hunting deer or accompanying another person hunting deer shall wear at least 500 square inches of daylight fluorescent-orange material as an outer garment, above the waistline. These provisions are not required when hunting with a bow and arrow during archery season.
2. Taking of spotted fawn, swimming deer or roosted turkey is prohibited.
3. It is illegal to hunt over bait or place any bait or other food for wildlife on this area.
4. Driving a metal object into any tree, or hunting from a tree into which a metal object has been driven, is prohibited.

5. No person shall cut, damage or remove any natural, man-made or cultural resource without written authorization of the landowner or primary land manager.
6. Taking or attempting to take any game with the aid of live decoys, recorded game calls or sounds, set guns, artificial light, net, trap, snare, drug or poison is prohibited. Recorded calls and sounds can be used to hunt furbearers, wild hog and crows.
7. The wanton and willful waste of wildlife is prohibited.
8. Hunting, fishing or trapping is prohibited on any portion of the area posted as closed to those activities.
9. People, dogs, vehicles and other recreational equipment are prohibited in areas posted as "Closed to Public Access" by FWC administrative action.
10. Taking or herding wildlife from any motorized vehicle, aircraft or boat, which is under power is prohibited until power, and movement from that power, has ceased.
11. Most game may be hunted from ½ hour before sunrise until ½ hour after sunset (see exceptions for each season).
12. The release of any animal is prohibited, without written authorization of the landowner or primary land manager.
13. The head and evidence of sex may not be removed from the carcass of any deer or turkey on the area.
14. The planting or introduction of any non-native plant is prohibited, without written authorization of the landowner or primary land manager.
15. Wild hog may not be transported alive.
16. A hunting license is not required to hunt wild hog.
17. Littering is prohibited.
18. It is unlawful to set fire to any forest, grass or woodlands.
19. An FWC Law Enforcement Officer may search any camp, vehicle or boat in accordance with law.
20. Falconers may hunt during the statewide falconry season anytime a management area is open for public access. Falconers are not exempt from quota permits during hunts requiring them.
21. The possession or consumption of intoxicating beverages is prohibited.

**Public Access and Vehicles:**

1. Open to public access year round. During periods when the area is closed to hunting and fishing, public access other than by foot is prohibited.
2. All persons shall enter and exit at the designated entrance (see map).
3. Parked vehicles may not obstruct a road, gate or firelane.
4. No motor vehicle shall be operated in areas designated as closed to vehicular traffic.
5. Vehicles may be operated only on named or numbered roads.
6. Horses and the use of all-terrain vehicles and bicycles are prohibited.

**Hunters and Check Stations:**

1. Hunters must check in at the check station when entering and check out when leaving the area and check all game harvested.
2. Hunting equipment may not be taken onto the WMA until after 8 a.m. the day before the opening of a season and shall be removed by 6 p.m. 1 day after the end of the season.
3. On hunt days, the check station hours are 4:30 a.m. to 6 p.m. Refer to the Fishing and Frogging section for check station hours on days open to fishing.

**Guns:**

1. Hunting at night with a gun is prohibited.
2. Muzzleloading guns used for taking deer must be .40 caliber or larger if firing a single bullet, or be 20 gauge or larger if firing 2 or more balls.
3. Hunting deer with rimfire or non-expanding, full metal jacket (military ball) ammunition is prohibited.
4. Hunting wildlife (other than deer, turkey, quail or migratory birds) with air guns is allowed. Hunting with air guns is prohibited during archery and muzzleloading gun seasons.
5. Children under the age of 16 hunting with a firearm or air gun must be in the presence of a supervising adult.
6. No person shall discharge a firearm or have a loaded firearm in hand while under the influence of alcohol or drugs.
7. For hunting non-migratory game, only shotguns, rifles, pistols, bows, crossbows or falconry may be used.
8. For hunting migratory game, only shotguns, bows, crossbows or falconry may be used. Shotguns shall not be larger than 10 gauge and shall be incapable of holding more than 3 shells in the magazine and chamber combined.
9. Hunting with full automatic firearms, centerfire semi-automatic rifles having a magazine capable of holding more than 5 rounds, explosive or drug-injecting devices and set guns is prohibited.
10. The discharge of a firearm outside of periods open to hunting or in areas closed to hunting is prohibited per s. 790.15 FS.

**Dogs:**

1. Hunting with dogs, other than bird dogs or retrievers, is prohibited.
2. No person shall allow any dog to pursue or molest any wildlife during any period in which the taking of wildlife by the use of dogs is prohibited.
3. Dogs on leashes may be used for trailing wounded game.
4. For purposes other than hunting, dogs are allowed, but must be kept under physical restraint at all times.

**Camping:** Prohibited.

**Bag and Possession Limits:** A guest hunter must share the host's bag limit, except bag limits specified as per person. No person shall exceed statewide bag limits.

1. Deer - Daily limit 2, possession limit 4 (see legal to take for each season).
2. Wild hog - No size or bag limit.
3. Turkey - Daily limit 1, except the youth turkey limit is 1 per quota permit; season limit 2, possession limit 2.
4. Gray squirrel and rabbit - Daily limit 12 per person, possession limit 24 for each.
5. Quail - Daily limit 12, possession limit 24.
6. Raccoon, opossum, armadillo, beaver, coyote, skunk and nutria - No bag limits.
7. Migratory birds - See Migratory Bird Hunting Regulations pamphlet.
8. **Bear - See Bear Hunting Guide at MyFWC.com.**

**Archery Season:**

October 22-28 and October 29 through November 6.

Permit, Stamp and License Requirements - Quota permit, hunting license, management area permit, archery permit, deer permit (if hunting deer), wild turkey permit (if hunting wild turkey) and migratory bird permit (if hunting migratory birds).

Legal to Hunt - Deer with at least 1 antler having 2 or more points (each point 1-inch or more in length) and having at least 1 antler 5-inches or more in length, antlerless deer (which includes does and bucks with antlers less than 5 inches in length, but not spotted fawn), wild hog, turkey of either sex, gray squirrel, quail, rabbit, raccoon, opossum, armadillo, beaver, coyote, skunk, nutria and migratory birds in season.

Regulations Unique to Archery Season -

1. Youth less than 16 years of age may harvest antlered deer with at least 1 antler 5 inches or more in length.
2. Hunting with guns or crossbows (except by disabled crossbow permit) is prohibited, except that centerfire shotguns are allowed for hunting migratory birds.

**General Gun Season:**

November 24-27, January 21-24 and January 25-29.

Permit, Stamp and License Requirements - Quota permit, hunting license, management area permit, deer permit (if hunting deer), migratory bird permit (if hunting migratory birds), and state waterfowl permit and federal duck stamp (if hunting waterfowl).

Legal to Hunt - Deer with at least 1 antler having 2 or more points (each point 1-inch or more in length) and having at least 1 antler 5-inches or more in length, wild hog, gray squirrel, quail, rabbit, raccoon, opossum, armadillo, beaver, coyote, skunk, nutria and migratory birds in season.

Regulations Unique to General Gun Season - Youth less than 16 years of age may harvest antlered deer with at least 1 antler 5 inches or more in length.

**Muzzleloading Gun Season:**

December 3-5.

Permit, Stamp and License Requirements - Quota permit, hunting license, management area permit, muzzleloading gun permit, deer permit (if hunting deer), migratory bird permit (if hunting migratory birds), and state waterfowl permit and federal duck stamp (if hunting waterfowl).

Legal to Hunt - Deer with at least 1 antler having 2 or more points (each point 1-inch or more in length) and having at least 1 antler 5-inches or more in length, wild hog, gray squirrel, quail, rabbit, raccoon, opossum, armadillo, beaver, coyote, skunk, nutria and migratory birds in season.

Regulations Unique to Muzzleloading Gun Season -

1. Youth less than 16 years of age may harvest antlered deer with at least 1 antler 5 inches or more in length.
2. Hunting with archery equipment or guns, other than muzzleloading guns, is prohibited, except that centerfire shotguns are allowed for hunting migratory birds.

**Small Game Season:**

December 10-25.

Permit, Stamp and License Requirements - Hunting license, management area permit, migratory bird permit (if hunting migratory birds) and state waterfowl permit and federal duck stamp (if hunting waterfowl).

Legal to Hunt - Wild hog, gray squirrel, quail, rabbit, raccoon, opossum, armadillo, beaver, coyote, skunk, nutria and migratory birds in season.

Regulations Unique to Small Game Season - Hunting with centerfire rifles is prohibited.

**Spring Turkey Season:**

Youth Turkey: March 11-12.

Spring Turkey: March 18-20, March 31 through April 2 and April 14-16.

Permit, Stamp and License Requirements - Quota permit, hunting license, management area permit and wild turkey permit.

Legal to Hunt - Bearded turkey or gobbler.

Regulations Unique to Spring Turkey Season -

1. Legal shooting hours are ½ hour before sunrise until 1 p.m.
2. Hunting other animals is prohibited.
3. Only bows, crossbows and shotguns using a #2 or smaller shot size may be used for hunting.
4. During the youth turkey hunt, only youth under 16 years of age may hunt and must be under the supervision and in the presence of an adult not younger than 18 years of age. Adults with required licenses and permits for taking wild turkeys may participate when in the presence of a youth, but may not harvest a wild turkey.

**Trapping:** Prohibited.

**Migratory Bird Seasons:**

Rails, common moorhen, mourning dove, white-winged dove, snipe, ducks, geese, coot, woodcock and crows may be hunted during statewide migratory bird seasons that coincide with the seasons where migratory birds are listed as legal to hunt in this brochure. Migratory birds may also be hunted during the September duck seasons.

Permit, Stamp and License Requirements - Quota permit (if hunting during any quota period), hunting license, management area permit, migratory bird permit and state waterfowl permit and federal duck stamp (if hunting waterfowl).

Legal to Hunt - See Migratory Bird Hunting Regulations pamphlet.

Regulations Unique to Migratory Bird Seasons - All Migratory Bird Regulations shall apply.

1. Hunting ducks, geese and coot with lead shot is prohibited.
2. Centerfire shotguns are allowed for hunting during established area seasons when migratory birds are legal to take.

**Fishing and Frogging:**

Allowed Friday through Monday (except during periods open to hunting) by permit only.

Permit, Stamp and License Requirements - Daily fishing permit and fishing license (not required when frogging).

Legal to Take - All legal fish (except as provided below) and frogs. See Florida Freshwater Fishing Regulations Summary.

Regulations Unique to Fishing and Frogging - All General Freshwater Fishing Regulations shall apply.

1. Anglers shall check in and out at the check station when entering and exiting the area and shall check all fish taken.
2. Fishing is allowed starting at 6 a.m. Entrance gates close at 8 p.m. during the summer period (March - October) and at 5 p.m. during the winter period (November - February).
3. Fishing is allowed in designated lakes and water bodies only. All other lakes, water bodies and restricted areas are closed to public fishing.
4. Boats are provided for use on each lake; these boats must be kept at the lake on which they are placed. No outside boats are allowed into the area. All state boating regulations, including the use of personal floatation devices (PFDs), apply.
5. Fish may be taken only by hook and line or rod and reel. The use or possession of nets, seines, fish traps, trotlines, set lines or bush hooks, spears, gigs, snatch hooks, crossbow, or bow and arrow is prohibited. Landing nets may be used for fish legally caught from a boat.
6. No person shall take more than 20 panfish in the aggregate per day. Any bluegill or redear sunfish less than 8 inches in total length must be released immediately. No person shall take more than 10 black crappie per day. Any black crappie less than 10 inches in total length must be released immediately. All largemouth bass are catch and release only.
7. Fish may not be filleted, nor the head or tail fin removed, until the angler has checked out at the check station.
8. Anglers will be given a creel kit and are expected to accurately complete the information sheet and return it to the check station upon check out.
9. Shooting frogs is allowed only during the listed open hunting seasons and only with the legal methods of take during each particular season.

**General Information:**

1. Other recreational uses, including canoeing, kayaking, hiking and bird watching, are allowed on the area and are subject to all area rules and regulations.
2. Information for persons with disabilities can be found at MyFWC.com/ADA.
3. If you have any questions about this material, please call the Fish and Wildlife Conservation Commission at 850-265-3676 (TDD 800-955-8771).
4. The FWC is not responsible for protection of personal property and will not be liable for theft of or damage to personal property.
5. Please report the location of any sick or extremely skinny deer to the Chronic Wasting Disease hotline, toll free at 866-293-9282.

**Northwest Florida WMD Rules and Information:**

1. This land was acquired by the Northwest Florida Water Management District (District) to protect public water resources. The purpose of the District's land acquisition and management program is to conserve and protect unique and irreplaceable land and water resources, restore areas to their original condition as much as possible and allow controlled multiple recreational and educational uses consistent with this purpose.
2. The District's land management activities for this area may include prescribed burning and timber harvesting during most months of the year. For personal safety reasons, area users should be aware of activities in the area and contact the District's Land Management office at 850-539-5999 with any questions. The District has no responsibility or obligation to identify and/or protect personal property while undertaking its land management activities.

**Cooperation Requested:**

*If you see law violators or suspicious activities, contact your nearest Commission regional office or call 888-404-FWCC. You may qualify for a cash reward from the Wildlife Alert Reward Association.*

*The U.S. Department of the Interior prohibits discrimination on the basis of race, color, national origin, age, sex or disability. If you believe that you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please write to: The Office for Human Resources, U.S. Fish and Wildlife Service, Department of the Interior, Washington, D.C. 20240. The project described in this publication is part of a program funded by federal dollars under the Wildlife Restoration Act. Federal funds pay 20 percent of the cost of the program.*

**Wildlife Alert Reward Program**  
Report fishing, boating or hunting law violations,  
you may qualify for a cash reward.

**888-404-FWCC (3922)**

**\*FWC or #FWC on cellular phones  
TIP@MyFWC.com by text message**

**Order Your Hunting and Fishing License  
by Phone...  
Use Your Credit Card and Call**

**888-HUNT-FLORIDA (486-8356) OR  
888-FISH-FLORIDA (347-4356)**

**(\$4.25+ 2.5% surcharge of total sale will be added.)**










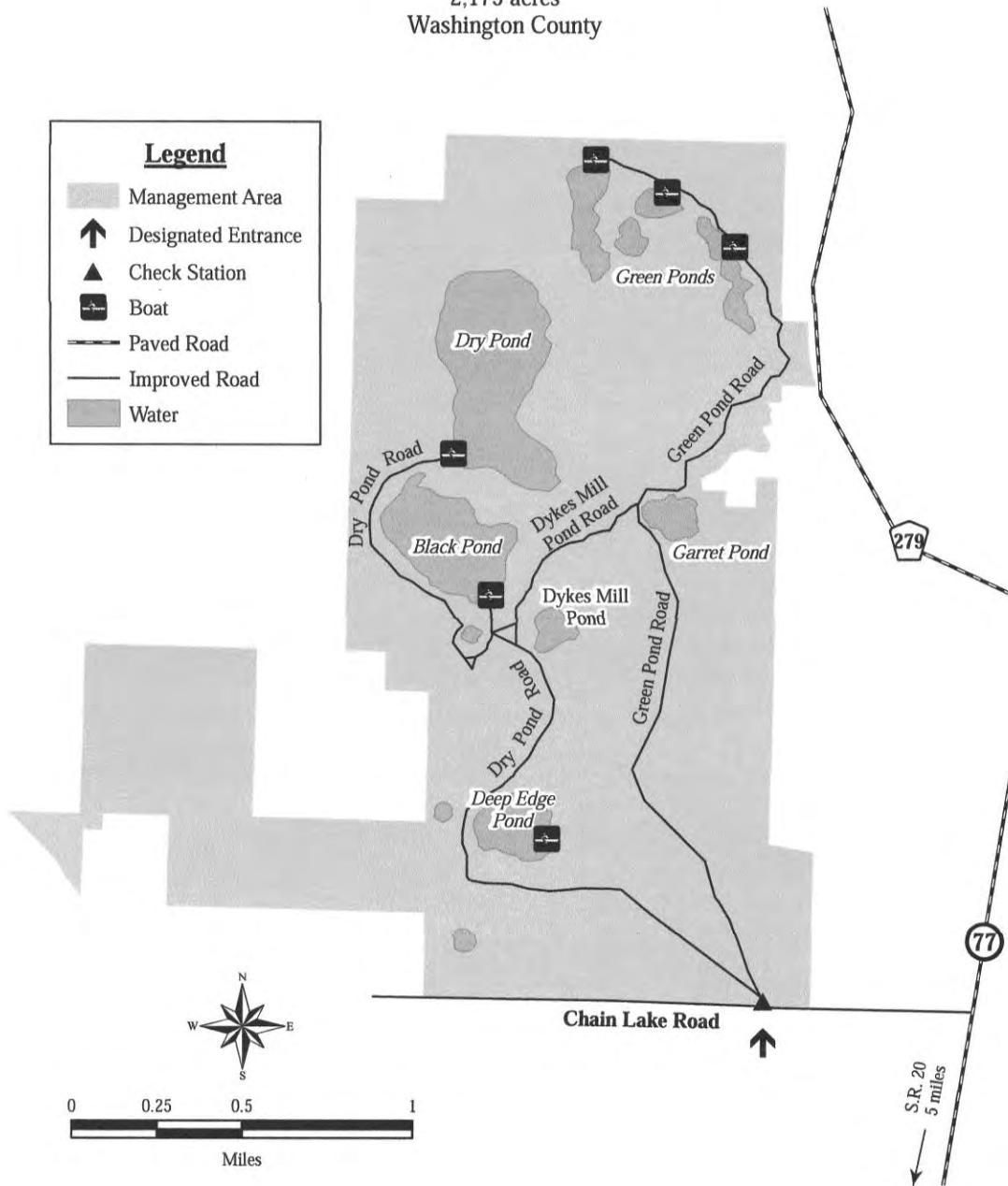
# FITZHUGH CARTER TRACT

## ECONFINA CREEK WILDLIFE MANAGEMENT AREA

2,175 acres  
Washington County

**Legend**

-  Management Area
-  Designated Entrance
-  Check Station
-  Boat
-  Paved Road
-  Improved Road
-  Water





**Appendix II. 2016-2017 Annual Work Plan and Accomplishment Report for the Fitzhugh Carter Tract of Econfina Creek Wildlife Management Area.**

**FY 2016-17**

**Project 7281 - NW FLORIDA WATER MANAGEMENT DISTRICT LANDS**

	<b>Man Days</b>	<b>Salary</b>	<b>FuelCost</b>	<b>Other</b>	<b>Total</b>	<b>Units Accomplishments</b>
<b>Species 9100 - All freshwater fish</b>						
Activity - 221	Animal surveys					
	0.75	\$236.58	\$11.08	\$107.27	\$354.93	0 Conducted sampling of fish populations in area ponds via electroshocking. NFA*
Activity - 250	Monitoring and assessments					
	0.37	\$95.02	\$23.99	\$397.78	\$516.79	0 Monitored area fish populations. NFA*
Activity - 342	Public use administration (non-hunting)					
	4.54	\$1,376.38	\$1,679.47	\$18,163.39	\$21,219.24	0 Administered public fishing program via check station. Salary for OPS fishing check station operators included here. NFA*
<hr/>						
Species 9100 Total	5.66	\$1,707.98	\$1,714.54	\$18,668.44	\$22,090.96	
<hr/>						
<b>Species 9200 - All wildlife</b>						
Activity - 100	Administration					
	0.00	\$0.00	\$4.61	\$488.83	\$493.44	0 General clerical and administrative support to Wildlife Management Area staff.
Activity - 101	Project inspection					
	7.43	\$2,013.04	\$120.38	\$1,291.02	\$3,424.44	0 Inspected area projects and activities. Field orientation of land boundaries, features, and habitats.

	<b>Man Days</b>	<b>Salary</b>	<b>FuelCost</b>	<b>Other</b>	<b>Total</b>	<b>Units Accomplishments</b>
Activity - 103	Meetings 8.14	\$2,358.37	\$152.06	\$2,224.53	\$4,734.96	0 Attended landowner, cooperators, scientific, and agency meetings. Attended training workshops and seminars.
Activity - 140	Report writing/editing/manuscript preparation 5.11	\$2,330.33	\$37.84	\$316.90	\$2,685.07	0 Prepared and reviewed annual wildlife reports and completed annual accomplishment report.
Activity - 150	Personnel management 21.49	\$7,725.74	\$200.23	\$1,679.42	\$9,605.39	0 Supervised volunteer activities. Recruited, hired, and supervised OPS personnel. Attended training workshops and seminars.
Activity - 182	Data management 17.53	\$5,358.84	\$259.73	\$2,815.00	\$8,433.57	0 Incorporated all data collected into GIS database. Analyzed and summarized WMA databases and pertinent information.
Activity - 200	Resource Management 6.63	\$1,923.87	\$124.53	\$1,801.02	\$3,849.42	0 Routine planning, paperwork, purchases and correspondences dealing with daily operations of the WMA.
Activity - 204	Resource planning 61.92	\$19,125.62	\$835.48	\$18,200.38	\$38,161.48	0 Coordinated work projects related to management activities. Purchased supplies, materials, and equipment for

	<b>Man Days</b>	<b>Salary</b>	<b>FuelCost</b>	<b>Other</b>	<b>Total</b>	<b>Units</b>	<b>Accomplishments</b>
							performing routine WMA operations.
Activity - 206	Prescribed burning - growing season						
	0.00	\$0.00	\$0.00	\$166.90	\$166.90	0	Assisted Northwest Florida Water Management District with prescribed burning.
Activity - 221	Animal surveys						
	0.00	\$0.00	\$0.00	\$1,265.98	\$1,265.98	0	Purchased gheenoe to facilitate wood duck nest box surveying and monitoring on area waterways.
Activity - 312	Informational signs						
	1.62	\$419.92	\$12.00	\$2,501.50	\$2,933.42	0	Developed and maintained information signs at kiosk and display boards.
Activity - 320	Outreach and education						
	3.61	\$783.86	\$74.75	\$1,021.69	\$1,880.30	0	Assisted local schools and the general public in wildlife-oriented training, presentations, and development. Participated as a steering committee member and wildlife facilitator for the Emerald Coast Regional Envirothon. NFA*
Activity - 350	Customer service support						
	0.24	\$56.74	\$2.76	\$17.43	\$76.93	0	Provided information to callers regarding fish and wildlife-based recreation opportunities and area regulations.

	<b>Man Days</b>	<b>Salary</b>	<b>FuelCost</b>	<b>Other</b>	<b>Total</b>	<b>Units Accomplishments</b>
Activity - 920	FEM -- buildings/structures					
	2.47	\$808.83	\$42.18	\$3,378.74	\$4,229.75	0 Maintained and repaired area office, fishing storage shed, and equipment workshop with storage bays as needed.
Activity - 923	FEM -- vehicles/equipment					
	3.16	\$895.17	\$27.17	\$4,058.58	\$4,980.92	0 Repaired and maintained vehicles, boats, ATVs and associated equipment, including services-parts and labor.
Activity - 926	FEM -- roads/bridges					
	5.59	\$1,347.08	\$41.51	\$0.00	\$1,388.59	0 Made minor repairs to access roads and bridges as needed.
<hr/>						
Species 9200 Total	144.94	\$45,147.41	\$1,935.23	\$41,227.92	\$88,310.56	
<hr/>						
Species 9210 - Game wildlife						
Activity - 221	Animal surveys					
	0.00	\$0.00	\$0.00	\$172.44	\$172.44	0 Conducted deer surveys and other game surveys as needed.
Activity - 341	Public use administration (hunting)					
	4.59	\$1,801.72	\$1,014.21	\$9,078.05	\$11,893.98	0 Administered and managed public hunts. Reviewed area hunt maps and brochures. Compiled weekly harvest and hunting pressure reports. Salary for OPS check station operators included here.
<hr/>						
Species 9210 Total	4.59	\$1,801.72	\$1,014.21	\$9,250.49	\$12,066.42	
<hr/>						

	<b>Man Days</b>	<b>Salary</b>	<b>FuelCost</b>	<b>Other</b>	<b>Total</b>	<b>Units Accomplishments</b>
Species 9211 - White-tailed deer						
Activity - 182	Data management					
	0.00	\$0.00	\$4.61	\$89.74	\$94.35	0 Summarized and analyzed survey, biological, harvest and hunter pressure data.
Activity - 221	Animal surveys					
	3.24	\$802.44	\$48.46	\$450.85	\$1,301.75	0 Conducted spotlight surveys employing line transect distance sampling methodology.
<hr/>						
Species 9211 Total	3.24	\$802.44	\$53.07	\$540.59	\$1,396.10	
<hr/>						
Species 9216 - Hogs						
Activity - 286	Population control					
	0.00	\$0.00	\$5.99	\$134.31	\$140.30	0 Assisted Northwest Florida Water Management District with wild hog population control. NFA*
Activity - 291						
	16.21	\$4,333.21	\$434.80	\$6,809.43	\$11,577.44	0 Assisted Northwest Florida Water Management District with controlling wild hogs on the area. NFA*
<hr/>						
Species 9216 Total	16.21	\$4,333.21	\$440.79	\$6,943.74	\$11,717.74	
<hr/>						
Species 9218 - Quail						
Activity - 221	Animal surveys					
	0.87	\$335.04	\$9.23	\$52.28	\$396.55	0 Conducted northern bobwhite calling surveys.
<hr/>						
Species 9218 Total	0.87	\$335.04	\$9.23	\$52.28	\$396.55	
<hr/>						

	<b>Man Days</b>	<b>Salary</b>	<b>FuelCost</b>	<b>Other</b>	<b>Total</b>	<b>Units Accomplishments</b>
Species 9222 - Wood duck						
Activity - 285	Nest structures					
	1.55	\$645.35	\$18.91	\$261.59	\$925.85	50 Maintained and monitored 50 wood duck nest boxes on area waterways.
<hr/>						
Species 9222 Total	1.55	\$645.35	\$18.91	\$261.59	\$925.85	
<hr/>						
Species 9226 - Mourning and white-winged doves (migratory and non-migratory)						
Activity - 221	Animal surveys					
	1.55	\$714.85	\$31.36	\$624.50	\$1,370.71	0 Trapped and banded area doves as part of a statewide project and nationwide effort.
<hr/>						
Species 9226 Total	1.55	\$714.85	\$31.36	\$624.50	\$1,370.71	
<hr/>						
Species 9240 - Nongame wildlife						
Activity - 221	Animal surveys					
	11.03	\$2,821.00	\$305.07	\$6,602.82	\$9,728.89	0 Conducted wading bird surveys and monitoring. Conducted herpetofauna surveys and monitoring. Installed and monitored drift fence arrays. NFA*
<hr/>						
Species 9240 Total	11.03	\$2,821.00	\$305.07	\$6,602.82	\$9,728.89	
<hr/>						
Species 9251 - Songbirds (passerines)						
Activity - 285	Nest structures					
	0.00	\$0.00	\$1.84	\$26.84	\$28.68	18 Maintained and monitored eighteen Eastern bluebird nest boxes.
<hr/>						
Species 9251 Total	0.00	\$0.00	\$1.84	\$26.84	\$28.68	
<hr/>						

	<b>Man Days</b>	<b>Salary</b>	<b>FuelCost</b>	<b>Other</b>	<b>Total</b>	<b>Units Accomplishments</b>
Species 9258 - Southeastern kestrel						
Activity - 285	Nest structures					
	0.55	\$119.21	\$17.98	\$253.42	\$390.61	6 Maintained and monitored six kestrel nest boxes.
<hr/>						
Species 9258 Total	0.55	\$119.21	\$17.98	\$253.42	\$390.61	
<hr/>						
Species 9271 - Bats						
Activity - 221	Animal surveys					
	0.18	\$45.56	\$1.38	\$0.00	\$46.94	2 Maintained and monitored bat houses.
<hr/>						
Species 9271 Total	0.18	\$45.56	\$1.38	\$0.00	\$46.94	
<hr/>						
Species 9278 - Gopher tortoise						
Activity - 140	Report writing/editing/manuscript preparation					
	0.50	\$156.37	\$27.68	\$640.21	\$824.26	0 Prepared annual progress report on gopher tortoise surveying and monitoring efforts. NFA*
Activity - 182	Data management					
	0.00	\$0.00	\$2.77	\$55.04	\$57.81	0 Analyzed and summarized gopher tortoise survey data. NFA*
Activity - 221	Animal surveys					
	0.00	\$0.00	\$0.00	\$10,000.00	\$10,000.00	0 Contracted gopher tortoise surveys conducted by Florida Natural Areas Inventory. NFA*
<hr/>						
Species 9278 Total	0.50	\$156.37	\$30.45	\$10,695.25	\$10,882.07	
<hr/>						

	<b>Man Days</b>	<b>Salary</b>	<b>FuelCost</b>	<b>Other</b>	<b>Total</b>	<b>Units Accomplishments</b>
Species 9280 - All threatened and endangered wildlife						
Activity - 221	Animal surveys					
	0.00	\$0.00	\$13.85	\$261.49	\$275.34	0 Conducted herpetofauna surveying and monitoring. NFA*
<hr/>						
Species 9280 Total	0.00	\$0.00	\$13.85	\$261.49	\$275.34	
<hr/>						
Project 7281 <sup>1</sup> Total	190.87	\$58,630.14	\$5,587.91	\$95,409.37	\$159,627.42	

**<sup>1</sup>Man-days for OPS Fish & Wildlife Technician for a year (210 man-days) and OPS Hunting & Fishing Check Station Operators (~380 man-days) not included. However, salary for such is included in “Other” expenses category.**



**Appendix III. Catch-per-unit-effort (CPUE) results for sportfish sampled via electrofishing at Black Pond, Dry Pond, and Green Pond in November 2016 on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

	Black Pond		Dry Pond		Green Pond	
November 2016	<i>n</i> <sup>a</sup>	CPUE <sup>b</sup>	<i>n</i> <sup>a</sup>	CPUE <sup>b</sup>	<i>n</i> <sup>a</sup>	CPUE <sup>b</sup>
Bluegill	0	0.00	0	0.03	0	0.08
Largemouth bass	2	0.04	9	0.23	1	0.03
Warmouth	0	0.00	0	0.00	0	0.00
Black Crappie	0	0.00	0	0.00	0	0.00
<b>TOTALS</b>	2	0.04	9	0.26	1	0.105

<sup>a</sup> Number of fish sampled

<sup>b</sup> Catch per unit effort (CPUE) measured in number of fish/minute

**Appendix IV. Number of fish caught and released per pond from July 2015 - June 2016 on the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

Species	Pond						
	Dry	Black	Deep Edge	Green 1	Green 2	Green 3	All Ponds
<b>Bluegill (<i>Lepomis macrochirus</i>)</b>							
Kept	1097	262	3	230	89	135	1816
Released	222	184	5	68	27	95	601
<b>Total caught</b>	<b>1319</b>	<b>446</b>	<b>8</b>	<b>298</b>	<b>116</b>	<b>230</b>	<b>2417</b>
<b>Black Crappie (<i>Pomoxis nigromaculatus</i>)</b>							
Kept	219	88	0	15	5	17	344
Released	12	34	0	10	5	7	68
<b>Total caught</b>	<b>231</b>	<b>122</b>	<b>0</b>	<b>25</b>	<b>10</b>	<b>24</b>	<b>412</b>
<b>Largemouth Bass<sup>†</sup> (<i>Micropterus salmoides</i>)</b>							
<b>Total caught</b>	<b>174</b>	<b>172</b>	<b>70</b>	<b>84</b>	<b>54</b>	<b>92</b>	<b>646</b>
<b>Warmouth (<i>Lepomis gulosus</i>)</b>							
Kept	3	2	0	0	0	0	5
Released	0	9	0	1	1	3	14
<b>Total caught</b>	<b>3</b>	<b>11</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>19</b>
<b>Catfish (<i>Ameirus nebulosus</i> and <i>Ameirus natalis</i>)</b>							
Kept	6	2	0	0	0	0	8
Released	0	0	0	0	0	0	0
<b>Total caught</b>	<b>6</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8</b>
<b>Other (Chain pickerel, Spotted Gar, Bowfin, Redbreast Sunfish,, Redear Sunfish, Flier)</b>							
Kept	6	2	0	1	0	0	9
Released	25	21	2	27	19	34	128
<b>Total caught</b>	<b>31</b>	<b>23</b>	<b>2</b>	<b>28</b>	<b>19</b>	<b>34</b>	<b>137</b>

<sup>†</sup>Largemouth Bass are catch-and-release only on Carter Tract ponds

**Appendix V. Wading bird survey results (2008 - 17) from Little Deep Edge Pond at the Fitzhugh Carter Tract of Econfina Creek WMA, Washington County, Florida.**

Species	Number of Birds Observed			
	Year	Adults	Active Nests	Chicks
<i>Anhinga (Anhinga anhinga)</i>	2008	6	3	0
	2009	3	unknown	3
	2010	2	0	0
	2011	2	0	0
	2012	0	0	0
	2013	11	2	3
	2014	14	4	9
	2015	3	0	0
	2016	2	1	0
	2017	0	0	0
<i>Cattle Egret (Bubulcus ibis)</i>	2008	25	18	0
	2009	0	0	0
	2010	0	0	0
	2011	14	12	24
	2012	0	0	0
	2013	33	20	27
	2014	45	46	40
	2015	34	27	23
	2016	73	51	112
	2017	56	52	44
<i>Great Egret (Ardea alba)</i>	2008	13	10	10
	2009	31	8	12
	2010	8	6	9
	2011	14	11	17
	2012	12	6	6
	2013	12	19	29
	2014	19	14	22
	2015	9	6	6
	2016	11	7	6
	2017	11	13	15
<i>Little Blue Heron (Egretta caerulea)</i>	2008	8	3	0
	2009	1	0	0
	2010	0	0	0
	2011	20	14	34
	2012	7	4	6

	2013	5	3	4
	2014	14	6	6
	2015	4	4	3
	2016	13	13	15
	2017	10	5	3
<hr/>				
Tricolored Heron ( <i>Egretta tricolor</i> )	2008	2	unknown	0
	2009	0	0	0
	2010	0	0	0
	2011	1	1	1
	2012	0	0	0
	2013	0	0	0
	2014	0	0	0
	2015	0	0	0
	2016	0	0	3
	2017	1	1	0
<hr/>				
Snowy Egret ( <i>Egretta thula</i> )	2008	0	0	0
	2009	3	0	0
	2010	0	0	0
	2011	2	2	5
	2012	0	0	0
	2013	0	0	0
	2014	0	0	0
	2015	0	0	0
	2016	3	1	0
	2017	3	1	0
<hr/>				
Green Heron ( <i>Butorides virescens</i> )	2008	1	0	1
	2009	2	unknown	1
	2010	1	0	0
	2011	0	0	0
	2012	0	0	0
	2013	0	0	0
	2014	0	0	0
	2015	0	0	0
	2016	0	0	0
	2017	0	0	0
<hr/>				
Great Blue Heron ( <i>Ardea herodias</i> )	2008	0	0	0
	2009	0	0	0
	2010	1	0	0
	2011	0	0	0
	2012	0	0	0

2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	0	0	0

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**Appendix VI. Bird species (n=128) documented on the Fitzhugh Carter Tract of Econfina Creek WMA, as of June 2016.**

**PODICIPEDIFORMES**

**Podicipedidae (Grebes)**

- Pied-billed Grebe *Podilymbus podiceps*

**PELICANIFORMES**

**Phalacrocoracidae (Cormorants)**

- Double-crested Cormorant *Phalacrocorax auritus*

**Anhingidae (Darters/Anhinga)**

- Anhinga *Anhinga anhinga*

**CICONIIFORMES**

**Ardeidae (Herons, Egrets, and Bitterns)**

- Great Blue Heron *Ardea herodias*
- Great Egret *Ardea alba*
- Snowy Egret *Egretta thula*
- Little Blue Heron *Egretta caerulea*
- Tricolored Heron *Egretta tricolor*
- Cattle Egret *Bubulcus ibis*
- Green Heron *Butorides virescens*

**Threskiornithidae (Ibises and Spoonbills)**

- White Ibis *Eudocimus albus*
- Roseate Spoonbill *Platalea ajaja*

**Ciconiidae (Storks)**

- Wood Stork *Mycteria americana*

**Cathartidae (New World Vultures)**

- Black Vulture *Coragyps atratus*
- Turkey Vulture *Cathartes aura*

**ANSERIFORMES**

**Anatidae (Ducks, Geese, and Swans)**

- Snow Goose *Chen caerulescens*
- Wood Duck *Aix sponsa*
- Blue-winged Teal *Anas discors*
- Green-winged Teal *Anas crecca*
- Canvasback *Aythya valisineria*
- Redhead *Aythya americana*
- Ring-necked Duck *Aythya collaris*
- Bufflehead *Bucephala albeola*
- Hooded Merganser *Lophodytes cucullatus*
- Ruddy Duck *Oxyura jamaicensis*

**CHARADRIIFORMES**

**Charadriidae (Plovers and Lapwings)**

- Killdeer *Charadrius vociferous*

**Scolopacidae (Sandpipers, Phalaropes, and Allies)**

- Greater Yellowlegs *Tringa melanoleuca*
- Lesser Yellowlegs *Tringa flavipes*
- Solitary Sandpiper *Tringa solitaria*
- Least Sandpiper *Calidris minutilla*
- Common Snipe *Gallinago gallinago*
- American woodcock *Scolopax minor*

**Laridae (Gulls, Terns, and Allies)**

- Least Tern *Sterna antillarum*
- Forster's Tern *Sterna forsteri*

**COLUMBIFORMES**

**Columbidae (Pigeons and Doves)**

- Mourning Dove *Zenaidura macroura*
- Common Ground Dove *Columbina passerina*

**CUCULIFORMES**

**Cuculidae (Cuckoos, Roadrunners, and Anis)**

- Yellow-billed Cuckoo *Coccyzus americanus*

**STRIGIFORMES**

**Strigidae (Typical Owls)**

- Eastern Screech Owl *Megascops asio*
- Great Horned Owl *Bubo virginianus*
- Barred Owl *Strix varia*

**CAPRIMULGIFORMES**

**Caprimulgidae (Nighthawks and Nightjars)**

- Common Nighthawk *Chordeiles minor*
- Chuck-will's-widow *Caprimulgus carolinensis*

**APODIFORMES**

**Apodidae (Swifts)**

- Chimney Swift *Chaetura pelagica*

**Trochilidae (Hummingbirds)**

- Ruby-throated Hummingbird *Archilochus colubris*

**CORACIIFORMES**

**Alcedinidae (Kingfishers)**

- Belted Kingfisher *Ceryle alcyon*



## FALCONIFORMES

### Accipitridae (Hawks and Allies)

- Osprey *Pandion haliaetus*
- Mississippi kite *Ictinia mississippiensis*
- Swallow-tailed Kite *Elanoides forficatus*
- Bald Eagle *Haliaeetus leucocephalus*
- Northern Harrier *Circus cyaneus*
- Sharp-shinned Hawk *Accipiter striatus*
- Cooper's Hawk *Accipiter cooperii*
- Red-shouldered Hawk *Buteo lineatus*
- Red-tailed Hawk *Buteo jamaicensis*

### Falconidae (Falcons and Caracaras)

- American Kestrel *Falco sparverius*
- Merlin *Falco columbarius*

## GALLIFORMES

### Phasianidae (Grouse, Turkeys, and Allies)

- Wild Turkey *Meleagris gallopavo*

### Odontophoridae (New World Quail)

- Northern Bobwhite *Colinus virginianus*

## GRUIFORMES

### Rallidae (Rails, Gallinules, and Coots)

- Purple Gallinule *Porphyrio martinicus*
- Common Moorhen *Gallinula chloropus*
- American Coot *Fulica Americana*

### Gruidae (Cranes)

- Sandhill Crane *Grus Canadensis*

## PASSERIFORMES

### Hirundinidae (Swallows and Martins)

- Purple Martin *Progne subis*
- Tree Swallow *Tachycineta bicolor*
- Northern Rough-winged Swallow *Stelgidopteryx serripennis*
- Barn Swallow *Hirundo rustica*

### Paridae (Chickadees and Titmice)

- Carolina Chickadee *Poecile carolinensis*
- Tufted Titmouse *Baeolophus bicolor*

### Sittidae (Nuthatches)

- Brown-headed Nuthatch *Sitta pusilla*

## PICIFORMES

### Picidae (Woodpeckers and Allies)

- Red-headed Woodpecker *Melanerpes erythrocephalus*
- Red-bellied Woodpecker *Melanerpes carolinus*
- Yellow-bellied Sapsucker *Sphyrapicus varius*
- Downy Woodpecker *Picoides pubescens*
- Hairy Woodpecker *Picoides villosus*
- Northern Flicker *Colaptes auratus*
- Pileated Woodpecker *Dryocopus pileatus*
- Pileated Woodpecker *Dryocopus pileatus*

## PASSERIFORMES

### Tyrannidae (Tyrant Flycatchers)

- Vermilion Flycatcher *Pyrocephalus rubinus*
- Vermilion Flycatcher *Pyrocephalus rubinus*
- Great Crested Flycatcher *Myiarchus crinitus*
- Eastern Kingbird *Tyrannus tyrannus*

### Laniidae (Shrikes)

- Loggerhead Shrike *Lanius ludovicianus*

### Vireonidae (Vireos)

- White-eyed Vireo *Vireo griseus*
- Red-eyed Vireo *Vireo olivaceus*

### Corvidae (Crows and Jays)

- American Crow *Corvus brachyrhynchos*
- American Crow *Corvus brachyrhynchos*
- Fish Crow *Corvus ossifragus*

### Cardinalidae (Cardinals and Allies)

- Northern Cardinal *Cardinalis cardinalis*
- Rose-breasted Grosbeak *Pheucticus ludovicianus*
- Indigo Bunting *Passerina cyanea*
- Indigo Bunting *Passerina cyanea*

### Icteridae (Blackbirds, Orioles, and Allies)

- Red-winged Blackbird *Agelaius phoeniceus*
- Eastern Meadowlark *Sturnella magna*
- Brown-headed Cowbird *Molothrus ater*
- Brown-headed Cowbird *Molothrus ater*
- Orchard Oriole *Icterus spurius*

**Troglodytidae (Wrens)**

- Carolina Wren *Thryothorus ludovicianus*
- Marsh Wren *Cistothorus palustris*

**Regulidae (Kinglets)**

- Golden-crowned Kinglet *Regulus satrapa*
- Ruby-crowned Kinglet *Regulus calendula*

**Sylviidae (Old World Warblers and Gnatcatchers)**

- Blue-gray Gnatcatcher *Poliophtila caerulea*

**Turdidae (Thrushes)**

- Eastern Bluebird *Sialia sialis*
- Hermit Thrush *Catharus guttatus*
- Wood Thrush *Hylocichla mustelina*
- American Robin *Turdus migratorius*

**Mimidae (Mockingbirds and Thrashers)**

- Gray Catbird *Dumetella carolinensis*
- Northern Mockingbird *Mimus polyglottos*
- Brown Thrasher *Toxostoma rufum*

**Bombycillidae (Waxwings)**

- Cedar Waxwing *Bombycilla cedrorum*

**Parulidae (Wood-Warblers)**

- Orange-crowned Warbler *Vermivora celata*
- Northern Parula *Parula Americana*
- Yellow-rumped Warbler *Dendroica coronata*
- Yellow-throated Warbler *Dendroica dominica*
- Pine Warbler *Dendroica pinus*
- Prairie Warbler *Dendroica discolor*
- Palm Warbler *Dendroica palmarum*
- Black-and-white Warbler *Mniotilta varia*
- Prothonotary Warbler *Protonotaria citrea*
- Common Yellowthroat *Geothlypis trichas*
- Hooded Warbler *Wilsonia citrine*

**Thraupidae (Tanagers)**

- Summer Tanager *Piranga rubra*
- Scarlet Tanager *Piranga olivacea*

**Emberizidae (New World Sparrows)**

- Eastern Towhee *Pipilo erythrophthalmus*
- Bachman's Sparrow *Peucaea aestivalis*
- Chipping Sparrow *Spizella passerine*
- Field Sparrow *Spizella pusilla*
- White-throated Sparrow *Zonotrichia albicollis*
- White-crowned Sparrow *Zonotrichia leucophrys*
- Dark-eyed Junco *Junco hyemalis*

## Appendix VII. Comprehensive list of herpetofaunal species (n=62) documented on the Fitzhugh Carter Tract of Econfina Creek WMA, 2005 -2016.

### CROCODILIA (Crocodilians)

#### Alligatoridae (Alligator and Caiman)

- American alligator *Alligator mississippiensis*

### TESTUDINES (Turtles)

#### Kinosternidae (Musk and Mud Turtles)

- Common Musk Turtle *Sternotherus odoratus*
- Eastern Mud Turtle *Kinosternon subrubrum*

#### Emydidae (Box and Water Turtles)

- Florida Box Turtle *Terrapene carolina bauri*
- Gulf Coast Box Turtle *Terrapene carolina major*
- Three-Toed Box Turtle *Terrapene carolina triunguis*
- Yellow-bellied Slider *Trachemys scripta*
- Florida Cooter *Pseudemys floridana floridana*
- Eastern Chicken Turtle *Deirochelys reticularia reticularia*

#### Testudinidae (Gopher Tortoises)

- Gopher Tortoise *Gopherus polyphemus*

#### Trionychidae (Softshell Turtles)

- Florida Softshell *Apalone ferox*

### SQUAMATA (Lizards and Snakes)

#### Lacertilia (Lizards)

##### Polychridae (Anoles)

- Green Anole *Anolis carolinensis*

##### Phrynosomatidae (Earless, spiny, side-blotched, and horned lizards)

- Southern Fence Lizard *Sceloporus undulatus undulatus*

##### Teiidae (Whiptails)

- Six-lined Racerunner *Cnemidophorus sexlineatus sexlineatus*

##### Scincidae (Skinks)

- Ground Skink *Scincella lateralis*
- Five-lined Skink *Eumeces fasciatus*
- Broadhead Skink *Eumeces laticeps*
- Southeastern Five-lined skink *Eumeces inexpectatus*
- Northern Mole Skink *Eumeces egregius similis*

#### Serpentes (Snakes)

##### Colubridae (Colubrid Snakes)

- Florida Green Water Snake *Nerodia floridana*
- Banded Water Snake *Nerodia fasciata fasciata*
- Eastern Garter Snake *Thamnophis sirtalis sirtalis*
- Eastern Ribbon Snake *Thamnophis sauritus sauritus*
- Smooth Earth Snake *Virginia valeriae*
- Eastern Hognose Snake *Heterodon platirhinos*
- Mud Snake *Farancia abacura*
- Southern Black Racer *Coluber constrictor priapus*
- Eastern Coachwhip *Masticophis flagellum*
- Rough Green Snake *Ophedrys aestivus*
- Corn Snake *Elaphe guttata guttata*
- Gray Rat Snake *Elaphe obsoleta spiloides*

- Florida Pine Snake *Pituophis melanoleucus*
- Scarlet Snake *Cemophora coccinea*
- Black Swamp Snake *Seminatrix pygaea*

**Elapidae (Coral Snakes)**

- Eastern Coral Snake *Micrurus fulvius*

**Viperidae (Vipers)**

**Crotalinae (Pit Vipers)**

- Florida Cottonmouth *Agkistrodon piscivorous conanti*
- Dusky Pigmy Rattlesnake *Sistrurus miliarius barbouri*
- Eastern Diamondback Rattlesnake *Crotalus adamanteus*

**CAUDATA (Salamanders)**

**Amphiumidae (Amphiumas)**

- Two-toed Amphiuma *Amphiuma means*

**Sirenidae (Sirens)**

- Greater Siren *Siren lacertina*
- Eastern Lesser Siren *Siren intermedia intermedia*
- Slender Dwarf salamander *Eurycea quadridigitata*

**Ambystomidae (Mole Salamanders)**

- Mole Salamander *Ambystoma talpoideum*

**Salamandridae (Newts)**

- Central Newt *Notophthalmus viridescens louisianensis*

**Plethodontidae (Lungless Salamanders)**

- Southeastern Slimy Salamander *Plethodon grobmani*

**ANURA (Frogs and Toads)**

**Pelobatidae (Spadefoots)**

- Eastern Spadefoot Toad *Scaphiopus holbrooki*

**Bufoinae (Toads)**

- Southern Toad *Bufo terrestris*
- Oak Toad *Bufo quercicus*

**Hylidae (Treefrogs and Their Allies)**

- Florida Cricket Frog *Acris gryllus dorsalis*
- Green Treefrog *Hyla cinerea*
- Barking Treefrog *Hyla gratiosa*
- Pine Woods Treefrog *Hyla femoralis*
- Squirrel Treefrog *Hyla squirella*
- Bird-voiced Treefrog *Hyla avivoca*
- Southern Chorus Frog *Pseudacris nigrita nigrita*
- Ornate Chorus Frog *Pseudacris ornata*

**Microhylidae (Narrowmouth Toads)**

- Eastern narrowmouth Toad *Gastrophryne carolinensis*

**Ranidae (True Frogs)**

- Bullfrog *Rana catesbeiana*
- River Frog *Lithobates heckscheri*
- Pig Frog *Rana grylio*
- Southern Leopard Frog *Rana sphenoccephala*
- Bronze Frog *Rana clamitans clamitans*

**Appendix VIII. Snake trap array capture results from September-November 2016 on the Carter Tract of Econfina Creek WMA, Washington County, Florida.**

<b>Reptiles</b>	<b>Number captured</b>
Six-lined racerunner ( <i>Cnemidophorus sexlineatus</i> )	8
Eastern fence lizard ( <i>Sceloporus undulates</i> )	9
Green anole ( <i>Anolis carolinensis</i> )	1
Northern mole skink ( <i>Eumeces egregious similes</i> )	1
Eastern hognose snake ( <i>Heterodon platyrhinos</i> )	2
Eastern coachwhip ( <i>Masticophis flagellum</i> )	8
Dusky pygmy rattlesnake ( <i>Sistrurus miliarius barbouri</i> )	9
Southern black racer ( <i>Coluber constrictor priapus</i> )	10
Corn snake ( <i>Elaphe guttata</i> )	2
Scarlet snake ( <i>Cemophora coccinea</i> )	1
TOTAL REPTILES	55
NUMBER OF REPTILE SPECIES	11
<b>Amphibians</b>	<b>Number captured</b>
Eastern narrowmouth toad ( <i>Gastrophryne carolinensis</i> )	29
Bronze frog ( <i>Rana clamitans clamitans</i> )	3
TOTAL AMPHIBIANS	32
NUMBER OF AMPHIBIAN SPECIES	2
<b>Mammals</b>	<b>Number captured</b>
Oldfield mouse ( <i>Peromyscus polionotus</i> )	14
Hispid cotton rat ( <i>Sigmodon hispidus</i> )	1
TOTAL MAMMALS	15
NUMBER OF MAMMAL SPECIES	2
<b>Birds</b>	<b>Number Captured</b>
House wren ( <i>Troglodytes aedon</i> )	2
TOTAL BIRDS	2
NUMBER OF BIRD SPECIES	1

**Appendix IX. Florida Natural Areas Inventory Gopher Tortoise Survey of Econfina Creek WMA, Fitzhugh Carter Tract**



**Gopher Tortoise Survey  
of Econfina Creek WMA,  
Fitzhugh Carter Tract**



**FNAI  
May 2017**





Photo Credits:

**Top:** Area of sandhill at Econfina WMA, Fitzhugh Carter Tract, Rebecca Zeroth, FNAI.

**Middle:** Corn snake (*Pantherophis guttatus*) observed at Econfina WMA, Fitzhugh Carter Tract during gopher tortoise transect survey on 22 March, 2017, Robert Gundy, FNAI.

**Bottom:** Gopher tortoise basking at the entrance of a burrow, Dan Hipes, FNAI.

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## INTRODUCTION

To address concerns regarding survey consistency, Line Transect Distance Sampling (LTDS) recently has been adopted as the preferred monitoring methodology through the Gopher Tortoise Candidate Conservation Agreement team. This method is widely used to estimate population size and density of wildlife species (Buckland et al., 2004) and provides a statistically valid, consistent method to evaluate tortoise populations. Standardized survey results will provide crucial baseline data, using a repeatable method, with which to compare future survey data and determine population trends or variation in response to habitat management activities.

The open source software program Distance 6 can be used to create LTDS survey designs and to analyze survey data. ArcGIS software is necessary for managing spatial data related to the survey [e.g., to define the survey area (sampling frame), and map transect and tortoise locations]. The sampling frame is the extent of suitable tortoise habitat on a particular property as determined by soils, vegetation (land cover), and land-use.

A pilot survey is generally conducted prior to the formal survey to determine the sampling intensity needed for the full survey. During the pilot survey, the length of transect surveyed per tortoise observation, called the tortoise encounter rate, is recorded. This value is used to calculate the distance of transect needed to achieve desirable results in the formal survey. There is flexibility in the amount of effort required for a pilot survey and in selecting locations for pilot survey transects, but it is important that the pilot survey captures variation in habitat type, quality, and tortoise distribution within the sampling frame.

The full LTDS survey is designed using Program Distance and incorporates the sampling frame and encounter rate from the pilot survey. The tortoise encounter rate (meters of transect sampled per tortoise observed) is used to extrapolate the total length of transect necessary to observe at least 60 objects (tortoises) and to derive abundance estimates with reasonable precision. As a general rule, to detect changes in population size over time, sampling should be intensive enough to produce a coefficient of variation (CV) of 15-20%, which is a practical expectation for most monitoring projects. If the CV exceeds 20%, the statistical power, confidence, and ability to detect trends in monitoring data are substantially reduced.

This report describes a pilot survey and a full survey for gopher tortoises at Econfina Creek WMA, Carter Tract, Florida.

## METHODS

### Pilot Survey

We conducted a pilot survey on 1 March, 2017 with a goal of determining the length of transect needed to achieve a tortoise population estimate with a coefficient of variation of less than 20 percent. ArcMap was used to create 800 meter square transects, which were placed randomly throughout the sampling frame in all suitable (or historically suitable) habitat types (Figure 1). Habitat information was obtained

from the Cooperative Land Coverage (CLC) database. We navigated the pilot transects using GPS (Trimble Geo7) and recorded all burrows within sight of the transect. Areas identified in the field as being natural communities that are generally unsuitable for gopher tortoises were cut out of the sample frame; the pilot transects from that region were excluded from the total length of transects. A camera scope was used to determine burrow occupancy and the burrow width was measured. A total of 8,041 meters of transect was surveyed in three different habitats (sandhill, coniferous plantation and mixed hardwood-coniferous) and a total of 11 burrows and 6 tortoises was observed. The data for each habitat was combined for the analysis, but provided in Table 1 as supplemental information.

To calculate the sampling intensity (L) (the length of transects that must be surveyed for a robust estimate of the total population) the dispersion parameter (b; a constant of 3) is divided by the desired coefficient of variation (cv(D)) (which should be below 20) squared, multiplied by the encounter rate (ER) calculated from the pilot survey data. See formula below.

**Sampling Intensity (L) = (b/cv(D)<sup>2</sup>)\*(ER)**

L = sampling intensity (length of transects for formal survey)

b = dispersion parameter (constant value of 3)

cv(D) = desired coefficient of variation (<20)

ER = encounter rate (length of transects surveyed/tortoise encounters)

**Encounter Rate (ER) = meters of transect surveyed/tortoise observations**

$$ER = 8,041/6 = 1,340$$

$$L = 3/(0.17^2)*(1,340) = 139,100 \text{ meters}$$

Formal Survey

Formal surveys were conducted 21-23 March, 3-4 April and 2 May, 2017.

Based on the encounter rate of 1,340, obtained in the pilot survey, 139,100 meters transect would have been necessary to obtain statistically robust results for an LTDS survey. This would have required the transects to be spaced less than 40 meters apart (the minimum separation distance for an LTDS survey). For these reasons we determined that a LTDS survey may not be appropriate for the Carter Tract at this time, although the results, if favorable, could still be analyzed using LTDS methods. For sites with low gopher tortoise densities belt transects are an effective and efficient survey method. For the belt transect survey transect lines spaced 50 meters apart were laid out across the sample frames using ArcGIS (Fishnet tool). This 50 meter distance equates to 20 percent of the area if the transect width is 10 meters (5 meters on either side of the transect line; a conservative distance to minimize missed burrows). This provides the option to analyze the data using both LTDS and traditional belt transects. Some short transects were removed from the survey to make efficient use of field time (prevent a long walk to a short transect). The total transect distance was 91,958 meters.

FNAI scientists traversed these transects using a double observer approach (one observer navigating the transect with the GPS (Trimble Geo7) and the second observer following closely behind focusing on looking for burrows the first observer missed). All usable burrows (non-collapsed) observed were searched with a

burrow scoping camera (Environmental Management Services) to determine occupancy. The position of each burrow scoped was recorded along with data on burrow size and occupancy.

#### RESULTS: LTDS

During the full survey a total of 75,925 m of transect was surveyed and 38 burrows were scoped: 25 occupied; 13 unoccupied. During the formal survey some areas were determined to be unsuitable for gopher tortoises and were eliminated from the sample frame. The total area of the final sample was 383.5 ha. Locations of transects and scoped burrows are shown in Figure 2. All transect lengths were calculated in ArcMap. For each data point where a tortoise was detected in the burrow (an encounter) the perpendicular distance from the burrow to the transect center line was calculated using the Near function. Each encounter is a single data point in the input file with two metrics: the length of the transect the burrow was found on and the perpendicular distance from the burrow to the transect center line. Lengths of transects where no tortoises were observed were also input, but without a perpendicular distance. These data were input into Distance 6.2 software and analyzed.

Distance 6.2 software results indicate an estimated density of 0.25 gopher tortoises per hectare and an estimated population size of 96 gopher tortoises with a CV of 24.89 and a 95% confidence interval for a population between 59 and 156 tortoises. Full results of the analysis can be viewed in the Appendix A. Because the CV exceeds 20%, the statistical power, confidence limits, and ability to detect trends are substantially reduced (Smith et al., 2009). For this reason we also analyzed to data using traditional belt transect method.

#### RESULTS: belt transects

Only burrows located within five meters on either side of the transects were included in the analysis. This reduced the number of burrows to 25: 17 occupied; 8 unoccupied (Figure 3). The transects were buffered by 5 meters (either side) in ArcMap to create a polygon shapefile of the surveyed area. This polygon was used to clip the natural community map in order to determine the area of each habitat surveyed. Occupied burrow densities were calculated for the area covered by transects for each community. These results were then used to extrapolate estimated tortoise densities for each community and overall population size (Table 2). This analysis estimated an average density of 0.225 gopher tortoises per hectare, and a total population size of 86 gopher tortoises. This falls within the Distance 6.2 software projected range.

#### DISCUSSION

Gopher tortoises are slow growing reptiles, which do not reach maturity until 12-15 years. Burrow width is correlated to carapace length and can be used to approximate age classes in gopher tortoises (Alford, 1980). The width of the burrows was measured to help determine the demographic structure of the population. Burrow width measurements were converted to approximate carapace length and classified as either hatchling (<5.5cm), juvenile (5.6-13.5cm), subadult (13.6-22.0cm), or adult (>22cm).

The population demographics (Figure 4) indicate the presence of hatchling, juvenile and subadult tortoises, suggesting a reproductively active population. It is also probable that the number of juvenile burrows is underrepresented. Smaller burrows are more difficult to detect and small tortoises sometimes commandeer the burrows of larger tortoises. The population demographics are somewhat unusual compared to other survey sites. The large proportion of hatchling, juvenile and subadult gopher tortoises indicates high recruitment. The Carter Tract was purchased by the Northwest Florida Water Management District (NFWFMD) in 2003, and habitat restoration began in 2007. The large proportion of young tortoises may be a very encouraging result of the recent land restoration efforts being undertaken at the Carter Tract.

Gopher tortoise burrows are host to over 350 commensals species. During the survey crickets were observed in several burrows, as well as a southern toad (*Anaxyrus terrestris*). Other notable species observed on site were a corn snake (*Pantherophis guttatus*) and a (dead) pigmy rattlesnake (*Sistrurus miliariusand*).

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Table 1: Number of transects, length of transects and number of gopher tortoise encounters recorded during pilot surveys on the Carter Tract.

<b>CLC Habitat type</b>	<b>Length of transects (m)</b>	<b>Burrows</b>	<b>Tortoises</b>
<b>Sandhill</b>	4,731.37	11	6
<b>Coniferous Plantations</b>	2,855.63	0	0
<b>Mixed Hardwood-Coniferous</b>	454	0	0
<b>Total</b>	8,041	11	6

Table 2: Total area, surveyed area, number of burrows, number of tortoises, density, and estimated tortoises for eight habitat types, with totals.

<b>CLC Habitat type</b>	<b>Total area (ha)</b>	<b>Surveyed area (ha)</b>	<b># burrows</b>	<b># tortoises</b>	<b>Density</b>	<b>Est. # tortoises</b>
<b>Sandhill</b>	232.73	46.17	22	15	0.325	76
<b>Coniferous Plantations</b>	127.41	25.08	3	2	0.080	10
<b>Mixed Hardwood-Coniferous</b>	13.3	2.58	0	0	0.000	0
<b>Powerline</b>	8.47	1.47	0	0	0.000	0
<b>Upland Coniferous</b>	0.8	0.18	0	0	0.000	0
<b>Improved Pasture</b>	0.33	0.01	0	0	0.000	0
<b>Upland Hardwood Forest</b>	0.27	0.05	0	0	0.000	0
<b>Shrub and Brushland</b>	0.18	0.04	0	0	0.000	0
<b>TOTAL</b>	383.5	75.58	25	17	0.225	86

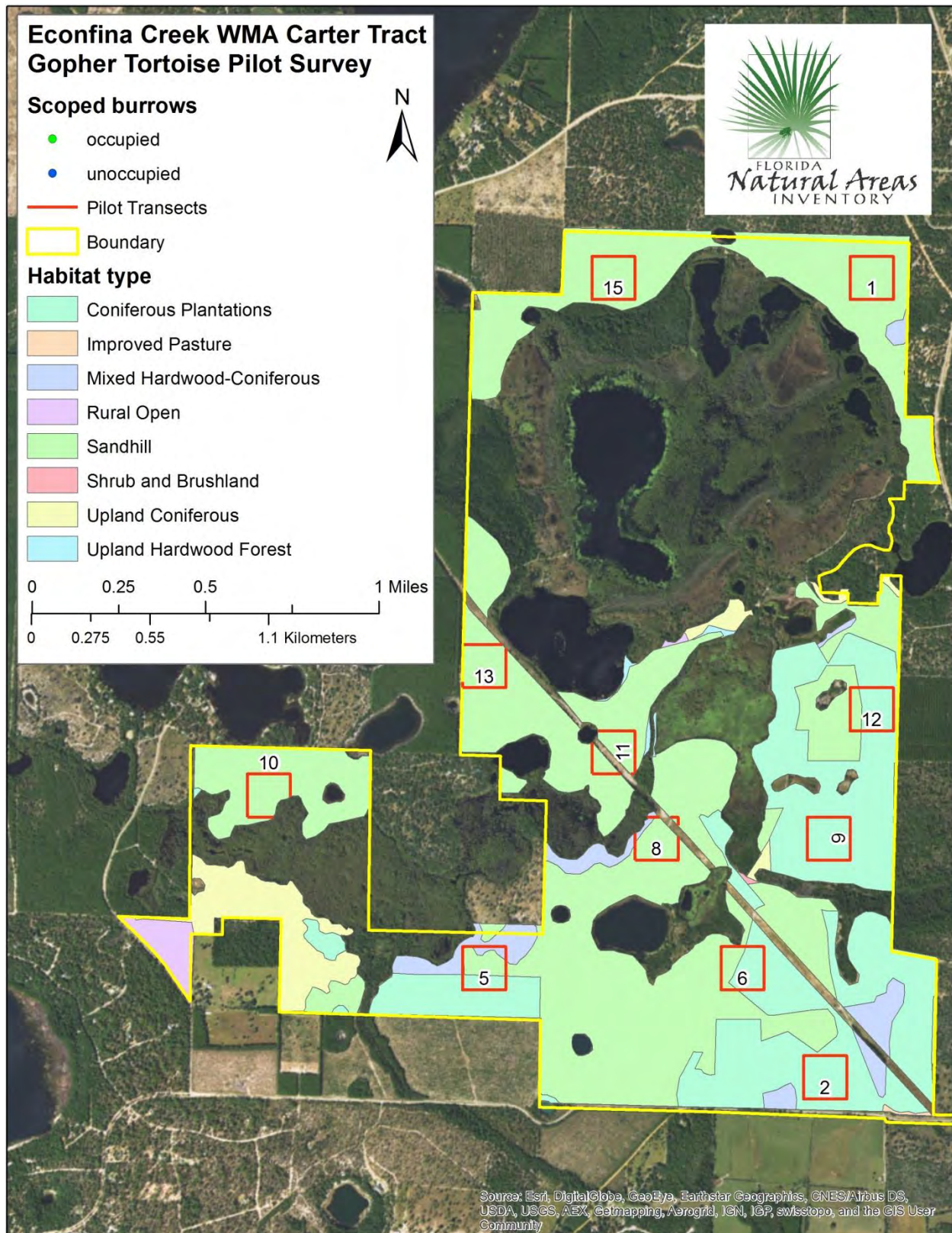


Figure 1: Location of scoped gopher tortoise burrows and pilot transects.



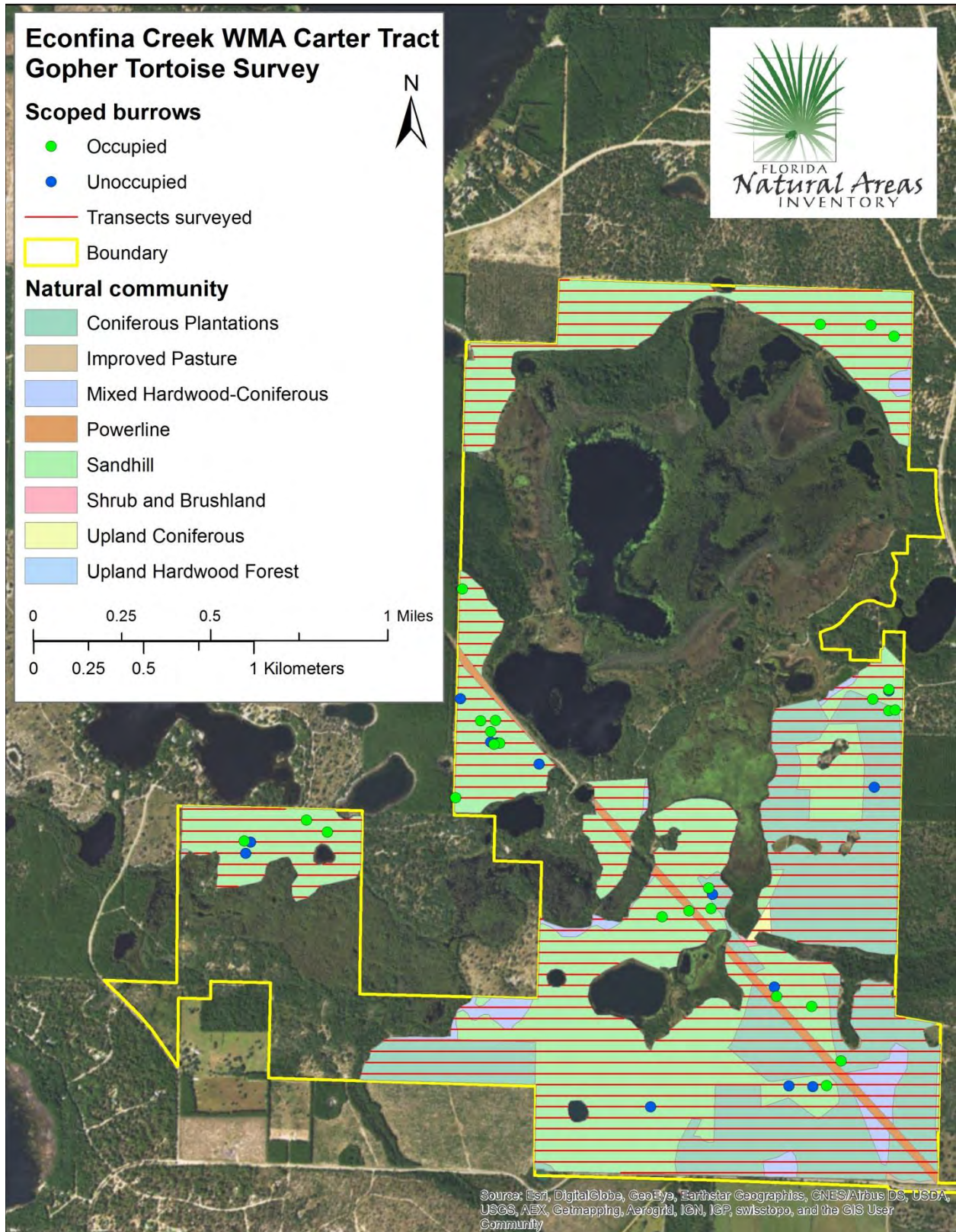


Figure 2: Location of scoped gopher tortoise burrows and transects surveyed.



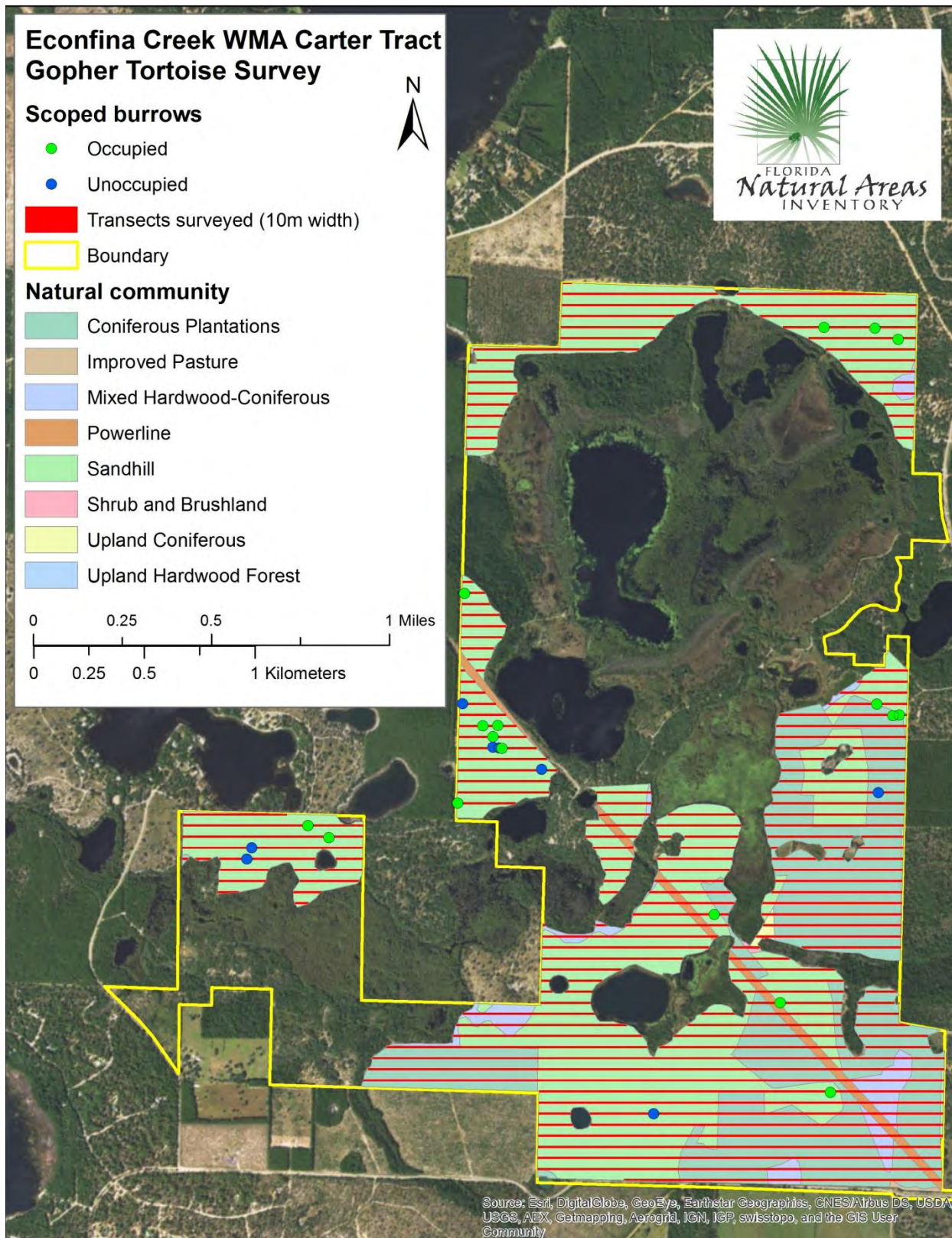


Figure 3: Location of scoped gopher tortoise burrows located within the 10 meter wide belt transects surveyed.

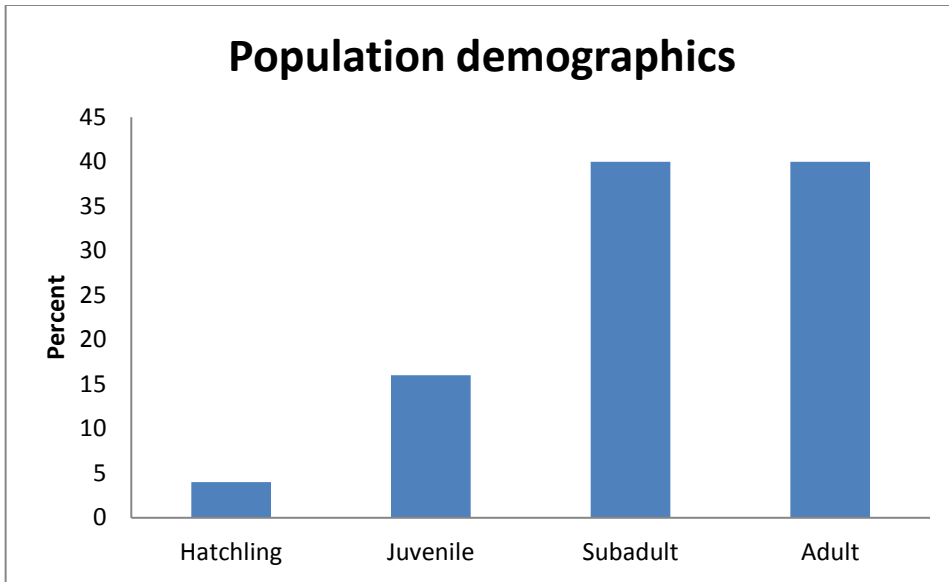


Figure 4: Population demographics for four age classes.

## Appendix A: Program Distance Results for Carter Tract

### Parameter Estimation Specification

-----  
Encounter rate for all data combined  
Detection probability for all data combined  
Density for all data combined

### Distances:

-----  
Analysis based on exact distances  
Width: use measurement/interval endpoint which represents 95.0 percentile.

### Estimators:

-----  
Estimator 1  
Key: Uniform  
Adjustments - Function : Cosines  
- Term selection mode : Sequential  
- Term selection criterion : Akaike Information Criterion (AIC)  
- Distances scaled by : W (right truncation distance)

Estimator selection: Choose estimator with minimum AIC  
Estimation functions: constrained to be nearly monotone non-increasing

### Variances:

-----  
Variance of n: Empirical estimate from sample  
(design-derived estimator R2/P2)  
Variance of f(0): MLE estimate

### Goodness of fit:

-----  
Cut points chosen by program

### Glossary of terms

#### Data items:

-----  
n - number of observed objects (single or clusters of animals)  
L - total length of transect line(s)  
k - number of samples  
K - point transect effort, typically K=k  
T - length of time searched in cue counting  
ER - encounter rate (n/L or n/K or n/T)  
W - width of line transect or radius of point transect  
x(i) - distance to i-th observation  
s(i) - cluster size of i-th observation  
r-p - probability for regression test  
chi-p- probability for chi-square goodness-of-fit test

#### Parameters or functions of parameters:

m - number of parameters in the model  
A(I) - i-th parameter in the estimated probability density function(pdf)  
f(0) - 1/u = value of pdf at zero for line transects  
u - W\*p = ESW, effective detection area for line transects  
h(0) - 2\*PI/v  
v - PI\*W\*W\*p, is the effective detection area for point transects  
p - probability of observing an object in defined area  
ESW - for line transects, effective strip width = W\*p  
EDR - for point transects, effective detection radius = W\*sqrt(p)  
rho - for cue counts, the cue rate  
DS - estimate of density of clusters

E(S) - estimate of expected value of cluster size  
 D - estimate of density of animals  
 N - estimate of number of animals in specified area

Effort : 75925.41  
 # samples : 171  
 Width : 11.33857  
 # observations: 24

Model 1

Uniform key,  $k(y) = 1/W$   
 Results:  
 Convergence was achieved with 1 function evaluations.  
 Final Ln(likelihood) value = -58.277044  
 Akaike information criterion = 116.55409  
 Bayesian information criterion = 116.55409  
 AICc = 116.55409  
 Final parameter values:

Model 2

Uniform key,  $k(y) = 1/W$   
 Cosine adjustments of order(s) : 1  
 Results:  
 Convergence was achieved with 11 function evaluations.  
 Final Ln(likelihood) value = -53.287851  
 Akaike information criterion = 108.57570  
 Bayesian information criterion = 109.75375  
 AICc = 108.75751  
 Final parameter values: 0.80005136

Likelihood ratio test between models 1 and 2  
 Likelihood ratio test value = 9.9784  
 Probability of a greater value = 0.001584

\*\*\* Model 2 selected over model 1 based on minimum AIC

Model 3

Uniform key,  $k(y) = 1/W$   
 Cosine adjustments of order(s) : 1, 2  
 Results:  
 Convergence was achieved with 16 function evaluations.  
 Final Ln(likelihood) value = -52.920785  
 Akaike information criterion = 109.84157  
 Bayesian information criterion = 112.19768  
 AICc = 110.41299  
 Final parameter values: 0.91992152 0.21111224

Likelihood ratio test between models 2 and 3  
 Likelihood ratio test value = 0.7341  
 Probability of a greater value = 0.391547

\*\*\* Model 2 selected over model 3 based on minimum AIC

Effort : 75925.41  
 # samples : 171  
 Width : 11.33857  
 # observations: 24

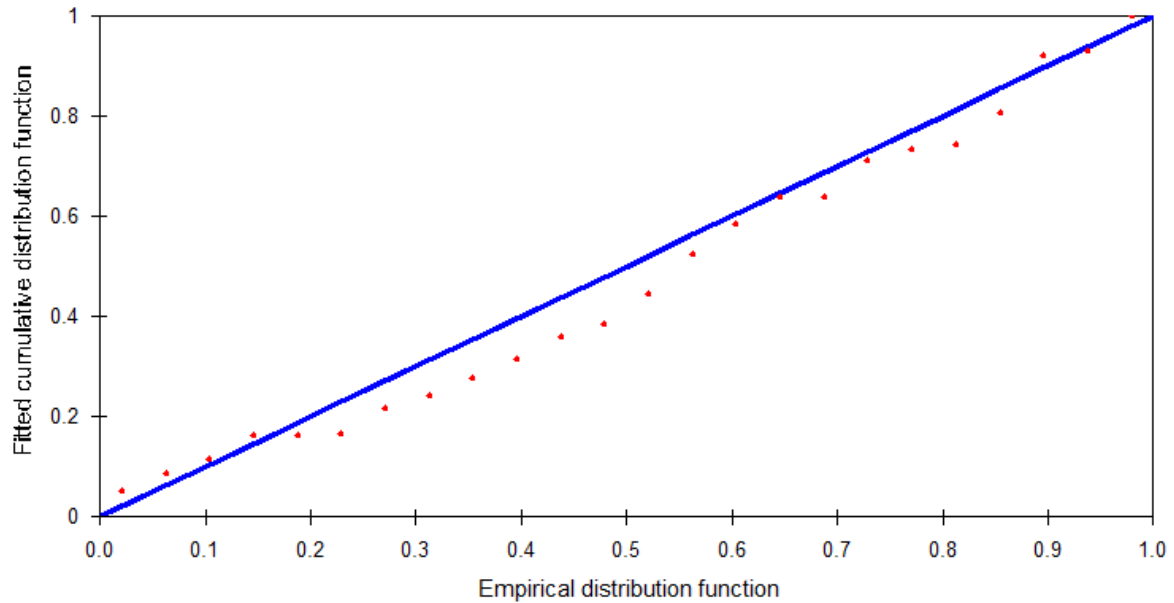
Model

Uniform key,  $k(y) = 1/W$   
 Cosine adjustments of order(s) : 1

Parameter	Point Estimate	Standard Error	Percent Coef. of Variation	95 Percent Confidence Interval
A( 1)	0.8001	0.1727		



f(0)	0.15875	0.15230E-01	9.59	0.13024	0.19352
p	0.55554	0.53296E-01	9.59	0.45575	0.67719
ESW	6.2990	0.60430	9.59	5.1675	7.6783



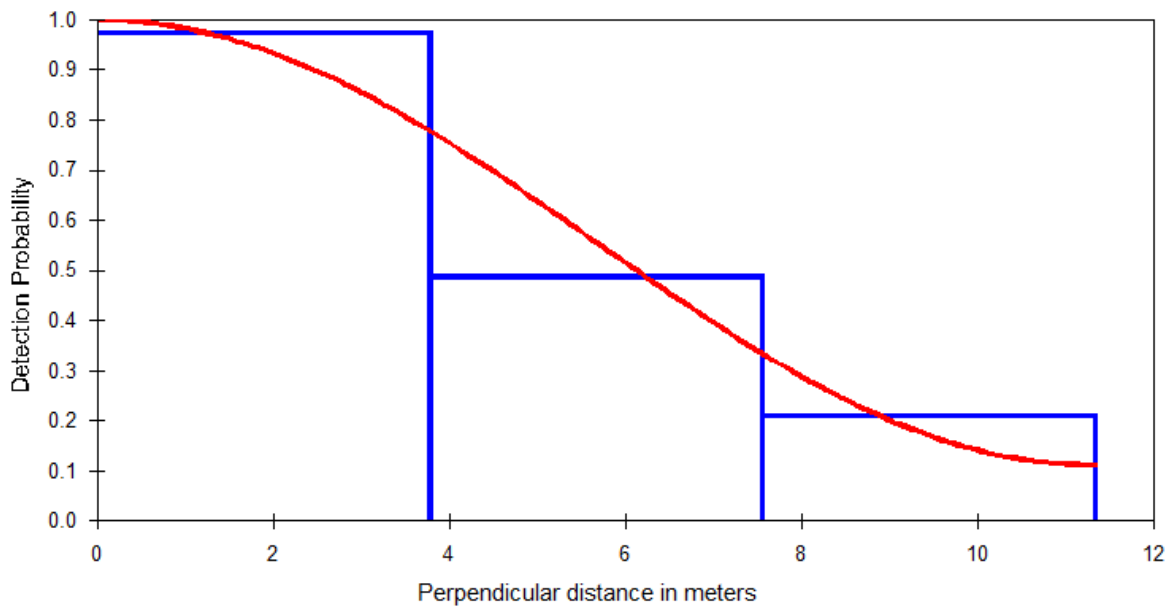
Kolmogorov-Smirnov test

D\_n = 0.1163                      p = 0.9016

Cramer-von Mises family tests

W-sq (uniform weighting) = 0.0662                      0.700 < p <= 0.800  
 Relevant critical values:  
 W-sq crit(alpha=0.800) = 0.0630  
 W-sq crit(alpha=0.700) = 0.0794

C-sq (cosine weighting) = 0.0493                      0.700 < p <= 0.800  
 Relevant critical values:  
 C-sq crit(alpha=0.800) = 0.0396  
 C-sq crit(alpha=0.700) = 0.0505

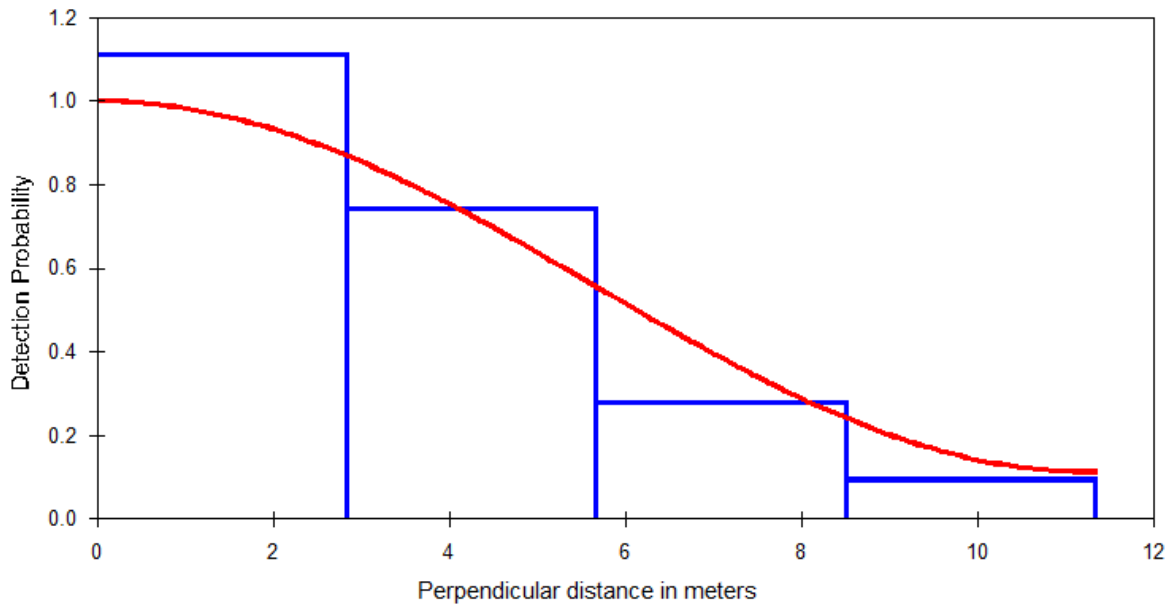


Cell i	Cut Points	Observed Values	Expected Values	Chi-square Values	
1	0.000	3.78	14	13.29	0.038
2	3.78	7.56	7	8.00	0.125
3	7.56	11.3	3	2.71	0.032

Total Chi-square value = 0.1944 Degrees of Freedom = 1.00

Probability of a greater chi-square value, P = 0.65928

The program has limited capability for pooling. The user should judge the necessity for pooling and if necessary, do pooling by hand.



Cell i	Cut Points	Observed Values	Expected Values	Chi-square Values	
1	0.000	2.83	12	10.32	0.273
2	2.83	5.67	8	7.79	0.006
3	5.67	8.50	3	4.21	0.348
4	8.50	11.3	1	1.68	0.274

Total Chi-square value = 0.8999 Degrees of Freedom = 2.00

Probability of a greater chi-square value, P = 0.63765

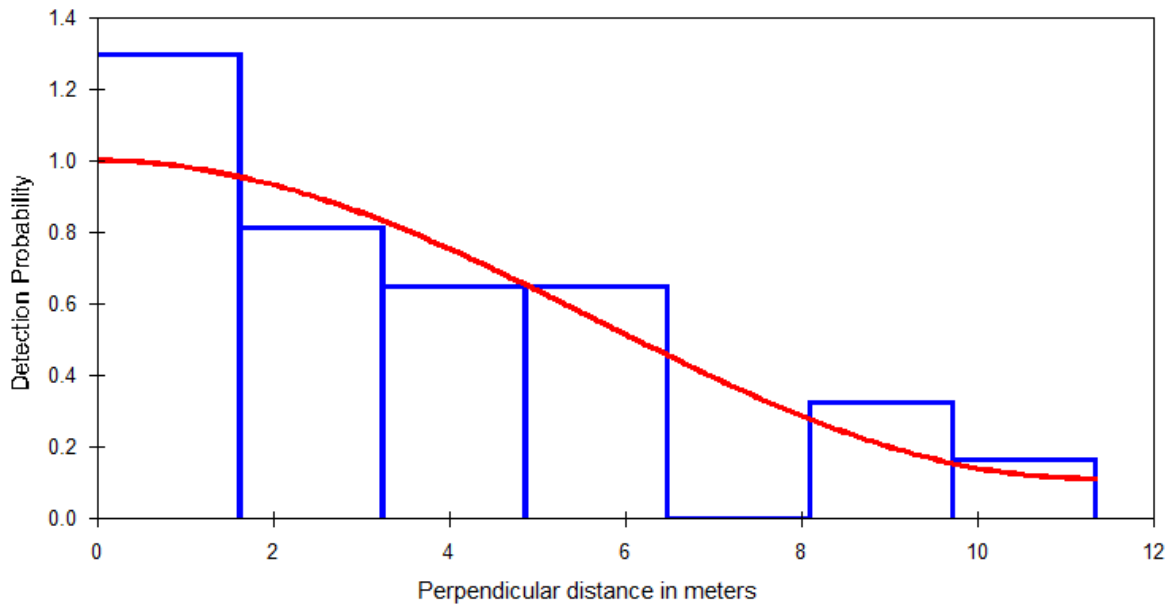
The program has limited capability for pooling. The user should judge the necessity for pooling and if necessary, do pooling by hand.

Goodness of Fit Testing with some Pooling

Cell i	Cut Points	Observed Values	Expected Values	Chi-square Values	
1	0.000	2.83	12	10.32	0.273
2	2.83	5.67	8	7.79	0.006
3	5.67	11.3	4	5.89	0.605

Total Chi-square value = 0.8836 Degrees of Freedom = 1.00

Probability of a greater chi-square value, P = 0.34721



Cell i	Cut Points	Observed Values	Expected Values	Chi-square Values	
1	0.000	1.62	8	6.08	0.606
2	1.62	3.24	5	5.56	0.055
3	3.24	4.86	4	4.61	0.080
4	4.86	6.48	4	3.43	0.095
5	6.48	8.10	0	2.25	2.248
6	8.10	9.72	2	1.30	0.374
7	9.72	11.3	1	0.78	0.064

Total Chi-square value = 3.5240 Degrees of Freedom = 5.00

Probability of a greater chi-square value, P = 0.61975

The program has limited capability for pooling. The user should judge the necessity for pooling and if necessary, do pooling by hand.

Goodness of Fit Testing with some Pooling

Cell i	Cut Points	Observed Values	Expected Values	Chi-square Values	
1	0.000	1.62	8	6.08	0.606
2	1.62	3.24	5	5.56	0.055
3	3.24	4.86	4	4.61	0.080
4	4.86	6.48	4	3.43	0.095
5	6.48	8.10	0	2.25	2.248
6	8.10	11.3	3	2.08	0.409

Total Chi-square value = 3.4940 Degrees of Freedom = 4.00

Probability of a greater chi-square value, P = 0.47880

Effort : 75925.41  
 # samples : 171  
 Width : 11.33857  
 # observations: 24

Model 2

Uniform key,  $k(y) = 1/W$

Cosine adjustments of order(s) : 1

Parameter	Point Estimate	Standard Error	Percent Coef. of Variation	95% Percent Confidence Interval	
D	0.25091	0.62461E-01	24.89	0.15469	0.40697
N	96.000	23.898	24.89	59.000	156.00

Measurement Units

Density: Numbers/hectares  
ESW: meters

Component Percentages of Var(D)

Detection probability : 14.9  
Encounter rate : 85.1

	Estimate	%CV	df	95% Confidence Interval	
n	24.000				
k	171.00				
L	75925.				
n/L	0.31610E-03	22.97	170.00	0.20203E-03	0.49457E-03
Left	0.0000				
Width	11.339				

	Estimate	%CV	df	95% Confidence Interval	
m	1.0000				
LnL	-53.288				
AIC	108.58				
AICc	108.76				
BIC	109.75				
Chi-p	0.47880				
f(0)	0.15875	9.59	23.00	0.13024	0.19352
p	0.55554	9.59	23.00	0.45575	0.67719
ESW	6.2990	9.59	23.00	5.1675	7.6783

	Estimate	%CV	df	95% Confidence Interval	
D	0.25091	24.89	191.43	0.15469	0.40697
N	96.000	24.89	191.43	59.000	156.00