Final Report

Investigation of Resources, Threats and Future Protection Needs of the Matanzas River Study Area

Submitted to:

St. Johns River Water Management District

Prepared by:

PBS&J

5300 West Cypress Street
Suite 200
Tampa, FL 33607-1768

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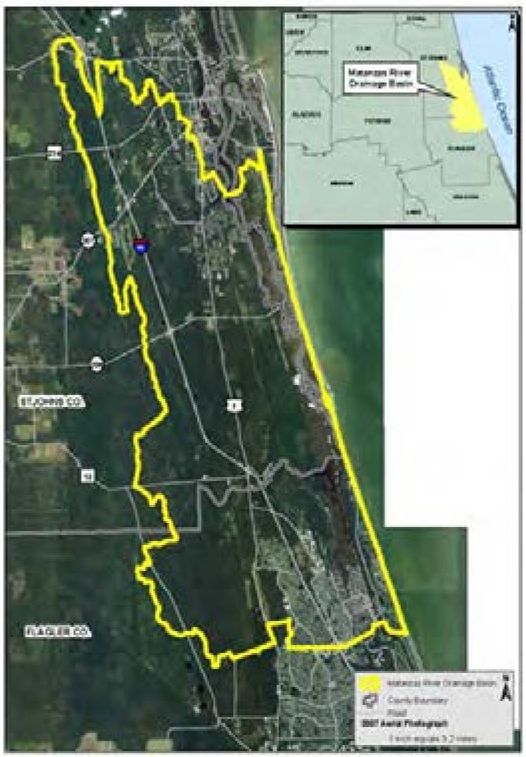
Executive Summary

1.0 Project Purpose

In response to public concerns regarding the potential for increased stresses on natural resources associated with expected continued future development, the District's Governing Board directed staff to implement the Matanzas River Basin Work Plan. This work plan includes a number of elements directed to providing enhanced protection of the Matanzas Basin's water resources. As part of the overall Matanzas River Basin Work Plan, the primary objective of this report was to investigate and provide the District with information regarding the Matanzas Basin study area's (Figure 1) wetland resources, potential threats, and future protection needs.

Figure 1.1.1
Location of the Matanzas River Study Area



This project was designed to:

- Identify, describe, and rank the distinct types of habitat in the Matanzas Basin study area.
- Identify observed and expected aquatic and wetland-dependent wildlife within the identified habitats.

- Identify the habitat requirements of such identified aquatic and wetland-dependent species.
- Working with District staff, identify likely scenarios for future land use development in the Matanzas Basin study area and assess potential impacts to identified aquatic and wetland-dependent species.
- Provide an initial assessment of potential additional habitat and resource protection measures to preclude such adverse impacts.

2.0 Project Objectives

The approach to meeting the overall project objectives was divided into a series of tasks summarized below.

Task 1: Identify the Aquatic and Wetland-dependent Wildlife in the Study Area

Lists of expected wetland-dependent species were assembled and used to quantify wetland and buffer use by wetland-dependent species during wildlife surveys conducted along selected transects during summer wet-season reconnaissance surveys. Comprehensive and normalized levels of sampling effort were implemented to assess the observed presence/occurrence of "expected taxa" and ultimately determine the relative potential influences of existing buffer widths on wetland-dependent wildlife use among sites.

Task 2: Catalog the Aquatic and Wetland-dependent Wildlife in the Study Area

Differing types of information were combined and incorporated to provide supplementary information regarding the regional list of aquatic and wetland-dependent species. Available Geographic Information System (GIS) and literature data were compiled for this task and were incorporated in determining potential relationships between buffer widths and wildlife utilization in the Matanzas watershed study area.

Task 3: Identify Upland and Wetland Habitats that are needed to Maintain the Abundance and Diversity of Aquatic and Wetland-dependent Wildlife

Data compiled and summarized from Tasks 1 and 2 and additional available information were applied to establish species specific and community habitat requirements necessary to maintain the expected abundance and diversity of aquatic and wetland-dependent species within the Matanzas River study area.

Task 4: Identify and Rank the Quality of Upland and Wetland Habitat Available within the Study Area

Current and historic land use/land cover mapping data and other available GIS imagery were reviewed to develop an array of potential transect sites having differing buffer widths between existing development and natural wetland habitats. Potential transects were then assigned to categories based on buffer widths to ensure sampling within four differing categories.

- 0 to 50 foot buffer
- 51 to 100 foot buffer
- 101 to 300 foot buffer
- 301 to 500 foot buffer

Sixteen freshwater and eight saltwater wetlands were selected to evaluate potential differences in species habitat requirements between the aquatic and wetland-dependent species associated with these characteristic communities within the study area. At each transect, wildlife sampling was performed at three locations: 1) at the mid-point between where the buffer meets the developed landscape and where it meets the wetland; 2) where the buffer meets the wetland it is intended to protect; and 3) at a point either 100 feet into the wetland or the middle of the wetland, whichever is less. Wildlife presence was quantified along each transect using the same techniques and sampling efforts (i.e., time of day, length of time, similarity of sampling tools). The intent of this effort was to minimize the variability between transects due to differences other than buffer width. Qualitative scoring was also conducted of the upland/wetlands associated with each of these transects.

Task 5: Would Future Development Likely Affect Wetland-dependent Wildlife?

GIS-based comparison were conducted of present-day, "near future" and predicted land use maps for the year 2035 based on information supplied by District staff. The "near future" land use reflected 2012 conditions, where 2004 GIS maps were first updated using aerial photography from 2008. Additional changes were then made based upon active Environmental Resource Permits to reflect existing permitted development in the study area, not yet fully constructed. The 2035 predicted development map was created by consulting several sources, including St. Johns and Flagler County Future Land Use Maps (FLUMs), environmental resource permits (ERPs), City of Palm Coast FLUM, and developments of regional impacts (DRIs). Public lands and conservation easements were displayed and avoided when evaluating areas likely to be developed in the 2035 future development scenario. Using the 2035 Future Land Use Map, the amount of wetlands within the footprint of expected development was then estimated, and the amount and location of buffers of different categories were then derived based on the compiled GIS layer information.

The literature on wildlife utilization of wetlands was then queried to determine what types of guidance had been developed as to various techniques to preserve wildlife with expected development pressure. Results from the summer wet-season sampling effort were then compared to the literature as a whole to determine if the results found in this study were consistent with the larger body of information available on this topic

A series of graphical and statistical analytical methods were employed to further evaluate and summarize the results of the observed occurrences of wetland-dependent taxa recorded during the field transect studies conducted during July 2009. Alternative methods of parametric and non-parametric statistical analyses were conducted using SAS ™ (Statistical Analysis System) and Primer ™ software

Task 6: Determine the Need for Additional Protection of Upland and Wetland Habitat

Based on the finds of the preceding project efforts, the objective of this final task was to determine and interpret:

- How much future land use is likely to be developed?
- How much wetland acreage is likely to be within the general footprint of expected development?
- Does the literature on wildlife utilization of wetlands indicate that future development constructed pursuant to existing regulatory criteria is likely to impact wetland-dependent wildlife?
- Do the results from this study's wildlife utilization effort support the need for additional protective efforts?

3.0 Project Results and Conclusions

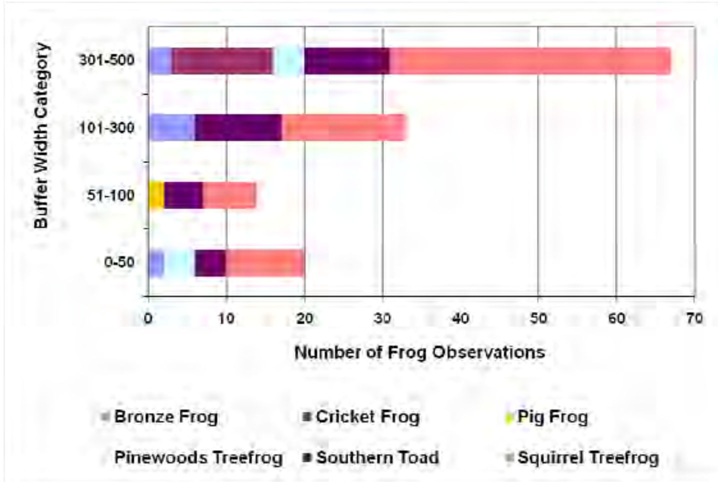
The following briefly summarizes some of the major results and conclusions of the tasks defined under the Project Scope of Work. The report results include lists of the potentially occurring wildlife in the study area, lists and graphics of wildlife observed during the summer surveys, and a summary of corresponding habitat requirements as well as a qualitative analysis of the wildlife habitat in the Matanzas River watershed study area.

3.1 Identify the Aquatic and Wetland-dependent Wildlife of the Study Area

The report presents a series of comprehensive lists of the major groups (mammals, birds, reptiles and amphibians) of aquatic, semi-aquatic, and wetland associated and dependent vertebrates that potentially might be expected to be observed in the Matanzas River study area. Additional literature-based compilations of potentially occurring species found in east central Florida, as well as State and Federally listed protected species found in Flagler and St. Johns counties are further presented in the report's appendices.

Grouped tabular and graphical results are presented of mammals, birds, reptiles and amphibians species observed during the summery 2009 wildlife transect field studies. Amphibian species are by definition wetland-dependent, and Figure 2 depicts both the number and species richness of amphibian taxa observed after combining the freshwater transects within each of the four transect buffer width classifications (0-50, 51-100, 101-300 and 301 to 500 feet). These results show that while the number of taxa (species richness) observed varied without a defined pattern, the number of individuals observed using a standardized level of effort was observed to generally increase with larger natural buffer widths.

Figure 2
Number and Species of Frogs with Different Buffer Width Categories



3.2 Catalog the Aquatic and Wetland-dependent Wildlife in the Study Area

The results are presented as a series of matrices listing species for each of the major wetland-dependent vertebrates groups potentially found in the Matanzas River study area. These matrices detail many aspects of the natural history including:

- Common name
- Species Name
- Resident or overwintering
- Preferred habitat (upland, wetland, reproduction, foraging, denning/nesting, wetland-dependency

Additional detailed information is provided for selected taxa and cited references are presented in the appendices.

3.3 Identify Upland and Wetland Habitats that are needed to Maintain the Abundance and Diversity of Aquatic and Wetland-dependent Wildlife

The narrative descriptions and references presented in this report section provided additional support regarding wetland-dependency of amphibian, reptile, bird and mammal species presented in the preceding project tasks.

3.4 Identify and Rank the Quality of Upland and Wetland Habitat Available within the Study Area

During the 2009 wet-season wildlife surveys, upland and wetland transect habitats were evaluated based on features that measure, or indicate, the relative wildlife value of each site. These presented tabular site-specific habitat evaluations were based upon the indicators listed below and were used to both rank the relative quality of the habitats and later in conjunction with evaluations relative differences in buffer widths.

- Vegetation communities
- Hydrology of the wetlands
- Absence of disturbance to the habitat
- Refuge (other than vegetation) for wildlife
- Species richness
- Presence of listed (state or federally protected) species
- Connectivity between adjacent habitats
- Value assigned by the Florida Fish and Wildlife Conservation Commission (FFWCC) Integrated Wildlife Habitat Ranking System (IWHRS)
- Uniqueness of the habitat in the study area

3.5 Would Future Development Affect Wetland-dependent Wildlife?

3.5.1 Predicted Development Map for 2035

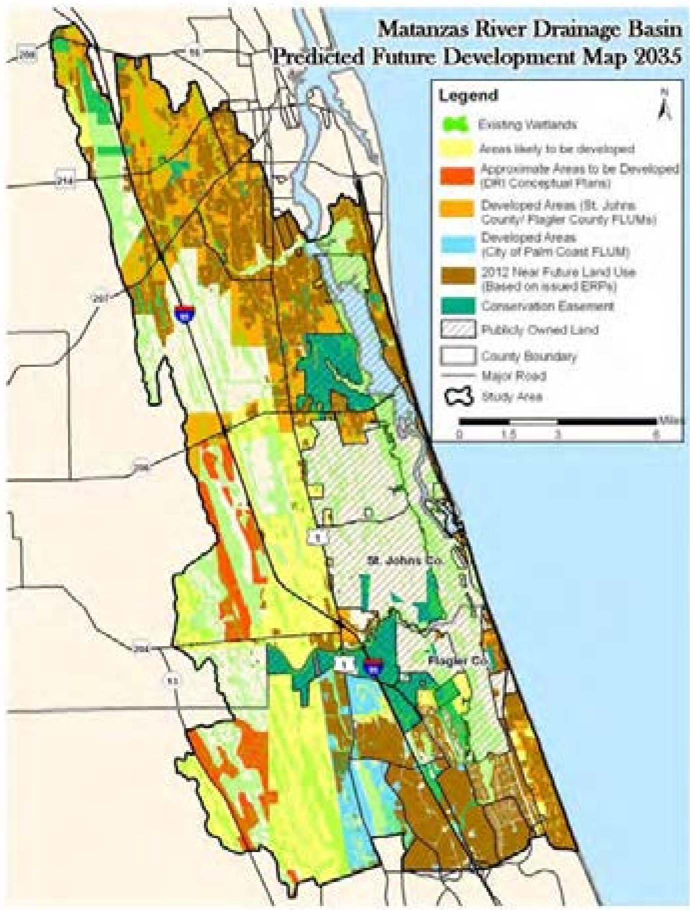
Areas of development and estimates of population growth were calculated for the years 1990, 2000, and 2008 in order to predict future development in the basin through the year 2035. A nonparametric linear regression was performed and a correlation coefficient computed that indicated a strong and significant relationship between population and area of development. This relationship was then used to estimated the future population values presented in Table 1.

Table 1
Calculated Estimates of Population and Acreage to be Developed in the Matanzas River Drainage Basin by 2035

County	Estimated Population 2035	Estimated Acreage to be Developed by 2035
St. Johns	84,706	34,280
Flagler	69,731	28,223
Total	154,437	62,503

A predicted future development map (Figure 3) was then created consulting several sources, including St. Johns and Flagler County future land use maps (FLUMs), environmental resource permits (ERPs), City of Palm Coast FLUM, and developments of regional impacts (DRIs). Public lands and conservation easements were displayed and avoided when evaluating areas likely to be developed in 2035 future development scenario.

Figure 3
Predicted Future Development Map for 2035 in the Matanzas River Drainage Basin



Based on previous development in the study area it was estimated that the total future wetland impacts in the basin would be approximately 2,142 acres within areas expected to be developed in Figure 3 by 2035.

3.5.2 Summary of Literature on Effects of Buffers on Wildlife Utilization

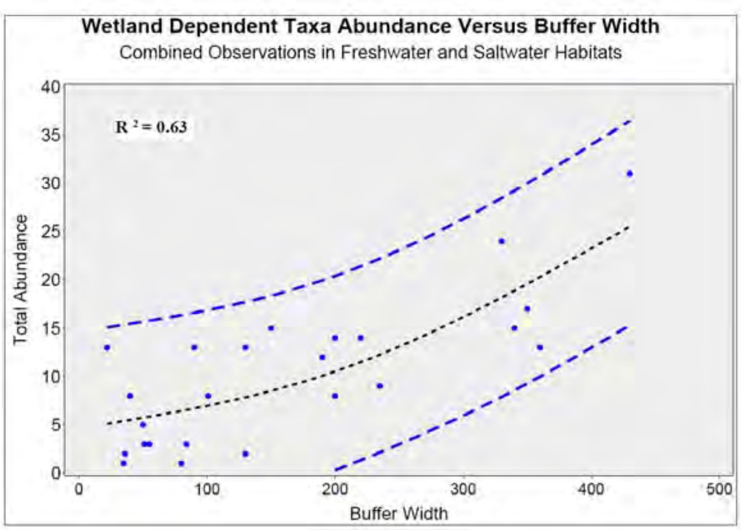
Riparian buffers have gained wide acceptance as tools for protecting water quality, maintaining wildlife habitat and providing additional environmental benefits. Much of the research and supporting information for buffer width is based on stormwater management and water quality. However, a number studies have been conducted to attempt to determine appropriate buffer widths for habitat preservation and wildlife utilization of wetlands. The report reviews and summarizes information from such literature, including discussions of some of the research and studies done in attempt to quantify wildlife buffers. While some of these studies include field gathered data and statistical analyses on one or more species, others simply incorporate data from other sources and general observations in an attempt to place a numeric value on the width or area required for habitat buffers. Many buffer studies in scientific literature make conclusions on appropriate buffer sizes for wildlife habitat based on how far individuals range from the wetland or water body for breeding or other life-cycle needs in attempting to develop specific information on ranges for birds, mammals, reptiles, and amphibians. A number of these studies have suggested that wetland functions, values, and sensitivity are attributes that influence the necessary level of protection for a wetland.

Alachua County, Florida, provides for a case-by-case performance-based standard buffer, but also provides for a numerical default value when sufficient information is not available to support a case-by-case determination. Alachua County requires the following factors to be considered in making the case-by-case determination: 1) Type of activity and associated potential for adverse site-specific impacts; 2) Type of activity and associated potential for adverse offsite or downstream impacts; 3) Surface water or wetland type and associated hydrologic requirements; 4) Buffer area characteristics, such as vegetation, soils, and topography; 5) Required buffer area function (e.g., water quality protection, wildlife habitat requirements, flood control); 6) Presence or absence of listed species of plants and animals; and 7) Natural community type and associated management requirements of the buffer

3.5.3 Results from Wildlife Surveys in Matanzas Basin

Analyses of field wildlife transect data collected during the summer of 2009 were conducted to determine relationships and patterns among the measured dependent variables (abundance, diversity and species richness) and the independent parameters including buffer width and core wetland habitat scoring.

Figure 4
Total Abundance of Wetland-dependent Organisms vs. Buffer Width



The observed increases in the numbers and abundance of wetland dependent taxa with increasing buffer width and wetland quality are consistent with the literature, where researchers have reported similar observed similar increases in the density, diversity and species richness of wetland dependent birds, mammals, and both reptiles and amphibians with greater buffer widths.

3.6 Determine the Need for Additional Protection of Upland and Wetland Habitat

Based anticipated future development (Figure 3, above), it is estimated that in St. in Johns County approximately 8,026 acres of wetlands occurring in portions of the Matanzas River Basin are likely to be developed by the year 2035. In Flagler County, this estimate is approximately 5,038 acres of wetlands. While various regulatory programs are in place to guide development away from impacting these wetlands, based on past patterns, it is expected that as much as 2,220 acres of these wetlands may be lost. Thus, by the year 2035, it is probable that the abundance of wetland-dependent animals (especially amphibians) would decrease in response to increasing development of upland habitats adjacent to the remaining wetlands in the Matanzas River basin.

Rather than using a single, default buffer width for protection of wildlife throughout the entire Matanzas River Basin, an optional approach would be for buffer width guidance to vary with the "quality" of the wetland system likely to be impacted by development (such as the current setback wetland protection rules used in Alachua County). Such a holistic approach to wetland protection might be warranted in the Matanzas River Basin, including assessing the quality of the wetland in question, their degree of interconnectedness to other valuable habitats (both uplands and wetlands), and developing buffer width requirements based on the results of site specific assessments. This approach might allow the variety of stakeholders in the region to focus their efforts on protecting those wetland features that are more likely to serve as critical wildlife habitat for wetland-dependent species in the Matanzas River watershed.

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1.0 Introduction

The Mission Statement of the St. Johns River Water Management District (District) is as follows:

> "We will ensure the sustainable use and protection of water resources for the benefit of the people of the District and the state of Florida."

Implicit in this statement is that "water resources" refers to resources other than water alone. Water resources are usually interpreted as including not only the quantity and quality of water, but also the aesthetic and habitat-related features of aquatic systems.

The Matanzas River is a tidal system overlapping portions of the Guana, Tolomato, and Matanzas (GTM) National Estuarine Research Reserve. It extends from the City of Palm Coast to the St. Augustine Inlet (Figure 1.1.1) and includes three main tributaries:

- Pellicer Creek
- Moses Creek
- Moultrie Creek

The contributing drainage area of the Matanzas Basin study area remains largely undeveloped, with roughly 60,000 acres currently under public (state and federal) ownership. Development pressures in the basin however have been increasing, with indications that some measures of water quality have been declining.

In response to public concerns regarding the potential for increased stresses on natural resources associated with expected continued future development, the District's Governing Board directed staff to implement the Matanzas River Basin Work Plan. This work plan includes a number of elements directed to providing enhanced protection of the Matanzas Basin's water resources. As part of the overall Matanzas River Basin Work Plan, the primary objective of this report is to investigate and provide the District with information regarding the Matanzas Basin study area's (Figure 1.1.1) wetland resources, potential threats, and future protection needs.

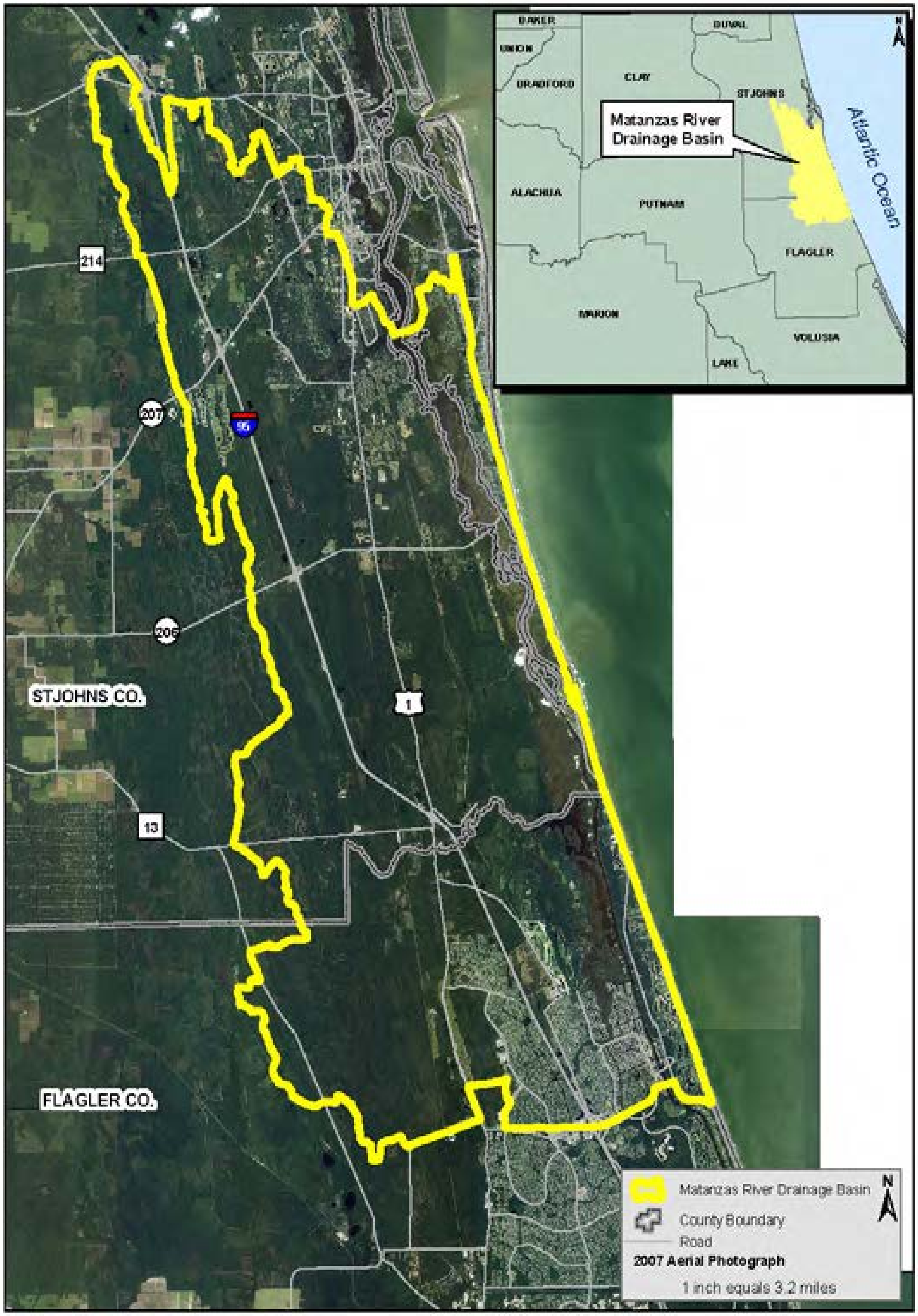
The investigation assumes that related items in the Matanzas River Basin Work Plan will result in Outstanding Florida Waters (OFW) designations of publicly-owned lands adjacent to the Matanzas River between Markers 29 and 109, Pellicer Creek and its tributaries (Stevens Branch and Dave Branch). In addition, it is anticipated that the Florida Department of Environmental Protection (FDEP) and the District will coordinate updating existing stormwater rules relative to nutrients as necessary to address any water quality impairments identified in conjunction with FDEP's ongoing Total Maximum Daily Load (TMDL) program.

1.1. Project Purpose

This project was designed to investigate the need for additional protection (beyond existing applicable local, state, and federal regulations) relative to preserving aquatic and wetland-dependent wildlife in the Matanzas River study area. Should findings support the need for additional protection, the District would use these results to guide deliberations related to whether or not rule-making should be initiated for the Matanzas River study area. The included goals of this study are:

- Identify, describe, and rank the distinct types of habitat in the Matanzas Basin study area.
- Identify observed and expected aquatic and wetland-dependent wildlife within the identified habitats.
- Identify the habitat requirements of such identified aquatic and wetland-dependent species.
- Working with District staff, identify likely scenarios for future land use development in the Matanzas Basin study area and assess potential impacts to identified aquatic and wetland-dependent species.
- Assess potential additional habitat and resource protection measures necessary to preclude such adverse impacts.

Figure 1.1.1
Location of the Matanzas River Study Area



2.0 Project Approach

The following summarizes the approaches to the first four tasks outlined in the Project Scope of Work. In some instances modifications and/or additions were included based on ongoing coordination with District staff. An illustrative example would include work associated with performing the site reconnaissance and habitat evaluation elements under Task 4. Prior to initial field sampling efforts in March 2009 it became clear that unusually dry conditions during much of the winter and spring might necessitate adding summer wet-season field work to the site reconnaissance efforts. This was also evidenced by the very low number of observations of wetland-dependent species at almost all of the surveyed transect sites during the initial reconnaissance efforts.

The approach and the continuing and proposed efforts to complete the four project tasks for the Matanzas River study area wildlife survey are summarized below.

2.1. Task 1: Identify the Aquatic and Wetland-dependent Wildlife in the Study Area

Several species lists of expected wetland-dependent species have been assembled based on information compiled from a variety of sources.

- A review of literature of Florida wetland-dependent taxa, especially regionally focusing on the Matanzas River basin and nearby watersheds.
- Existing regionally specific information compiled in conjunction with efforts by the Florida Fish and Wildlife Conservation Commission's (FFWCC) biodiversity assessment (GAP), and the Florida Natural Areas Inventory (FNAI).
- Information from District staff, local scientists, and others with specific regional knowledge of key aquatic and wetland-dependent wildlife.
- Results obtained during the June and July field surveys along the established transects.

These species lists were used to quantify wetland and buffer use by wetland-dependent species during wildlife surveys along each of the selected transects during the summer wet-season reconnaissance surveys. Comprehensive and normalized levels of sampling effort were implemented using the species list, to assess the observed presence/occurrence of "expected taxa" and ultimately determine the relative potential influences of existing buffer widths on wildlife use among sites.

2.2. Task 2: Catalog the Aquatic and Wetland-dependent Wildlife in the Study Area

The results of this task supplemented information acquired during completion of Task 1 of the Project. The following types of information were incorporated to provide supplementary information regarding the regional list of aquatic and wetland-dependent species.

- Identify taxa as either resident or migratory in their regional use of aquatic and wetland habitats.
- Determine those identified species that are currently (and/or proposed to be) listed federally or by the state of Florida as endangered, threatened or a species special concern.
- Match identified aquatic and wetland-dependent species with existing rules and regulations designed for their protection.

Available Geographic Information System (GIS) and literature data were compiled for this task and were used to determine potential relationships between buffer widths and wildlife utilization in the study area.

2.3. Task 3: Identify Upland and Wetland Habitats that are Needed to Maintain the Abundance and Diversity of Aquatic and Wetland-dependent Wildlife

The objective of this task was to use compiled and summarized data from Tasks 1 and 2 and additional available information to establish species specific and community habitat requirements necessary to maintain the expected abundance and diversity of aquatic and wetland-dependent species within the Matanzas River study area. The following efforts were included in assembling the elements associated with this project task.

- Compilation of information (literature and GIS) relative to specific habitat requirements and the known territorial ranges of larger species were evaluated.
- Comparison of alternative habitat indices relative to their potential application (and weighting) in assessing potential buffer effects.

These task elements were further evaluated and modified (in coordination with District staff) before being integrated with the results of the summer wet-season monitoring of the final selected transects.

2.4. Task 4: Identify and Rank the Quality of Upland and Wetland Habitat Available within the Study Area

Current and historic land use/land cover mapping data and other available GIS imagery were reviewed to develop an array of potential transect sites having differing buffer widths between existing development and natural wetland habitats. Land use (2004) and publicly-owned land GIS data (received from the District) as well as National Wetlands Inventory (NWI) data and 2008 aerial photography were evaluated for potential transect locations. Initial transect locations were limited to publicly-owned lands due to time constraints in obtaining permits to access privately-owned land. Two additional transects that did not abut development were chosen by the District as reference wetlands. One of these wetlands, containing transect E-Xd, was on privately-owned property. Access to this property was obtained by the District. Potential transects were then assigned to categories based on buffer widths to ensure sampling of the below-listed buffer width categories.

- 0 to 50 foot buffer
- 51 to 100 foot buffer
- 101 to 300 foot buffer
- 301 to 500 foot buffer

Based on initial GIS evaluations, an equal number of transects in each of these categories was selected for further field reconnaissance and evaluation, and transects from the adjacent upland buffers into the middle of the wetlands were conducted in June/July 2009. Qualitative scoring of habitat assessments of the upland/wetlands associated with these transects was conducted.

- Sixteen freshwater and eight saltwater wetlands were chosen for transect locations. This was done to evaluate potential differences in species habitat requirements between the aquatic and wetland-dependent species associated with these characteristic communities within the study area.

- In order to evaluate potential differences among buffer widths, surveys were conducted in at least four transects within each of the four freshwater buffer width categories and in at least one transect within each of the four saltwater buffer width.

- At each transect, wildlife sampling was performed at three locations: 1) at the mid-point between where the buffer meets the developed landscape and where it meets the wetland; 2) where the buffer meets the wetland it is intended to protect; and 3) at a point either 100 feet into the wetland or the middle of the wetland, whichever is less. Figures 2.4.1 and 2.4.2 show wildlife sampling points along transects B-2 and C-4, respectively.

- Wildlife presence was quantified along transects using the same techniques and sampling efforts (i.e., time of day, length of time, similarity of sampling tools) and will be similar for all surveys. The intent of this effort is to minimize the variability between transects due to differences other than buffer width. A more detailed discussion of the methods is provided in section 3.1.

- At least one survey of each saltwater wetland was conducted around low tide to coincide with expected maximum wildlife usage.

Figure 2.4.1
Wildlife Sampling Points along Transect B-2

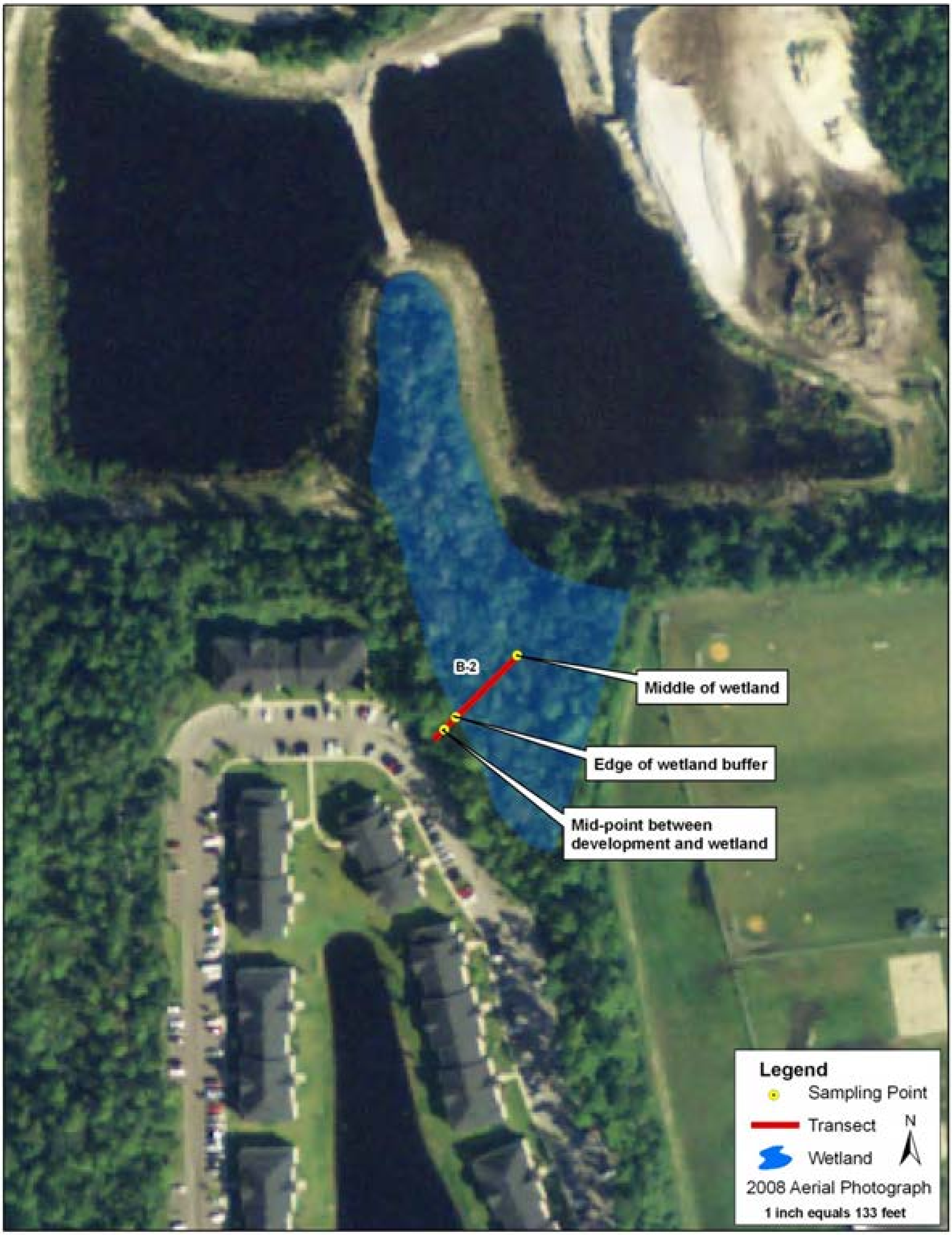
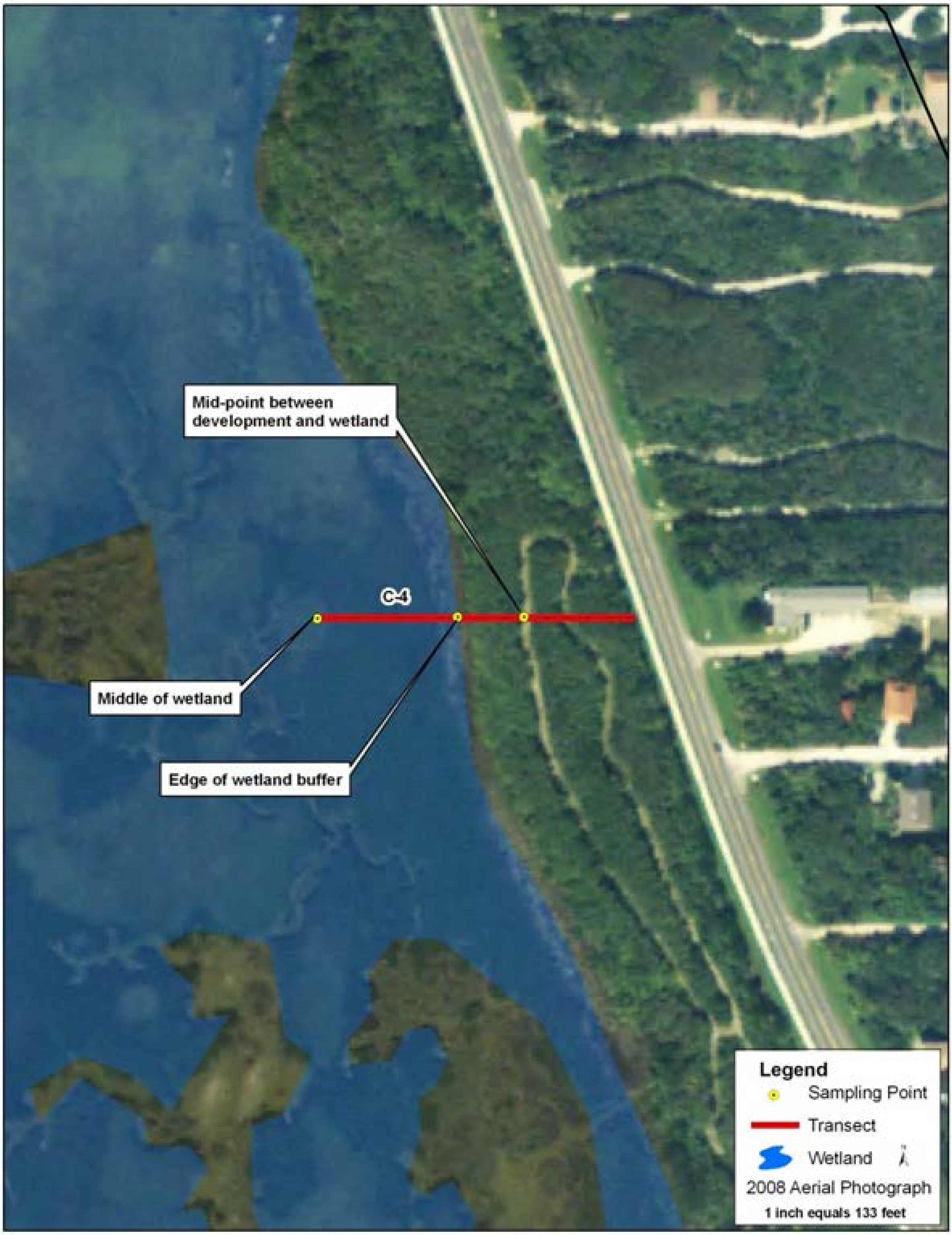


Figure 2.4.2
Wildlife Sampling Points along Transect C-4



2.5. Task 5: Would Future Development Likely Affect Wetland-dependent Wildlife?

This effort was conducted via a GIS-based comparison of present-day, "near future" and predicted land use maps for the year 2035. GIS data were supplied by District staff. The "near future" land use map reflects 2012 conditions, where 2004 GIS maps were first updated using aerial photography from 2008. Additional changes were made based upon active Environmental Resource Permits to reflect development that had been permitted in the study area, but not yet fully constructed. The 2035 predicted development map was created by consulting several sources, including St. Johns and Flagler County Future Land Use Maps (FLUMs), environmental resource permits (ERPs), City of Palm Coast FLUM, and developments of regional impacts (DRIs). Public lands and conservation easements were displayed and avoided when evaluating areas likely to be developed in the 2035 future development scenario. Using the 2035 Future Land Use Map, the amount of wetlands within the footprint of expected development was estimated. The amount and location of buffers of different categories were then derived based on this GIS layer. A more comprehensive discussion is included in section 3.5.

The literature on wildlife utilization of wetlands was then queried to determine what types of guidance had been developed as to various techniques to preserve wildlife with expected development pressure. Results from the summer wet-season sampling effort were then compared to the literature as a whole to determine if the results found in this study were consistent with the larger body of information available on this topic. Analyses of Wetland-dependent Species Observed during Field Investigations

A series of graphical and statistical analytical methods were employed to further evaluate and summarize the results of the observed occurrences of wetland-dependent taxa recorded during the field transect studies conducted during July 2009. Alternative methods of parametric and non-parametric statistical analyses were conducted using SAS ™ (Statistical Analysis System) and Primer ™ software. The following summarizes the statistical methodologies utilized and the resulting determined relationships regarding the number, richness and diversity of observed wetland-dependent taxa.

Of the large number of expected potentially occurring wetland-dependent taxa previously identified for the Matanzas River study area, the 25 taxa listed in Table 2.5.1 were observed during the course of the field transect studies conducted during July 2009.

Table 2.5.1
Wetland-dependent Taxa Observed During Study

Birds	Amphibians
Double-crested Cormorant (*Phalacrocorax auritus*)	Squirrel Treefrog (*Hyla squirella*)
Anhinga (*Anhinga anhinga*)	Pinewoods Treefrog (*Hyla femoralis*)
Clapper Rail (*Rallus longirostris*)	Bronze Frog (*Rana clamitans clamitans*)
Great Blue Heron (*Ardea herodias*)	Pig Frog (*Rana grylio*)
Great Egret (*Ardea alba*)	Cricket Frog (*Acris gryllus*)
Green Heron (*Butorides virescens*)	Southern Toad (*Bufo terrestris*)
Little Blue Heron (*Egretta caerulea*)	
Roseate Spoonbill (*Platalea ajaja*)	**Reptiles**
Snowy Egret (*Egretta thula*)	Florida Green Watersnake (*Nerodia floridana*)
Tricolored Heron (*Egretta tricolor*)	
Willet (*Catoptrophorus semipalmatus*)	**Mammals**
Yellow-crowned Night Heron (*Nyctanassa violacea*)	Marsh Rice Rat (*Oryzomys palustris*)
Barred Owl (*Strix varia*)	Marsh Rabbit (*Sylvilagus palustris*)
Common Yellowthroat (*Geothlypis trichas*)	
Northern Parula (*Parula americana*)	
Red-shouldered Hawk (*Buteo lineatus*)	
Yellow-throated Warbler (*Dendroica dominica*)	

The observed occurrences of taxa at each of the 16 freshwater and eight saltwater selected study transects using the previously described standardized monitoring procedures were used to determine four dependent measures of wetland-dependent taxa.

1. Total abundance of individuals
2. Species richness (numbers of taxa)
3. Bray-Curtis similarity index
4. Shannon-Weaver Diversity Index

The equation for Shannon Diversity Index is:

$$\overset{S}{\underset{i=1}{H}} = - \sum (Pi * LnP_i)$$

Where:

- H= Shannon Weaver Diversity Index Score
- P_i= Proportion of sample for a given taxa
- S = Number of taxa in the sample

Each of these dependent variables was then graphically and statistically analyzed against five measured independent variables to test for the presence of observed patterns within the data.

1. The relative measured widths of the upland buffers associated with each transect.

2. The corresponding measured width of the matching wetland.

3. The calculated ratio of each transect buffer to wetland widths.

4. The combined core wetland habitat score (see previous discussion) based on:

   - Hydrology
   - Vegetation
   - Absence of disturbance
   - Connectivity
   - Refuge

5. A scaled term for the interaction between buffer width and wetland habitat score.

Each of the three dependent variables was graphically contrasted with each of the five independent variables and a series of five statistical procedures were then applied in analyzing differences and testing for patterns.

1. The SAS Univariate Procedures was used to test for the normality of both un-transformed and log transformed dependent and independent variables.

2. The SAS CORR, RSREG and STEPWISE Procedures were then used to survey the data for possible linear and non-linear relationships among each of the dependent variables and independent variables.

3. SAS GLM (General Linear Model) Procedures were then used iteratively to construct best-fit models for each dependent variable using the smallest number of statistically significant independent terms (or interactions).

4. SAS multiple range tests were run to test for differences in abundance, species richness and Shannon Diversity among the four selected buffer width groupings (0-50, 51-100, 101-300 and 301 to 500 feet). Three different methods of range tests were used and contrasted to account for differences in error terms and experimental error.

   - Waller-Duncan K-ratio t Test
   - Ryan-Einot-Gabriel-Welsch Multiple Range Test
   - Bonferroni (Dunn) t Test

Additional analyses were conducted on the raw data using Primer v6.1.6. Datasets utilized were all raw data, amphibians in freshwater wetlands, birds in all wetlands, birds in saltwater wetlands, and all freshwater wetlands. Factors utilized were buffer width, wetland width, fresh vs. saltwater, wetland core score (the sum of the scores of five criteria: wetland hydrology, appropriate and healthy vegetation, absence of disturbance, connectivity to other habitats, and presence of refuge for small animals), and a wetland core score*buffer width cross product. Raw data were not transformed prior to production of the Bray-Curtis similarity matrix. One way ANOSIM analyses were performed using the factors described above.

2.6. Task 6: Determine the Need for Additional Protection of Upland and Wetland Habitat

This task was addressed based on an interpretation of the following findings:

- How much future land use is likely to be developed?
- How much wetland acreage is likely to be within the general footprint of expected development?
- Does the literature on wildlife utilization of wetlands indicate that future development constructed pursuant to existing regulatory criteria is likely to impact wetland-dependent wildlife?
- Do the results from this study's wildlife utilization effort support the need for additional protective efforts?

3.0 Results

The results of efforts addressing tasks in the Project Scope of Work are presented here. Results include lists of the potentially occurring wildlife in the study area, lists of wildlife observed during the summer surveys, and a summary of corresponding habitat requirements as well as a qualitative analysis of the wildlife habitat in the Matanzas River study area.

3.1. Task 1: Identify the Aquatic and Wetland-dependent Wildlife of the Study Area

Aquatic, semi-aquatic, and wetland-dependent vertebrates potentially found in the Matanzas River study area are listed in Tables 3.1.1 through 3.1.4. Literature-based compilations of potentially occurring species are provided in Appendix A. These lists include species that are not wetland-dependent. Appendix B (after Brown et al. 1990) lists wetland-dependent species found in east central Florida. These lists were used as a basis for cataloging wetland-dependent species under Task 2. State-listed protected species in Florida and federally-listed species found in Flagler and St. Johns counties are listed in Appendix C.

Table 3.1.1
Potentially Occurring Wetland-dependent Mammals in the Matanzas River Study Area

Common Name	Scientific Name
Southeastern shrew	*Sorex longirostris*
Eastern pipistrelle	*Pipistrellus subflavus*
Marsh rabbit	*Sylvilagus palustris*
Marsh rice rat	*Oryzomys palustris*
Round-tailed muskrat	*Neofiber alleni*
Black bear	*Ursus americanus*
Raccoon	*Procyon lotor*
River otter	*Lutra canadensis*
Bobcat	*Lynx rufus*

Table 3.1.2
Potentially Occurring Wetland-dependent Birds in the Matanzas River Study Area
(breeding season only, excludes winter residents and migrants)

Common Name	Scientific Name
Pied-billed Grebe	*Podilymbus podiceps*
Double-crested Cormorant	*Phalacrocorax auritus*
Anhinga	*Anhinga anhinga*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
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*
Black-crowned Night Heron	*Nycticorax nycticorax*
Yellow-crowned Night Heron	*Nyctanassa violacea*
White Ibis	*Eudocimus albus*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Wood Stork	*Mycteria americana*
Wood Duck	*Aix sponsa*
Mottled Duck	*Anas fulvigula*
Osprey	*Pandion haliaetus*
Swallow-tailed Kite	*Elanoides forficatus*
Bald Eagle	*Haliaeetus leucocephalus*
Red-shouldered Hawk	*Buteo lineatus*
Clapper Rail	*Rallus longirostris*
King Rail	*Rallus elegans*
Purple Gallinule	*Porphyrio martinica*
Common Moorhen	*Gallinula chloropus*
Limpkin	*Aramus guarauna*
Sandhill Crane	*Grus canadensis*
Wilson's Plover	*Charadrius wilsonia*
American Oystercatcher	*Haematopus palliatus*
Black-necked Stilt	*Himantopus mexicanus*
Willet	*Catoptrophorus semipalmatus*
American Woodcock	*Scolopax minor*
Least Tern	*Sterna antillarum*
Black Skimmer	*Rynchops niger*
Barred Owl	*Strix varia*
Belted Kingfisher	*Ceryle alcyon*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Northern Parula	*Parula americana*
Yellow-throated Warbler	*Dendroica dominica*
Prothonotary Warbler	*Protonotaria citrea*
Common Yellowthroat	*Geothlypis trichas*
Red-winged Blackbird	*Agelaius phoeniceus*
Boat-tailed Grackle	*Quiscalus major*

Table 3.1.3
Potentially Occurring Wetland-dependent Reptiles in the Matanzas River Study Area

Common Name	Scientific Name
Florida cottonmouth	*Agkistrodon piscivorus conanti*
Eastern mud snake	*Farancia abacura abacura*
Rainbow snake	*Farancia erytrogramma erytrogamma*
Eastern hognose snake	*Heterodon platirhinos*
Atlantic saltmarsh snake	*Nerodia clarkii taeniata*
Banded watersnake	*Nerodia fasciata*
Florida green watersnake	*Nerodia floridana*
Brown watersnake	*Nerodia taxispilota*
Striped crayfish snake	*Regina alleni*
Glossy crayfish snake	*Regina rigida*
North Florida swamp snake	*Seminatrix pygaea pygaea*
Dusky pygmy rattlesnake	*Sistrurus miliarius barbouri*
Florida redbelly snake	*Storeria occipitomaculata obscurus*
Peninsula ribbon snake	*Thamnophis sauritus sackenii*
Eastern garter snake	*Thamnophis sirtalis sirtalis*
American alligator	*Alligator mississippiensis*
Common snapping turtle	*Chelydra serpentina*
Stinkpot	*Sternotherus odoratus*
Loggerhead musk turtle	*Sternotherus minor minor*
Striped mud turtle	*Kinosternon bauri*
Mud turtle	*Kinosternon subrubrum*
Spotted turtle	*Clemmys guttata*
Florida box turtle	*Terrapene carolina bauri*
Diamondback terrapin	*Malaclemys terrapin*
Florida cooter	*Pseudemys floridana*
Florida redbelly turtle	*Pseudemys nelsoni*
Chicken turtle	*Deirochelys reticularia*
Florida softshell	*Apalone ferox*

Table 3.1.4
Potentially Occurring Wetland-dependent Amphibians in the Matanzas River Study Area

Common Name	Scientific Name
Two-toed amphiuma	*Amphiuma means*
Greater siren	*Siren lacertina*
Eastern lesser siren	*Siren intermedia intermedia*
Southern dwarf siren	*Pseudobranchus axanthus*
Mole salamander	*Ambystoma talpoideum*
Flatwoods salamander	*Ambystoma cingulatum*
Eastern newt	*Notophthalmus viridescens*
Southern dusky salamander	*Desmognathus auriculatus*
Slimy salamander	*Plethodon grobmani*
Mud salamander	*Pseudotriton montanus*
Dwarf salamander	*Eurycea quadridigitata*
Eastern spadefoot toad	*Scaphiopus holbrooki holbrooki*
Greenhouse frog	*Eleutherodactylus planirostris planirostris*
Southern toad	*Bufo terrestris*
Oak toad	*Bufo quercicus*
Florida cricket frog	*Acris gryllus dorsalis*
Green treefrog	*Hyla cinerea*
Barking treefrog	*Hyla gratiosa*
Pinewoods treefrog	*Hyla femoralis*
Squirrel treefrog	*Hyla squirella*
Southern spring peeper	*Pseudacris crucifer bartramiana*
Southern chorus frog	*Pseudacris nigrita*
Ornate chorus frog	*Pseudacris ornata*
Little grass frog	*Pseudacris ocularis*
Eastern narrowmouth toad	*Gastrophryne carolinensis*
Bullfrog	*Rana catesbeiana*
Pig frog	*Rana grylio*
River frog	*Rana heckscheri*
Bronze frog	*Rana clamitans clamitans*
Southern leopard frog	*Rana sphenocephala*
Florida Gopher frog	*Rana capito aesopus*

3.1.1. Wildlife Field Survey Methods

A total of 26 transects were surveyed over three five-day periods between June 22, 2009 and July 17, 2009. Wildlife utilization at each transect was determined using three techniques: through the use of motion-activated wildlife cameras, with Sherman small mammal traps, and by sight and sound.

Wildlife camera: At each site along the wetland-upland edge or a short way into the wetland viewing area was cleared and then baited with moist canned dog food, and a motion-activated wildlife camera was then attached to an adjacent tree. Animal activity was monitored this way for two nights at each site with two exceptions noted below. Photographs of wildlife captured by the cameras are located in Appendix D and the species encountered are included in Table 3.1.5.

Sherman traps: At each site at the wetland-upland edge or farther upland (to avoid the possibility that the trap could become submerged during high tide or heavy rainfall) two Sherman small mammal traps were baited with peanut butter and bird seed. These traps were attached to nearby vegetation with fishing line to prevent the trap from being taken away by a large animal such as a canine or raccoon. Due to the hot weather, these traps were opened late in the day and checked and closed in the early morning to avoid harming any animals via heat stress. With the exceptions noted below each site was sampled for two evenings. Rodents captured are included in the mammal column in Table 3.1.5.

Sight and sound: Surveys for animals by sight and sound were conducted twice at each site, once in the evening and once in the morning. Each transect was surveyed at three locations: at the point approximately halfway between the developed land use and the wetland edge; at the wetland-upland border; and halfway into the wetland or 100 feet into the wetland, whichever distance was shorter. Each survey lasted for five minutes at each of the three stations along the transect. The evening surveys at the saltwater sites were made without regard to the tide stage, but all of the morning surveys at the saltwater transects were conducted around low tide. In an effort to minimize variability due to factors other than buffer widths, wildlife encountered during the preliminary spring surveys are not included in the following graphs or statistical analyses. The exceptions to the above methods were limited to the two reference sites. Cameras and traps were set for only one night at transect E-Xd due to the difficult condition of the access road and ongoing timber extraction. We were concerned that these conditions, combined with heavy local rainfall, would cause field crews to be cut off from the sampling equipment. Transect FD, located in the Favre-Dykes State Park, was surveyed only by sight and sound for two mornings. At this site, Park personnel did not permit the use of motion cameras or small mammal traps.

Wildlife observed during the summer surveys is listed in Table 3.1.5. This table does not distinguish wetland-dependent species from non-wetland animals, but it serves to provide a baseline list of the animals most likely to be encountered in wetland habitats in the Matanzas River study area during the summer. This table shows the animals found in each transect, the transect name, its buffer-width category, and whether the wetland was freshwater or saltwater.

Table 3.1.5
Vertebrates Observed in the Matanzas River Study Area Transects during the Wet Season Observation Period

Transect	Buffer Width	Fresh/ Saltwater	Amphibians	Reptiles	Birds	Mammals
A2	0-50	Saltwater			Great Blue Heron Clapper Rail Chimney Swift Barn Swallow Northern Cardinal	
A4	0-50	Saltwater			Great Egret Snowy Egret Clapper Rail Willet	Unidentified rat
20	0-50	Saltwater			Great Blue Heron Great Egret Tricolored Heron Yellow-crowned Night Heron Red-shouldered Hawk Chimney Swift Barn Swallow	
B3	51-100	Saltwater			Great Blue Heron Great Egret	Marsh Rice Rat Raccoon
C1	101-300	Saltwater		Brown Anole	Great Blue Heron Great Egret Green Heron Yellow-crowned Night Heron Roseate Spoonbill Red-shouldered hawk Clapper Rail Laughing Gull Red-bellied Woodpecker Downy Woodpecker Blue Jay Tufted Titmouse Carolina Wren Yellow-throated Warbler Northern Cardinal	Eastern Gray Squirrel Raccoon
C4	101-300	Saltwater		Six-lined Racerunner	Great Egret Snowy Egret Clapper Rail Willet White-eyed Vireo Carolina Wren Red-winged Blackbird	
19	101-300	Saltwater		Green Anole	Great Blue Heron Great Egret Snowy Egret Little Blue Heron Tricolored Heron Clapper Rail Purple Martin Carolina Wren Northern Cardinal Red-winged Blackbird	

Transect	Buffer Width	Fresh/ Saltwater	Amphibians	Reptiles	Birds	Mammals
D4	301-500	Saltwater	Squirrel Treefrog	*Five-lined Skink Six-lined Racerunner	Great Blue Heron Great Egret Little Blue Heron Tricolored Heron Red-shouldered Hawk Clapper Rail Barred Owl Red-bellied Woodpecker Pileated Woodpecker Red-eyed Vireo Tufted Titmouse Carolina Wren Blue-gray Gnatcatcher Northern Parula Yellow-throated Warbler Northern Cardinal Boat-tailed Grackle	
B2	0-50	Freshwater	Squirrel Treefrog		Northern Cardinal	
I1	0-50	Freshwater	Southern Toad Pinewoods Treefrog Squirrel Treefrog	Brown Anole	Carolina Wren Northern Cardinal	
I2	0-50	Freshwater	Southern Toad	Brown Anole	Pine Warbler Carolina Wren Northern Cardinal	Marsh Rice Rat
8	0-50	Freshwater	Southern Toad Squirrel Treefrog Bronze Frog	Green Anole Ground Skink Garter Snake	Yellow-billed Cuckoo Red-bellied Woodpecker Downy Woodpecker Red-eyed Vireo Tufted Titmouse Northern Mockingbird	Raccoon
B4	51-100	Freshwater	Southern Toad Squirrel Treefrog Pig Frog		Downy Woodpecker Great Crested Flycatcher Red-eyed Vireo Carolina Wren Pine Warbler Common Yellowthroat Northern Cardinal	Virginia Opossum Marsh Rabbit Raccoon
C	51-100	Freshwater	Southern Toad Squirrel Treefrog		Great Crested Flycatcher Carolina Wren Northern Cardinal	Eastern Gray Squirrel Raccoon
21	51-100	Freshwater	Southern Toad Squirrel Treefrog		Carolina Wren Blue-gray Gnatcatcher Blue Jay Northern Cardinal	White-tailed Deer
22	51-100	Freshwater	Squirrel Treefrog		Downy Woodpecker Tufted Titmouse Carolina Wren Blue-gray Gnatcatcher Summer Tanager Northern Cardinal	Virginia Opossum Cotton Mouse Bobcat scat
C2	101-300	Freshwater	Southern Toad Squirrel Treefrog Bronze Frog		Red-eyed Vireo Tufted Titmouse Carolina Wren Northern Cardinal	Eastern Gray Squirrel Raccoon Feral Pig

Transect	Buffer Width	Fresh/ Saltwater	Amphibians	Reptiles	Birds	Mammals
D1	101-300	Freshwater	Southern Toad Squirrel Treefrog Bronze Frog		Barred Owl Downy Woodpecker Pileated Woodpecker Tufted Titmouse Carolina Wren Blue-gray Gnatcatcher Yellow-throated Warbler Northern Cardinal	
D2	101-300	Freshwater	Southern Toad Squirrel Treefrog Bronze Frog	Green Anole	Carolina Wren	Cotton Mouse
2	101-300	Freshwater	Southern Toad Squirrel Treefrog Bronze Frog	Green Anole	Red-shouldered Hawk Red-bellied Woodpecker Downy Woodpecker Tufted Titmouse Carolina Wren Northern Cardinal	Virginia Opossum Eastern Gray Squirrel
13	301-500	Freshwater	Southern Toad Florida Cricket Frog Squirrel Treefrog Bronze Frog		Red-bellied Woodpecker Downy Woodpecker Carolina Wren Common Yellowthroat Northern Cardinal	Southern Flying Squirrel Raccoon White-tailed Deer
18	301-500	Freshwater	Southern Toad Squirrel Treefrog Bronze Frog	Green Anole Florida Green Watersnake Eastern Garter Snake	Red-shouldered Hawk Red-bellied Woodpecker Downy Woodpecker Blue-gray Gnatcatcher Carolina Wren Northern Parula Yellow-throated Warbler Northern Cardinal	Eastern Gray Squirrel Cotton Mouse
30	301-500	Freshwater	Southern Toad Cricket Frog Pinewoods Treefrog Squirrel Treefrog		Downy Woodpecker Pileated Woodpecker Carolina Wren Pine Warbler Northern Cardinal	
32	301-500	Freshwater	Southern Toad Cricket Frog Squirrel Treefrog		Red-shouldered Hawk Red-bellied Woodpecker Downy Woodpecker Carolina Wren Blue Jay Northern Cardinal	
E-Xd		Freshwater	Cricket Frog	Green Anole	Broad-winged Hawk Downy Woodpecker Carolina Wren	

Transect	Buffer Width	Fresh/ Saltwater	Amphibians	Reptiles	Birds	Mammals
FD		Freshwater	Cricket Frog Squirrel Treefrog Pig Frog Bronze Frog	Florida Green Watersnake	Anhinga Great Egret Green Heron Tufted Titmouse Carolina Wren Blue-gray Gnatcatcher White-eyed Vireo Red-eyed Vireo Yellow-throated Warbler Pine Warbler Common Yellowthroat Eastern Towhee Northern Cardinal	
* Five-lined Skink or Southeastern Five-lined Skink						

3.1.2. Summary of Amphibians Observed

Because amphibian species encountered are by definition wetland-dependent, they are detailed in this section. The total number of observations of frogs and toads made during the sight and sound surveys at the freshwater wetlands are listed in Table 3.1.6 and graphed in Figure 3.1.1. A more thorough statistical analysis of these results is included in Section 3.5.4. These are the total number of observations and do not necessarily represent the total number of individual frogs. It is possible that some frogs were counted twice, once in the evening survey and again in the morning survey.

Table 3.1.6
Total Frog and Toad Observations by Species in each Buffer Width Category

Species	Buffer Width Category			
	0 - 50	51 – 100	101 – 300	301 - 500
Bronze Frog	2	0	6	3
Cricket Frog	0	0	0	13
Pig Frog	0	2	0	0
Pinewoods Treefrog	4	0	0	4
Southern Toad	4	5	11	11
Squirrel Treefrog	10	7	16	36
Sum	**20**	**14**	**33**	**67**

3.1.3. Amphibians and Buffer Widths in Freshwater Wetlands

Figure 3.1.1
Number and Species of Frogs with Different Buffer Width Categories

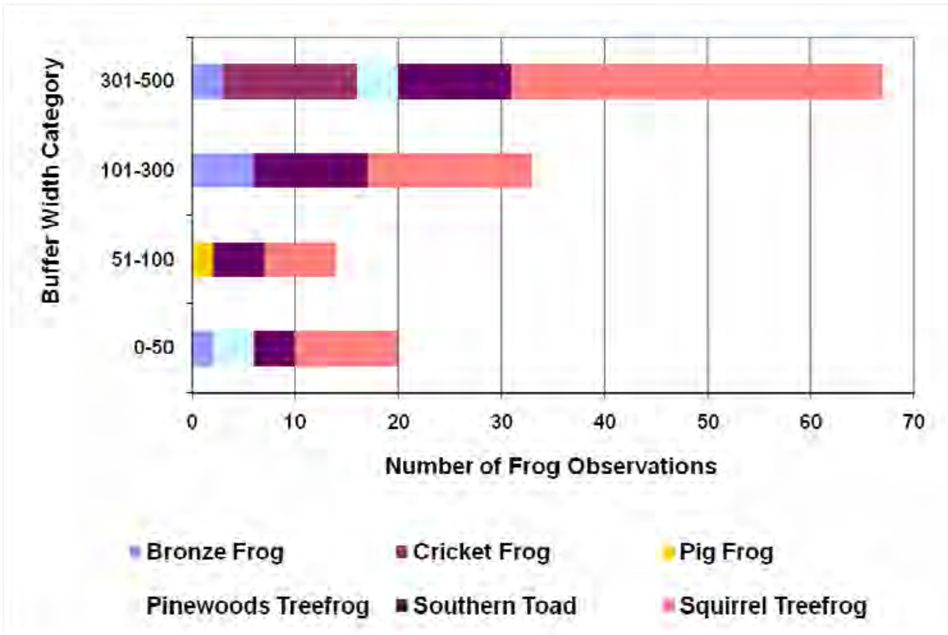


Figure 3.1.1 shows both the number and species richness of amphibian taxa observed after combining the freshwater transects within each of the four transect buffer width classifications (0-50, 51-100, 101-300 and 301 to 500 feet). These results show that while the number of taxa (species richness) observed varied without a defined pattern, the number of individuals observed using a standardized level of effort increased as the buffer width increased.

3.1.4. Birds and Buffer Widths in Freshwater Wetlands

Figure 3.1.2
Number of Bird Observations and Species with Different Buffer Width Categories for Freshwater Wetlands

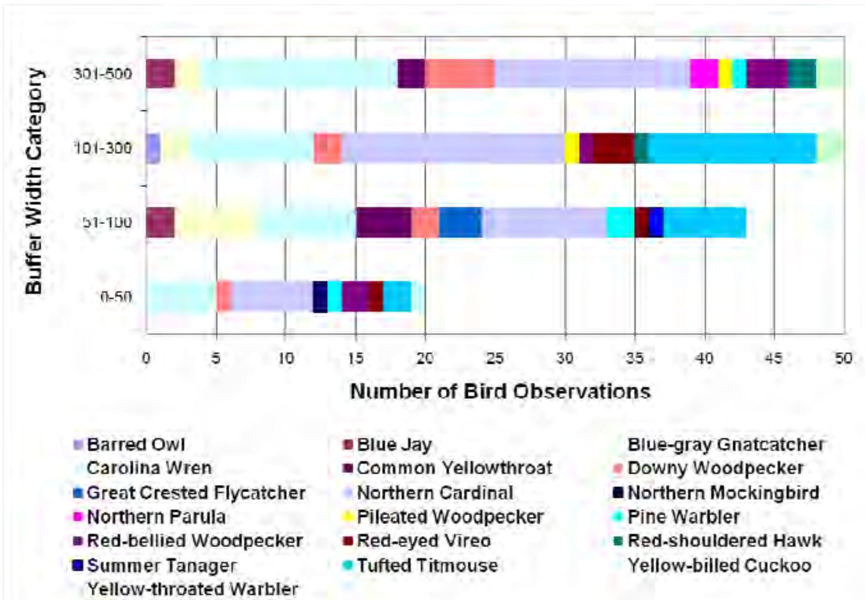


Figure 3.1.2 depicts both the number and species richness of the total birds observed in the buffers and adjoining freshwater wetlands within each of the four selected buffer categories. The data indicate that both the numbers and species of birds increased with buffer width. However, while the Barred Owl, Northern Parula, Yellow-throated Warbler, Common Yellowthroat and Red-shouldered Hawk are considered wetland-dependent taxa, the remainder are all typically associated with upland habitats. Thus, when all observed avian species are included, the data seem to indicate that wider buffers are associated with wildlife utilization of both the wetland itself, and also the upland buffer. The benefit to the wetland-dependent avian fauna is not clearly differentiated with this display of the observed information.

3.1.5. Birds and Buffer Widths in Saltwater Wetlands

Figure 3.1.3
Number Bird Observations with Different buffer Width Categories for Saltwater Wetlands

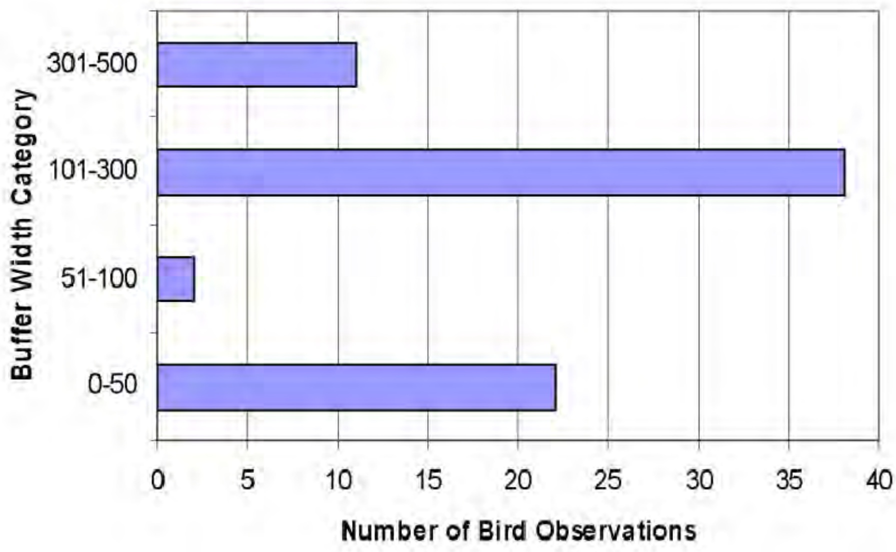
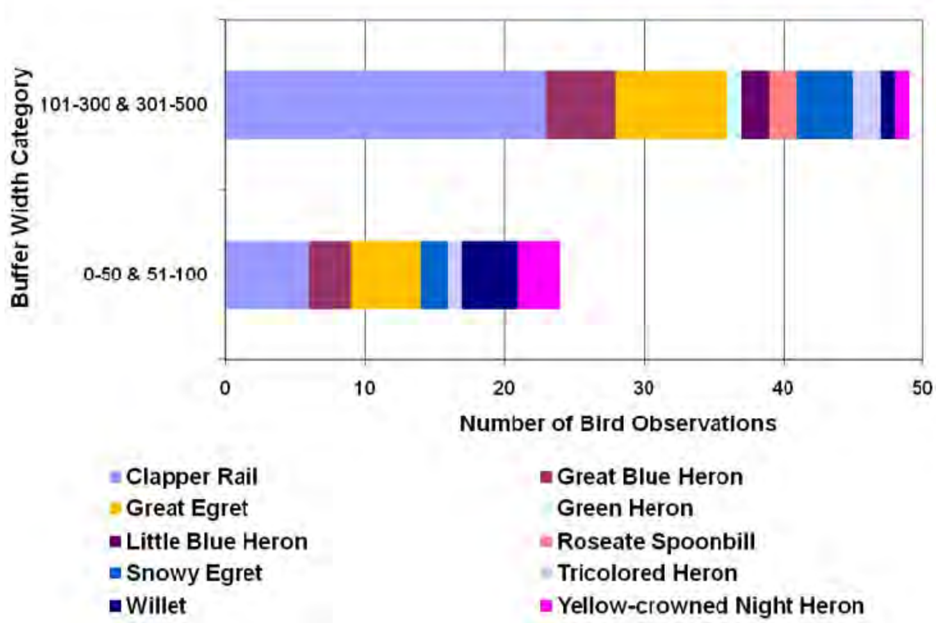


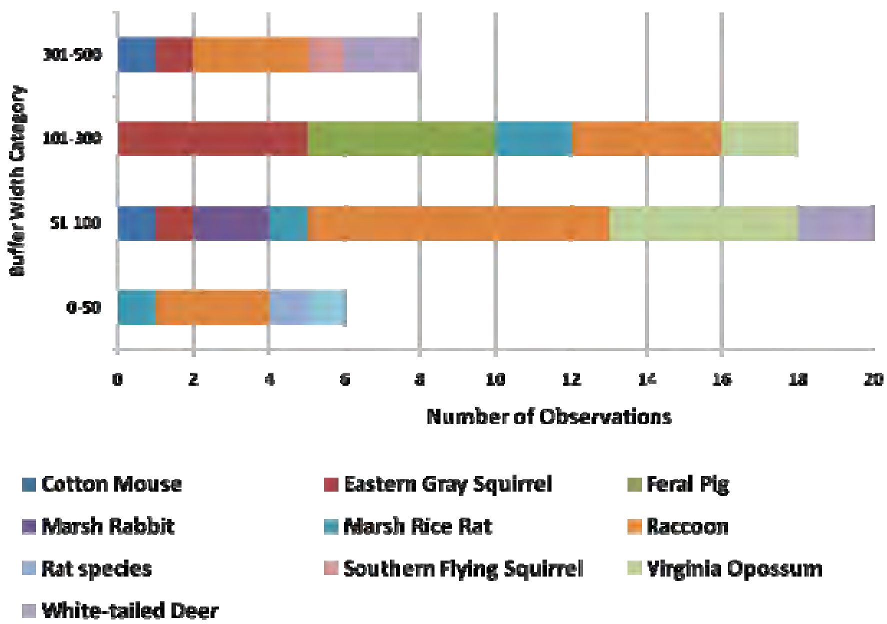
Figure 3.1.4
Number of Bird Observations and Species in Different Buffer Width Categories for Saltwater Wetlands



Combined, Figures 3.1.3 and 3.1.4 show a lack of any clear indications of differences in these observed wetland-dependent species associated with the limited number of saltwater transects. As indicated in the statistical analyses of these data, the number of taxa seemed to have been influenced by the widths of the wetlands suggesting that greater numbers and frequencies of taxa were observed in wider wetlands independent of the width of the buffer itself.

3.1.6. Mammals and Buffer Widths

Figure 3.1.5
Number of Mammal Observations and Species with Different Buffer Width Categories



Among the observed mammal species, only the Marsh Rice Rat and Marsh Rabbit are considered wetland-dependent. These results (Figure 3.1.5) show no distinct patterns relative to upland buffer widths in either the numbers of individual mammals or the number of taxa observed utilizing standardized sampling efforts along the wildlife monitoring transects.

3.2. Task 2: Catalog the Aquatic and Wetland-dependent Wildlife in the Study Area

This section contains several matrices detailing many aspects of the natural history of the wetland-dependent vertebrates potentially found in the Matanzas River study area. The references that are cited in these matrices and in the additional information that follow these matrices can be found in Appendix H.

Table 3.2.1 Summary of Selected Characteristics of the Amphibians of the Matanzas Basin Study Area

Species	Common Name	Resident/Migrant/Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning	Wetland Dependent?
Acris gryllus	Southern Cricket Frog	Resident (University of Florida 2002.)	Shallow marsh (641), permanent and temporary wetlands (653) (University of Florida 2002, Knapp 2002).	Adult life, rangeland (300), upland forests (400), large variety of upland habitats (University of Florida, 2002).	Egg deposits on submerged aquatic plants (645) (University of Florida, 2002).			Larval aquatic algae/bacteria, adult insectivore (University of Florida 2002).
Ambystoma cingulatum	Flatwoods Salamander	Resident (AmphibiaWeb 2009)..	Pond cypress (621), blackgum (613) (Anderson and Williamson 1976, Palis 1995b, 1997b), ponds that lack predatory fish (FNAI 2001.)	Longleaf pine flatwoods (411) with wire grass and savannas (Palis 1996a and Means *et al.* 1996).	Breeds in ponds that lack predatory fish (FNAI 2001), aquatic include isolated swamps where pond cypress (621) or blackgum (613) predominant, marshy pasture ponds, roadside ditches (510), or small, shallow borrow pits (742) (Anderson and Williamson 1976, Palis 1995b, 1997b.)			Adults mostly terrestrial earthworms, larvae prey on a variety of aquatic invertebrates and perhaps small vertebrates (e.g., other amphibian larvae, smaller conspecifics) (AmphibiaWeb 2009)...
Ambystoma talpoideum	Mole Salamander	Resident (NatureServe 2009).	Scrub-shrub wetlands (630, 631), temporary pools (653) (NatureServe 2009).	Upland coniferous forests (410) and upland hardwood forests (420) (NatureServe 2009).	Aquatic (AmphibiaWeb 2009)., breed in forested, fishless wetlands (Semlitsch 1988).		During daylight hours, larvae remain hidden in leaf litter, vegetation, and debris on the bottom of ponds (Anderson and Williamson 1974), terrestrial adults live in underground burrows, sometimes found under logs or other objects in damp places (NatureServe 2009.)	Larvae zooplankton (Taylor *et al.* 1988), adults variety of invertebrates (Petranka 1998) including zooplankton, aquatic insects, and tadpoles (Gibbons and Semlitsch 1991).
Amphiuma means	Two-toed Amphiuma	Resident (NatureServe 2009.)	Swamps (610), margins of muddy sloughs (616), cypress heads (621), drainage ditches, sluggish streams (510), wet meadows (643), muddy lakes (500) (NatureServe 2009).	Moist terrestrial sites (Gunzburger 2003).	Females may leave the water for moist terrestrial sites to deposit their eggs, eggs appaear to be specialized for development in terrestrial nest chambers (Gunzburger 2003).	Emerge at night to actively forage in shallow water (Funderburg 1955, Dundee and Rossman 1989).	Often found inhabiting crayfish burrows (Carr 1940a, Bishop 1943, Dundee and Rossman 1989), soft substrate for burrowing or thick aquatic vegetation important for shelter (NatureServe 2009).	Eats insects, crayfish, mollusks, worms, fishes, and small amphibians and reptiles (NatureServe 2009).
Bufo quercicus	Oak Toad	Resident (NatureServe 2009).	Shallow pools, cypress (621) and flatwoods (411) ponds, and ditches (AmphibiaWeb 2009).	Open canopied oak (427)and pine (415) forests containing shallow temporary ponds (653) and ditches (Duellman and Schwartz 1958, Dodd 1994) and wet prairies (643) characterized by short hydroperiods (Hamilton 1955, Pechmann *et al.* 1989).	Aquatic prefer shallow pools, cypress (621) and flatwood (411) ponds, and ditches (510) (AmphibiaWeb 2009).		Commonly seek refuge under boards and logs or in shallow depressions or burrows surrounded by vegetation, including cabbage palms and saw palmettos (Hamilton 1955, Duellman and Schwartz 1958).	Larval (tadpole) aquatic feeders (Dalrymple 1990), adults are insectivorous with a strong preference for ants (Punzo, 1995).
Bufo terrestris	Southern Toad	Resident (NatureServe 2009).	Shallow waters, from lake (520) margins to seasonal pools (653), including cypress ponds (621), wooded bays (611) (Wright and Wright 1949), ditches and canals (Dundee and Rossman 1989, Bartlett and Bartlett 1999a).	Agricultural fields (200), pine woodlands (410), hammocks, and maritime forests (Wright and Wright 1949, Kraukauer 1968, Wilson 1995), sandy soils are preferred (Blem 1979, Martof *et al.* 1980.)	Both temporary and permanent aquatic habitats (Gibbons and Semlitsch 1991), shallow waters from the littoral regions of lakes to seasonal wetlands, usually amongst aquatic vegetation (AmphibiaWeb 2009).	Larval (tadpole) algae scraped from aquatic vegetation (Ashton and Ashton 1988).	Adults may also take refuge under logs or other debris during the day (Amphbiaweb 2009).	Larval (tadpole) aquatic algae (Ashton and Ashton 1988), adult nonspecific, typically eats small invertebrates including beetles, earwigs, ants, cockroaches, mole crickets, and snails (Duellman and Schwartz 1958).

Species	Common Name	Resident/Migrant/Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning	Wetland Dependent?
Desmognathus auriculatus	Southern Dusky Salamander	Resident (NatureServe 2009).	Mucky areas near springs (550), swamps, cypress heads (621), mud-bottomed streams (510), floodplain pools, and ravine streams (510) where pockets of organic debris collect, usually in or near moving water (NatureServe 2009).	Uplands surrounding wetland habitat (AmphibiaWeb 2009).	Semi-aquatic, eggs are laid and incubated on land, hatchlings move into water and larvae are aquatic (AmphibiaWeb 2009).		Hides under leaves, logs, or debris or in burrows during day (NatureServe 2009).	Aquatic beetle larvae, lumbricid worms, beetles, tabanid larvae, lycosid spiders, and tipulid larvae (Carr 1940a), larval and adult insects, arachnids, and annelids (Folkerts 1968).
Eurycea quadridigitata	Dwarf Salamander	Resident (NatureServe 2009).	Low swampy areas, margins of pine savanna ponds, bottomland forests (615) (NatureServe 2009), have been found beneath cover objects at the edges of ponds (500) and swamps (610) as well as in seeps and amongst leaf litter in springs (550) (Mount 1975, Petranka 1998).	Little is known, however Carr (1940a) notes that dwarf salamanders from Florida can be found at considerable distances from aquatic habitats outside of the breeding season (NatureServe 2009).	Aquatic in Florida, breeding dwarf salamanders were found only to be associated with ponds (500) (Goin 1951).			Larvae aquatic, primarily zooplankton, ostracods, and insect larvae (Taylor *et al.* 1988), adults in Florida coleopterans (larval and adult), annelids, and amphipods (Carr 1940a).
Gastrophryne carolinensis	Eastern Narrowmouth Toad	Resident (Carr 1940a).	Cypress-gum swamps (613), bottomland hardwoods (615), riparian floodplains, brackish marshes, coastal secondary dune scrub forest (322), and maritime forests (Blanchard 1922, Wright 1932, Brandt 1936a, Wood 1948, Blair 1950, Werler and McCallion 1951, Anderson 1954, Tinkle 1959, Dodd 1992, Buhlmann *et al.* 1994, Learm *et al.* 1999), adults are tolerant of brackish water (Noble and Hassler 1936, Hardy 1953, Conant 1958b, Neill 1958a).	Upland habitats include live-oak ridges (427), pine-oak uplands (412), sandy woodlands and hillsides, open woods, prairies (310), mixed hardwoods (438), pine forests (411), longleaf pine sandhills (412) (Blanchard 1922, Wright 1932, Brandt 1936a, Wood 1948, Blair 1950, Werler and McCallion 1951, Anderson 1954, Tinkle, 1959, Dodd 1992, Buhlmann *et al.* 1994, Learm *et al.* 1999.	Aquatic flooded pastures (300), shallow depressions in open fields, rain-filled ditches, edges of permanent ponds (500), and open grassy habitats (Allen 1932, Brandt 1936a, Gosner and Black 1956, Gibbons and Semlitsch, 1991).		Cover objects such as rocks, decaying logs, mats of vegetation, bark of logs and stumps, and boards along the edges of ponds and streams are often used for shelter (Holbrook 1842, Wright 1932, J.C.M. personal observations), may also use crayfish burrows, loose leaf mold, and other vegetation for shelter (Carr 1940a).	Adults mostly terrestrial (Wood 1948, Anderson 1954, Martof 1955, Duellman and Schwartz 1958), larvae aquatic planktonic feeders (Amphbiaweb 2009).
Hyla cinerea	Green Treefrog	Resident (Conant and Collins 1991).	Marsh (641) with emergent vegetation (Garton and Brandon 1975, Redmer *et al.* 1999), wet prairie (643), cypress (621), and hydric hammocks (University of Florida 2002), barrier islands, coastal areas (Allen 1932, Dunn 1937, Oliver 1955a, Neill 1958a, Martof 1963, Diener 1965, Moore 1976, Mueller 1985, Smith *et al.* 1993, Mitchell and Anderson 1994).	Upland areas surrounding wetlands (AmphibiaWeb 2009).	Oviposition takes place in association with floating mats of vegetation, such as duckweed (Garton and Brandon 1975, Mount 1975, Turnipseed and Altig 1975).		Refugia or hibernacula bird houses, human litter such as tin cans, human dwellings (Goin 1958, Tinkle 1959, Grzimek 1974, Garton and Brandon 1975, Delnicki and Bolen 1977, McComb and Noble 1981).	Larvae (tadpole) aquatic algae/bacteria (AmphibiaWeb 2009), adult variety of arthropods and other small invertebrates (Haber 1926, Kilby 1945, Oliver 1955a, Brown 1974, Freed 1982a, Ritchie 1982).
Hyla femoralis	Pinewoods Treefrog	Resident (Conant and Collins 1991).	Wetland depressionals in flatwoods (411) and additional shallow ponds, swamps, and ditches (Wright and Wright 1949.)	Strongly associated with pine flatwoods (411) and a variety of hammocks, swamps (610), cypress (621), vernal pools (Harper 1932, Duellman and Schwartz 1958).	Aquatic eggs attached to vegetation or debris no more than 2–3 cm below shallow water (Wright 1932, Livezey and Wright 1947, Mount 1975).			Larval (tadpole) aquatic lgae/bacteria, adults nonspecific prey on grasshoppers, crickets, beetles, caddisflies, ants, wasps, craneflies, moths, and jumping spiders (Carr 1940a, Duellman and Schwartz 1958).

Species	Common Name	Resident/Migrant/Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning	Wetland Dependent?
Hyla gratiosa	Barking Treefrog	Resident (AmphibiaWeb 2009).	Shallow wetlands, including ephemeral pools (653), semi-permanent ponds, and permanent ponds (500) (Wright and Wright 1949, Mount 1975, VanNorman and Scott 1987).	Variety of uplands where they remain in trees and shrubs or burrow into damp sand under logs or grass tussocks around the pond border (Neill 1952, 1958b).	Aquatic breed in a wide variety of shallow wetlands, including ephemeral pools (653), semi-permanent ponds, and permanent ponds (500) (Wright and Wright 1949, Mount 1975, VanNorman and Scott 1987).	Larval aquatic herbivore, adult insectivore (NatureServe2009).	Barking treefrogs burrow into sandy substrates in Georgia and Florida and use gopher tortoise burrows and other burrows for overwintering (Mitchell author In Lannoo editor 2005), Florida gopher mouse burrows (Lee 1968b).	Larval (tadpole) aquatic herbivore (NatureServe 2009), adults opportunistic foragers consuming arboreal and terrestrial prey (insects) (AmphibiaWeb 2009).
Hyla squirella	Squirrel Treefrog	Resident (NatureServe 2009).	Hydric (wet) hammocks, marsh (641), wetland hardwood forests (610), and cypress swamps (621) (University of Florida 2002).	Open woodlands, such as mature pine (415) and mixed hammock forests and open woody areas (Wright 1932, Carr 1940a, Wright and Wright 1949, Delzell 1979).	Aquatic eggs are laid in shallow pools (Wright 1932.)	Tadpoles are suspension feeders that eat organic and inorganic food particles they scrape from rock, plant, and log substrates (aquatic) (AmphibiaWeb 2009).	Juveniles use palmettos for cover to more permanent shelters including oaks, holly trees, and magnolias (Goin and Goin 1957).	Tadpoles organic and inorganic aquatic material (AmphibiaWeb 2009), adults aggressive predators that feed on insects and other invertebrates (Wright 1932, Garrett and Barker 1987).
Notophthalmus perstriatus	Striped Newt	Resident (Christman and Means 1978).	Flatwoods ponds (625), sinkhole ponds, ponds in scrub or sandhill (412) (Christman and Means 1978).	Pine flatwoods (411), scrub, sandhill (412) (Christman and Means 1978)	Aquatic (AmphibiaWeb 2009), flatwoods ponds (625), sinkhole ponds, ponds in scrub or sandhill (412) (Christman and Means 1978)			Adults feed heavily on aquatic dipteran larvae and frog eggs (AmphibiaWeb 2009), adults may remain neotenic, increasing reliance on aquatic food sources (Christman and Means 1978).
Notophthalmus viridescens	Eastern Newt	Resident (NatureServe 2009).	Aquatic adults inhabit pools, ponds (500), wetlands (600), sloughs (616), canals, and quiet areas of streams (510) (Bishop 1943, Schwartz and Duellman 1952, Bellis 1968, Gates and Thompson 1982, Petranka 1998).	Terrestrial efts are usually found in wooded areas (Bishop 1941b, Evans 1947, Williams 1947), upland coniferous forests (410), upland hardwood forests (420), mixed hardwoods (438), unimproved pastures (212), and woodland pastures (213) (AmphibiaWeb 2009).	Aquatic, eggs are attached to submerged vegetation; metamorphose to aquatic subadult or terrestrial eft (AmphibiaWeb 2009).	Efts forage in the forest floor leaf litter, especially during rains (AmphibiaWeb 2009).	Adults and larvae inhabit ponds, swamps, and quiet stream pools, especially those lacking predaceous fishes, may burrow into mud if pond dries (AmphibiaWeb 2009).	Adults are primarily aquatic, nonspecific carnivores (AmphibiaWeb 2009).
Plethodon grobmani	Southeastern Slimy Salamander	Resident (Allen and Neill 1949).	Steephead ravines (615), maritime forests, and river bottom hardwood forests (615) (Lazell 1994, Enge 1998).	Terrestrial- specific habitat unknown (AmphibiaWeb 2009).	Terrestrial- specific habitat unknown (AmphibiaWeb 2009).		Under rotting logs (Highton 1956)	Non-selective, snails, millipedes, spiders, phalangids, beetles, Hymenoptera (mainly ants), and miscellaneous insect larvae (Brandon 1965b).
Pseudacris crucifer bartramiana	Southern Spring Peeper	Resident (AmphibiaWeb 2009).	Eastern deciduous and mixed forests (630) (Conant and Collins 1991), bog forests (615) (Blanchard 1928b), lowland marshes (641), sphagnum bogs, cattail wetlands (6412), ponds, pools, and ditches (500) in and near woods (Wright and Wright 1949), mesophytic and low hammock, swamp borders, the more open bay-heads (611) (AmphibiaWeb 2009).	Uplands surrounding wetland habitat (AmphibiaWeb 2009).	Aquatic eggs attached to submerged vegetation in seasonal and semipermanent wetlands (Olson 1956, Minton 2001) breed within the vicinity of forested wetlands (630) (AmphibiaWeb 2009).		Retreat under logs and bark and perhaps in knot-holes (Wright and Wright 1949), overwinter within the vicinity of forested wetlands (AmphibiaWeb 2009).	Larvae aquatic, suspension feeders, graze on organic and inorganic material typically associated with submerged surfaces (AmphibiaWeb 2009), adults nonspecific, small arthropods, spiders, phalangids, and mites (McAlister 1963), primarily non-aquatic prey (Oplinger, 1967) .
Pseudacris nigrita	Southern Chorus Frog	Resident (AmphibiaWeb 2009).	Drier hammocks (Wright and Wright 1949), wet prairie edges only (Duellman and Schwartz 1958).	Pine savanna (626) (Martof *et al.* 1980) or pine flatwoods (411) (Carr and Goin 1959.)	Aquatic, temporary pools (653), roadside ditches (510), flatwood/woodland ponds (411/500) (Caldwell, 1987), flooded fields (626) (Mount 1975).			Larvae aquatic (Amphibia 2009), adults nonspecific, insects, ants, beetles (Duellman and Schwartz 1958).

Species	Common Name	Resident/Migrant/Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning	Wetland Dependent?
Pseudacris ocularis	Little Grass Frog	Resident (AmphibiaWeb 2009).	Grass, sedge, and/or sphagnum habitats in or near cypress ponds (621), bogs, pine flatwoods (411) and savannas (646), river swamps (615), and ditches (Harper 1939, Wright and Wright 1949, Mount 1975, Gibbons and Semlitsch 1991).		Aquatic shallow, grassy, rain-filled depressional wetlands (640), including roadside ditches (510) and semi-permanent ponds (Harper 1939, Mount 1975, Gibbons and Semlitsch 1991).			Larvae aquatic dependant i.e. algae (Jensen author in Lannoo editor 2009), adults indiscriminate, arthropods, mostly insects assocciated with leaf litter and/or soil, suggesting that little grass frogs frequently forage on the ground (Marshall and Camp 1995).
Pseudacris ornata	Ornate Chorus Frog	Resident (Brown and Means 1984).	Non-specific, rely on wetlands for breeding purposes only (Wright and Wright 1949, Neill 1957c).	Pine woodlands (411) (Harper 1937, Gerhardt 1973, Martof *et al.* 1980), pine-oak forest (412) (Dundee and Rossman 1989), fallow fields (261) (Harper 1937, Brown and Means 1984, Caldwell 1987), habitats with sandy substrates are needed to accommodate their burrowing needs (Brown and Means 1984).	Aquatic temporary wetland pools and ponds (653), including cypress ponds (621) and rain-filled meadows (Harper 1937), flooded fields and ditches (510) (Martof *et al.* 1980, Caldwell 1987), sinkhole ponds, and borrow pits (Jensen)	Earthworms, nematodes, and certain insect larvae may be attracted to the root masses in which ornate chorus frogs often burrow, providing a potential food source (Brown and Means 1984.)		Larvae unknown, but tadpoles likely graze on algae (AmphibiaWeb 2009), newly transformed ornate chorus frogs feed on nymphal orthopterans around the breeding ponds (Carr 1940b), adults nonspecific small insects (Wilson 1995).
Pseudobranchus axanthus	Southern Dwarf Siren	Resident (AmphibiaWeb 2009).	Heavily vegetated marshes (640) and shallow lakes (500) (Carr 1940a)		Aquatic heavily vegetated marshes (641) and shallow lakes (500)(AmphibiaWeb 2009).		Have been found hibernating in deep mud (Carr 1940a).	Aquatic amphipods, chironomid larvae, aquatic oligochaetes, and ostracods (Harper 1935, Carr 1940a, Duellman and Schwartz 1958, Freeman 1967).
Pseudotriton montanus	Mud Salamander	Resident (AmphibiaWeb 2009).	Lowland seeps, palustrine wetlands (600), muddy springs and streams, and swampy pools and ponds (500) (AmphibiaWeb 2009).		Aquatic breeding in springs (550), seeps, and bogs (Brimley 1939, Fowler 1946, Goin 1947c).		Fossorial, burrow into substrate (Bruce 1975.)	Larvae feed on a variety of aquatic invertebrates (AmphibiaWeb 2009), adults feeding unknown, may prey on smaller salamanders (Dunn 1926).
Rana capito aesopus	Florida Gopher Frog	Resident (AmphibiaWeb 2009).		Preferred xeric, fire enhanced habitats, especially longleaf pine–turkey oak sandhill (412) (Palis 1995a), pine flatwoods (411), sand pine scrub (436), and xeric hammocks (421) (Godley 1992).	Aquatic in temporary or semi-permanent ponds that are shallow, have an open canopy and emergent herbaceous vegetation, and lack large, predatory fish (Moler and Franz 1987, Bailey 1991), cypress (621) ponds are often utilized in Florida (Godley 1992, Stevenson and Davis 1995), ditches (510) and borrow pits (500) are occasionally used (Means 1986b, Jensen and LaClaire 1995).		Adults seek refuge in the burrows of gopher tortoises (Franz 1986, Jackson and Milstrey 1989), oldfield mice (Gentry and Smith 1968, Lee 1968b), and crayfish (Godley 1992, Phillips 1995), as well as within stump holes (Wright and Wright 1949).	Larvae aquatic grazing herbivores (AmphibiaWeb 2009), adults nonspecific, invertebrates, including beetles, hemipterans, orthopterans, arachnids, and annelids (Deckert 1920, Carr 1940a, Wright and Wright 1949), as well as on other anurans (Godley 1992), especially toads (Dickerson 1906.)
Rana catesbeiana	Bullfrog	Resident (AmphibiaWeb2009).	Vegetated shoals, sluggish backwaters and oxbows, farm ponds, reservoirs, marshes (641), still waters with dead woody debris (Holbrook 1842, Storer 1922), dense and often emergent vegetation (Bury and Whelan 1984), shorelines of lakes (500) and streams (510) (AmphibiaWeb 2009).		Aquatic in vegetation-choked shallows of permanent bodies of water (Pope, 1964a).			Adults nonspecific but much of diet is aquatic due to lifestyle, tadpoles algae, aquatic plant material, and some invertebrates (Treanor and Nichola 1972, Bury and Whelan 1984).

Species	Common Name	Resident/Migrant/Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning	Wetland Dependent?
Rana clamitans clamitans	Bronze Frog	Resident (AmphibiaWeb 2009).	Shorelines of lakes (500) and permanent wetlands (Whitaker 1961, Collins 1993), ponds, bogs, marshes (641), swamps, and streams (510) (AmphibiaWeb 2009).		Aquatic lakes (500) and permanent wetlands such as ponds, bogs, fens, marshes (641), swamps (610), and streams (510) (AmphibiaWeb 2009).		Adults typically overwinter in water (Dickerson 1906, Walker 194, Pope 1947, Wright and Wright 1949, Harding and Holman 1992) but will occasionally overwinter on land (Bohnsack 1951.)	Adults nonspecific but much of diet is aquatic due to lifestyle (AmphibiaWeb 2009), invertebrates such as annelids, mollusks, millipedes, centipedes, crustaceans, arachnids, insects, fishes and other frogs, vegetable matter, and shed skins (Hamilton 1948, Whitaker 1961, Stewart and Sandison 1972, and Forstner *et al.* 1998) , tadpoles aquatic organic debris (Jenssen 1967, Warkentin 1992a,b.)
Rana grylio	Pig Frog	Resident (AmphibiaWeb 2009).	Largely aquatic permanent freshwater lakes (500), cypress ponds (621), marshes (641), brushy swamps (631), roadside ditches, and overflowed river banks containing emergent aquatic vegetation (644) (Wright 1932, Smith and List 1955, Mount 1975, Ashton and Ashton 1988, Dundee and Rossman 1989).		Aquatic open, permanent freshwater lakes (500), cypress ponds (621), marshes (641), brushy swamps (631), roadside ditches (510), and overflowed river banks containing emergent aquatic vegetation (644) (Wright 1932, Smith and List 1955, Mount 1975, Ashton and Ashton 1988, Dundee and Rossman 1989.)			Tadpoles aquatic (AmphibiaWeb 2009), adults primarily aquatic prey consists primarily (95%) of arthropods, crayfish are most common food item (Lamb 1984, Carr 1940a.)
Rana heckscheri	River Frog	Resident (AmphibiaWeb 2009).	Swampy edges of rivers and streams (510) (Wright 1932), along the edges of shallow impoundments, associated with vegetation such as titi (614), bay (611), and cypress (621) (Mount 1975), bottomland forests (615) (Martof *et al.* 1980).		Breed in ponds with emergent vegetation (Martof *et al.* 1980, Bartlett and Bartlett 1999a), habitats ranging from river edges (510) to adjacent, upland ponds (500).			Adults feed largely on invertebrates, especially insects (AmphibiaWeb 2009), small vertebrates, including other ranid frogs (Hill 2000), tadpoles aquatic (AmphibiaWeb 2009).
Rana sphenocephala	Southern Leopard Frog	Resident (Amphibaweb 2009).	All types of shallow freshwater habitats, including temporary pools (500), cypress ponds (621), ponds, lakes (520), ditches, irrigation canals, and stream and river edges (510), will inhabit slightly brackish coastal wetlands (Wright and Wright 1949, Garrett and Barker 1987, Hoffman 1990, Conant and Collins 1991, Bartlett and Bartlett 1999a).	Following breeding, disperse throughout upland habitats (Brandt 1936a), will move into terrestrial habitats to feed during the summer, when vegetation in pastures, fields, and sod lands afford shade and shelter (Brandt 1936a, Conant and Collins 1991, Johnson 1992, Bartlett and Bartlett 1999a).	Aquatic (AmphibiaWeb2009), egg masses are laid in shallow, non-flowing waters (Hillis 1982, Behler and King 1998), which are usually fishless, masses are typically partly floating and attached to vegetation (Wright 1932).	Will feed in upland habitats during the summer on insects and a variety of other invertebrate prey (Johnson 1992), and aquatic invertebrates including crayfish (Force 1925).		Adults some wetland-dependant prey including crayfish (Force 1925), tadpoles aquatic green algae and diatoms (Hillis 1982).
Scaphiopus holbrooki holbrooki	Eastern Spadefoot Toad	Resident (Palis author in Lannoo editor 2009).	Bottomlands (615), including ruderal habitats, that have friable, sandy to loamy soils (Stone 1932, Driver 1936, Pearson 1955, Ashton and Ashton 1988, Dundee and Rossman 1989).	Open and forested uplands that have friable, sandy to loamy soils (Stone 1932, Driver 1936, Pearson 1955, Ashton and Ashton 1988, Dundee and Rossman 1989).	Aquatic variety of temporary waterbodies, including temporary ponds in uplands and bottomlands (615), flooded fields and roads, roadside ditches (510) and borrow pits (500) (Carr 1940a, Smith 1961, Minton 1972, Mount 1975, Gibbons and Semlitsch 1991).		Spadefoots use the same burrow for 1–713 d (0–24 mo) and emerge about 29 nights annually (Pearson (1955).	Tadpoles aquatic feed on phytoplankton, zooplankton, periphyton, dead plants and animals (e.g., earthworms, tadpoles), and anuran eggs, including their own (Driver 1936, Richmond 1947), adults variety of terrestrial arthropods (Carr 1940a, Pearson 1955, Punzo 1992a, Jamieson and Trauth 1996),

Species	Common Name	Resident/Migrant/Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning	Wetland Dependent?
Siren intermedia intermedia	Eastern Lesser Siren	Resident (AmphibiaWeb 2009).	Shallow, warm, quiet water of ponds and sloughs (560) where aquatic vegetation is plentiful (Smith and Minton 1957), permanent or semipermanent habitats, including marshes (641), swamps, farm ponds, ditches, canals, and sluggish, vegetation-choked creeks (Neill 1949b, Petranka 1998), temporary floodplain pools and shallow, heavily vegetated sections of ponds with deep sediments provide burrowing sites (Funderburg and Lee 1967, Gehlbach and Kennedy 1978).		Aquatic, sirens lack an obvious overland dispersal stage in their life cycle (Petranka 1998), but aquatic migrations to specialized breeding sites are possible, breeding habitat is subset of the adult habitat (Amphibia 2009).		Survive drought and the drying of their habitat by retreating into crayfish tunnels to a depth of ≥ 1 m (Cagle 1942) or by burrowing into the mud (Harding 1997).	Adults and juveniles aquatic dependant (AmphibiaWeb 2009), variety of invertebrate prey, including small crustaceans, insect larvae, snails, and annelid worms (Scroggin and Davis 1956), tadpoles (Fauth *et al.* 1990), larval salamanders (Fauth and Resitarits 1991, Fauth 1999a), worms and minnows (Hurter 1911), juveniles forage on small invertebrates (Petranka 1998) and feed mostly on zooplankton but also eat larger prey, such as amphipods, craneflies, and lumbriculid worms (Carr 1940a.)
Siren lacertina	Greater Siren	Resident (Hendricks author in Lannoo editor 2009).	Greater sirens are found in muddy and weed-choked ditches (Funderburg and Lee 1967), swamps, and ponds (Jobson 1940, Neill 1949b), as well as large lakes and streams.		Shallow water or streams (510) (Ultsch 1973).			Adults and juveniles aquatic dependant (Dunn 1924, Ultsch 1973, Hanlin 1978), prey include insects, crustaceans (Duellmann and Schwartz 1958), gastropods, peliecypods, spiders, mollusks (Hanlin 1978), crayfish, and small fish (Moler 1994.)

Table 3.2.2 Summary of Selected Characteristics of the Wetland Dependent Reptiles of the Matanzas Basin Study Area

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Nesting	Foraging	Denning	Wetland Dependent?
Agkistrodon piscivorus conanti	Florida Cottonmouth	Resident (Behler and King, 2008)	Wetlands (600), Streams and Waterways (510), Lakes (520), Reservoirs (530), Springs (550), Slough Waters (560) (King and Wray, 1996)	Pine Flatwoods (411) (in ponds and streams) (Ashton Jr. and Ashton, 1988)	N/A Ovoviviparous	Feed on fish, frogs, mice, rats, and other small mammals (Huegal and Cook, 2004)		Yes, fish and frogs (Huegal and Cook 2004)
Alligator mississippiensis	American Alligator	Resident (Pajerski *et al.* 2000)	Fresh and brackish Marshes (641, 642), ponds, Lakes (520), Rivers (510), Swamps (611, 612, 613, 614, 615), bayous, large Spring runs (550) (NatureServe 2009)	Basks on land next to water (NatureServe 2009)	Nests are built in Freshwater Marshes (641) or at Lake (520) or River (510) margins, mounded nest made of leaves, mud, rotting vegetation, rocks, or other debris (NatureServe 2009)	Primarily in the water at night, idle hunters for land animals, wait offshore for unsuspecting prey to drink at the water's edge (Delaney and Abercrombie 1986)	May excavate cave in a waterway and leave a portion of it above water during this time, in areas where water level fluctuates, they dig themselves into hollows in the mud, which fill with water (Delaney and Abercrombie 1986); tunnels often as long as 65 feet and provide protection during extreme hot or cold weather (Britton, 1999; Levy, 1991)	Opportunistic feeder, juveniles eat mainly invertebrates: crayfish, aquatic and terrestrial insects, and mollusks; also small fishes, amphibians, and small mammals (NatureServe 2009);larger individuals eat vertebrates, including birds, reptiles (infrequently conspecifics), mammals (up to the size of deer), and fishes (USFWS 1980)
Apalone ferox	Florida Softshell Turtle	Resident (NatureServe 2009)	Streams and Waterways (510), Cypress (621), Lakes (520) (Neill, 1964) Freshwater Marshes (641) (Behler and King, 2008), Emergent Aquatic Vegetation (644), Spring Runs (550) (Ashton Jr. and Ashton 1988)	Upland areas adjacent to wetlands (see NatureServe 2009)	Eggs are laid in sandy, sunny areas near water (NatureServe 2009) In Florida, a nest was in the sand apron of a recently abandoned gopher tortoise burrow, 103 m from the nearest body of water (Heinrich and Richardson, 1993, Herpetol. Rev. 24:31) (NatureServe 2009)	Streams and Waterways (510), Cypress (621), Lakes (520) (Neill, 1964) Freshwater Marshes (641) (Behler and King, 2008), Emergent Aquatic Vegetation (644), Spring Runs (550) (Ashton Jr. and Ashton 1988)	Often burrows into sand-mud bottom, leaving only head out (NatureServe 2009)	Feeds primarily on aquatic animals, including carrion (Ernst and Barbour 1972)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Nesting	Foraging	Denning	Wetland Dependent?
Cemophora coccinea	Scarlet Snake	Resident (Ashton Jr. and Ashton 1988)	Bottomland forest (615), margins of irrigation canals in sawgrass prairies (643), borders of swamps (Tennant 1984, 1997; Werler and Dixon 2000)	Specific habitats include pine flatwoods (411), dry prairie (310), salt grass prairie , maritime hardwood hammock (322), sandhills (412), borders of plowed fields (200), abandoned fields (200), and roadsides (Tennant 1984, 1997; Werler and Dixon 2000); sandy Scrub (436), elevated Hammocks, Dry Prairies (310) (Bartlett and Bartlett 2003)	Burrower in sand, more than likely will nest down under the sand (Ashton Jr. and Ashton 1988); eggs are laid under moist humus (Minton 1972) or in other underground sites (NatureServe 2009)	Bottomland forest (615), margins of irrigation canals in sawgrass prairies (643), borders of swamps (Tennant 1984, 1997; Werler and Dixon 2000); pine flatwoods (411), dry prairie (310), salt grass prairie, maritime hardwood hammock (322), sandhills (412), borders of plowed fields (200), abandoned fields (200), and roadsides (Tennant 1984, 1997; Werler and Dixon 2000); sandy Scrub (436), elevated hammocks, Dry Prairies (310). (Bartlett and Bartlett 2003)	Burrows in the sand (Ashton Jr. and Ashton, 1988)	Primarily eats reptile eggs (Behler and King 2000); small lizards and reptile eggs are the chief diet; also eats insects, small frogs, and nestling mice (Minton 1972)
Chelydra serpentina osceola	Florida Snapping Turtle	Resident (NatureServe 2009)	All types of freshwater habitats, especially those with soft mud bottom and abundant aquatic vegetation or submerged brush and logs, in brackish water in some areas (NatureServe 2009, Barlett and Bartlett 1999)	Sandy soils (see NatureServe 2009)	Nests in soft soil in open area, often hundreds of meters from water (Congdon *et al.* 1987); also nests in muskrat houses (NatureServe2009)	8Mostly a bottom dweller, forages in water (NatureServe 2009)	Hibernates singly or in groups in streams (510), lakes (520), ponds (500, 653) or marshes (641) in bottom mud, in or under submerged logs or debris, under overhanging bank, or in muskrat tunnel; often in shallow water; sometimes in anoxic sites (Brown and Brooks 1994)	Carrion, invertebrates, fish, birds, small mammals, amphibians, and a surprisingly large amount of aquatic vegetation (Holoweb); many kinds of vertebrates, invertebrates, and plants (NatureServe 2009)
Clemmys guttata	Spotted Turtle	Resident - N. Florida (NatureServe 2009)	Mostly unpolluted, small, shallow bodies of water such as small Freshwater Marshes (641), marshy pastures, bogs, woodland Streams (510), Swamps (611, 612, 613, 614, 615), small ponds, and Intermittent Ponds (653); also occurs in brackish tidal streams, ponds surrounded by relatively undisturbed meadow or undergrowth are most favorable (NatureServe 2009)	Nests in well-drained areas exposed to full sunlight (Ernst 1970)	Well-drained areas exposed to full sunlight (Ernst 1970); eggs are laid in well-drained soil of marshy pasture, in grass or sedge tussock or mossy hummock, in open area (e.g., dirt path or road) at edge of thick vegetation, or similar site in sun (NatureServe 2009)	Forages and seeks out food by creeping about in shallow water and periodically probing with snout into algae and other aquatic vegetation (Ernst 1976); does not feed out of the water (NatureServe. 2009); hatchlings eat mainly small insects, worms, and snails (Tyning 1990)	When inactive, hides in bottom mud and detritus, or in muskrat burrow (NatureServe 2009)	Yes, omnivorous diet reliant on submerged aquatic vegetation and fish, crayfish, crabs, frogs, etc. (Ernst 1976); primary diet is various aquatic and terrestrial invertebrates; also eats plant material, carrion, and occasionally small vertebrates (Harding and Holman 1990); hatchlings eat mainly small insects, worms, and snails (Tyning 1990)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Nesting	Foraging	Denning	Wetland Dependent?
Deirochelys reticularia	Chicken Turtle	Resident (NatureServe 2009)	Quiet heavily vegetated bodies of water, grassy ditches, shallow canals, weedy ponds and Lake (520) edges (Bartlett and Barlett 1999); Gum Swamps (613), Cypress (621) (Rageot *in* Buhlman 1995); shallow ponds and Lakes (520) with thick vegetation, cypress swamps, ditches, temporary pools; usually not in flowing water (NatureServe 2009)	Utilizes terrestrial habitats for periods and is likely needed to sustain populations (Buhlmann 1995); typically present within 165 m of wetlands (Buhlmann *et al.* 2009)	Occurs on land where hatchlings migrate to wetlands (Buhlmann *et al.* 2009); eggs are laid in soil in an open area near water (NatureServe 2009)	In or near aquatic areas (Demuth and Buhlmann 1997)		Yes, 72% of ingested food was aquatic insects, including a large number of dragonfly nymphs (Demuth and Buhlmann 1997); specializes on live, slow-moving arthropods; occasionally ingests plant matter and may sometimes eat carrion (Jackson 1996)
Diadophis punctatus punctatus	Southern Ringneck Snake	Resident (Behler and King 2008)	Edges of Wetlands (600), Mixed Wetland (617) Hardwoods,Wetland Coniferous Forests (620) (Vigil and Willson, Snakes of Georgia and South Carolina), along Streams and Waterways (510) (NatureServe 2009)	Palm-palmetto scrubland (320, 321) (Bartlett and Bartlett, 2003); Pine Flatwoods (411) (Ashton Jr. and Ashton, 1988)	Lays eggs under rotting logs, stumps, or under leaf litter (Ashton Jr. and Ashton, 1988)	See Habitat Type: Wetland/Upland	Will burrow beneath all types of debris (Barlett and Bartlett, 2003), Hides under leaf litter and logs/fallen limbs (King and Krysko, 1999)	Eats earthworms; slugs; small salamanders, frogs, lizards, and snakes; and various other small invertebrates (NatureServe 2009)
Drymarchon corais couperi	Eastern Indigo Snake	Resident (Grosse and Willson, Snakes of Georgia and South Carolina, NatureServe 2009)	Along Streams and Waterways (510) (Bartlett and Bartlett, 2003); Tropical Hammocks, Sand Palmetto stands near water (Behler and King 2008); and wet fields (Matthews and Moseley 1990, Tennant 1997, Ernst and Ernst 2003); edges of Freshwater Marshes (641), and human-altered habitats, need a mosaic of habitats to complete their annual cycle (USFWS 1999)	Longleaf Pine-Xeric Oak (412) (Grosse and Willson, Snakes of Georgia and South Carolina), Fields (200), Meadows (300), Cropland and Pastureland (210), Citrus Groves (221) (Bartlett and Bartlett, 2003), Pine Flatwoods (411), Xeric Oak (421) (Behler and King, 2008); coastal scrub (322) (NatureServe 2009); scrubby flatwoods (413), high pine (412), dry prairie (310), agricultural fields (200), coastal dunes (720) (USFWS 1999)	Eggs may be laid in pocket gopher (Geomys) burrows (Ashton and Ashton 1981); stump holes flatwoods and pond edge habitats (Smith 1987)	Active forager; often searches along edges of wetlands (Moler 1992)	Seek shelter in gopher tortoise burrows (Bartlett and Bartlett, 2003) (Ashton Jr. and Ashton, 1988); Refuges include tortoise burrows, stump holes, land crab burrows, armadillo burrows, or similar sites. (NatureServe. 2009); In wetter habitats that lack gopher tortoises, may use hollowed root channels, hollow logs, or the burrows of rodents, armadillo, or land crabs (Lawler 1977, Moler 1985, Layne and Steiner 1996)	Eats small mammals, birds, frogs, snakes, lizards, and other vertebrates of appropriate size (NatureServe 2009); fish, frogs, toads, snakes (venomous as well as nonvenomous), lizards, turtles, turtle eggs, juvenile gopher tortoises, small alligators, birds, and small mammals (Keegan 1944,Babis 1949, Kochman 1978, Steiner *et al.* 1983); juvenile eat mostly invertebrates (Layne and Steiner 1996)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Nesting	Foraging	Denning	Wetland Dependent?
Farancia abacura abacura	Eastern Mud Snake	Resident (Bartlett and Bartlett, 2003)	Ponds and Sloughs (616), Flatwood Ponds (653), Lakes (520) (Neill 1964), Freshwater Marshes (641); Wet Prairies (643), Wetland Coniferous Forests (620), Bayheads (611) (Ashton Jr. and Ashton 1988); Emergent Aquatic Vegetation (644), Streams and Waterways (510) (Bartlett and Bartlett 2003)	sandy uplands near water (Willson, Snakes of Georgia and South Carolina)	Female lays eggs in sandy uplands near water (Willson, Snakes of Georgia and South Carolina), Nests on higher ground above the water level (Neill, 1964)	Active at night, burrowing through detritus and mud in search of sirens and amphiumas (Ashton Jr. and Ashton 1988)	During the day, the mud snake will stay buried in the mud (Ashton Jr. and Ashton, 1988)	Yes, primary food source is sirens and amphiuma (Ashton Jr. and Ashton 1988, Neill 1964, Behler and King 2008)
Farancia erytrogramma erytrogramma	Rainbow Snake	Resident (Bartlett and Bartlett, 2003)	Streams and Waterways (510), Cypress (621), Lakes (520) (Neill 1964); Freshwater Marshes (641) (Behler and King 2008); Emergent Aquatic Vegetation (644), Spring Runs (550) (Ashton Jr. and Ashton 1988)		Nests at water's edge, near or under the water hyacinths (Neill, 1964)	At night it emerges from mud to hunt for eels (Bartlett and Bartlett 2003)	Will live in the roots of bald cypress trees above water (Neill 1964); will burrow into the mud during the day (Bartlett and Bartlett 2003); also uses vegetation for cover (Behler and King 2008)	Yes, wetland dependent for primary food sources (see Neill 1962, Behler and King 2008, Bartlett and Bartlett 2008); eel is highly restricted to lakes and streams (Neill 1964); Feeds on eel which is the primary food source (Neill 1964, Behler and King 2008, Bartlett and Bartlett 2003), also will eat amphiuma, sirens, fish and tadpoles (Ashton Jr. and Ashton 1988)
Kinosternon baurii	Striped Mud Turtle	Resident (Lamb and Lovich 1990)	Ponds, Lakes (520), swamps, Freshwater Marshes (641), canals, ditches, estuaries (540), and other weakly brackish situations (Bartlett and Bartlett 1999); Hardwood swamp (Mushinsky and Wilson 1992, Wilson 1998)	Utilize sandhill (412) during migration to and from nesting area (Mushinsky and Wilson 1992)	Nesting typically occurs in upland sandhill areas with moderate-to-dense vegetation and higher than average soil moisture (Wilson 1998); Nesting areas in Florida include turkey oak-longleaf pine sandhills adjacent to swamps; may travel up to at least 50-100 meters to nest (Mushinsky and Wilson 1992)	Utilize wetlands for most life-history strategies outside of nesting (Wygoda 1979; Wilson 1998)		Omnivorous, including cabbage palm seeds, algae, small snails, aquatic larvae (Einem 1956)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Nesting	Foraging	Denning	Wetland Dependent?
Kinosternon subrubrum subrubrum	Eastern Mud Turtle	Resident (Gibbons 1983)	Utilize wetlands for most life-history needs (Gibbons 1983; Frazer *et al.* 1991); Ponds, Lakes (520), swamps, Freshwater Marshes (641), canals, ditches, estuaries (540), and other weakly brackish situations (see Bartlett and Bartlett 1999)	Utilize upland areas for nesting (Gibbons 1983)	Upland areas several-to-several hundred meters away from wetlands (Gibbons 1983; Frazer *et al.* 1991)	Utilize wetlands for most life-history strategies outside of nesting (Gibbons 1983; Frazer *et al.* 1991).		Yes, omnivorous, aquatic feeder (Muhmoud 1968; Mount 1975)
Malaclemys terrapin	Diamondback Terrapin	Resident (Burger 1976)	brackish water off the Atlantic coast (Burger 1976); Saltwater Marsh (642) (Tucker *et al.* 1995)	Sand Dunes (720) and barrier beaches adjacent to brackish water coasts (Burger 1976; Seigel 1980)	Sand dunes and barrier beaches adjacent to brackish water coasts (Burger 1976; Seigel 1980)	76-79% of dietary volume was the salt marsh periwinkle, crabs, barnacles, and clams (Tucker *et al.* 1995)		76-79% of dietary volume was the salt marsh periwinkle, crabs, barnacles, and clams (Tucker *et al.* 1995)
Nerodia floridana	Florida Green Watersnake	Resident (Bloom)	Lakes (520), ditches, Freshwater Marshes(641), Wet Prairies(643), Emergent Aquatic Vegetation (644) (Gibbons and Dorcas 2004); Bay and Estuaries (540) (Behler and King 2008)		N/A Viviparous	Lakes (520), ditches, Freshwater Marshes(641), Wet Prairies(643), Emergent Aquatic Vegetation (644) (Gibbons and Dorcas 2004); Bay and Estuaries (540) (Behler and King 2008)		Yes, feeds primarily on fish and frogs (Gibbons and Dorcas 2004) Feeds on salamanders, tadpoles, and small turtles (Ashton Jr. and Ashton, 1988)
Nerodia taxispilota	Brown Watersnake	Resident (Bartlett and Bartlett 2003)	Rivers and Streams (510), Sloughs (560), canals, channels, Lakes (520) (Mills*et al.* 1995); blackwater cypress creeks (Vigil and Willson)		N/A Viviparous	Rivers and Streams (510), Sloughs (560), canals, channels, Lakes (520) (Mills*et al.* 1995); blackwater cypress creeks (Vigil and Willson)		Yes, primarily eats fish which restricts them to permanent waterbodies (Vigil and Willson, Mills*et al.* 1995); fish and frogs among emergent vegetation (Behler and King 2008); Neonates will eat aquatic invertebrates (Bartlett and Barlett 2003)
Opheodrys aestivus	Rough Green Snake	Resident (Ashton Jr. and Ashton, 1988)	Found near edges of: Streams and Waterways (510), Lakes (520) (Goldsmith 1984); near edges of Wetlands (600) (Ashton Jr. and Ashton 1988); dense vegetation (vines, shrubs, trees) near water (NatureServe 2009)	Upland ravine habitats (Goldsmith 1984); Edges of Upland Hardwood Forests (420) (Bartlett and Bartlett 2003); Shrub and Brushland (320) (Ashton Jr. and Ashton1988)	Nest sites with in rotting logs (Goldsmith 1984); lays eggs in damp areas under objects (Ashton Jr. and Ashton, 1988); in tree hollows (NatureServe 2009)	Streams and Waterways (510), Lakes (520) (Goldsmith 1984); edges of Wetlands (600) (Ashton Jr. and Ashton 1988); dense vegetation (vines, shrubs, trees) near water (NatureServe 2009)	Dens in shrubs, vine tangles or thick vegetation (Willson)	Feeds on insects, spiders, and other invertebrates (Willson); tree crickets and moths (Ashton Jr. and Ashton 1988)
Pseudemys floridana peninsularis	Peninsula Cooter	Resident (Bartlett and Barlett 1999)	Found in Rivers (510), Lakes (520), Sloughs (560), Stream and Lake Swamps (615), Inland Ponds and Soughs (616) (Bartlett and Bartlett 1999); Springs (550) (Hubbs 1995)	Upland areas adjacent to wetlands (Corkscrew Swamp)	Shallow hole in loose open soil (Corkscrew Swamp)	Rivers (510), Lakes (520), Sloughs (560), Stream and Lake Swamps (615), Inland Ponds and Soughs (616) (Bartlett and Bartlett 1999); Springs (550) (Hubbs 1995)		Hatchlings and young insectivorous, adults are primarily herbivores (Bartlett and Bartlett 1999)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Nesting	Foraging	Denning	Wetland Dependent?
Pseudemys nelsoni	Florida Red -bellied Turtle	Resident (Bartlett and Barlett 1999)	Occurs in nearly any permanent body of freshwater, ponds, Lakes (520), ditches, canals, Rivers and Streams (510) (Bartlett and Bartlett 1999); usually in water with abundant aquatic vegetation (NatureServe 2009)	Uplands adjacent to water bodies (see Bartlett and Bartlett 1999)	Nest dug into soil or in an alligator nest (Bartlett and Bartlett 1999); nesting may occur away from water (NatureServe 2009)	Ponds, Lakes (520), ditches, canals, Rivers and Streams (510) (Bartlett and Barlett 1999)		Aquatic vegetation, young may feed on dead fishes (NatureServe 2009)
Regina alleni	Striped Crayfish Snake	Resident (Slone)	Emergent Aquatic Vegetation (644) (Godley 1980); Lakes (520), Rivers (510), Freshwater Swamps (641) (Ashton Jr. and Ashton 1988); sphagnum bogs, roadside ditches (Slone)		N/A Viviparous	Emergent Aquatic Vegetation (644) (Godley 1980); Lakes (520), Rivers (510), Freshwater Swamps (641) (Ashton Jr. and Ashton 1988); sphagnum bogs, roadside ditches (Slone)	Dens in water hyacinth beds (Ashton Jr. and Ashton 1988); burrowing in or using soil, fallen log/debris, various burrows, including those made by crayfish, and spaces among or under wood or thick vegetation (NatureServe 2009)	Feeds on crayfish (Godley 1980, Behler and King 2008); crayfish, dragonfly nymphs, shrimp (Slone)
Regina rigida	Glossy Crayfish Snake	Resident (Ashton Jr. and Ashton 1988)	Wetlands (600), ditches, Cypress (621), Emergent Aquatic Vegetation (644) (Willson); sphagnum swamps (Ashton Jr. and Ashton 1988); Rivers (510), Lakes (520) (Huheey 1962); slow waters of lowland areas, such as swamps, nontidal and tidal Freshwater Marshes (641), sphagnum bogs, seepage wetlands, ponds, flatwoods ponds, cypress ponds, canals, drainage ditches, mucky areas along streams, and floodplains (Ernst and Ernst 2003, Gibbons and Dorcas 2004)	Sometimes grassy or wooded upland habitats adjacent to wetlands (Ernst and Ernst 2003, Gibbons and Dorcas 2004)	N/A Viviparous	Wetland (500 and 600) (NatureServe 2009)	Dens in crayfish burrows, beneath logs, or mats of vegetation (Bartlett and Bartlett, 2003); usually this snake is secluded in burrows (e.g., crayfish, muskrat), under mats of wet vegetation or debris at the water's edge, or among aquatic plants, but occasionally it basks on banks or on vegetation over water (NatureServe 2009)	Feeds primarily on crayfish, also frogs, fish, and salamanders (Ashton Jr. and Ashton 1988); dragonfly naiads and other aquatic insects (Bartlett and Bartlett2003, Behler and King 2008)
Seminatrix pygaea pygaea	North Florida Swamp Snake	Resident (Winne, 2005)	Wetlands (600) (Winne 2005); sphagnum bogs, ditches, Lakes (520), Inland Ponds and Sloughs (616) (Willson); Streams and Waterways (510) (Behler and King, 2008); swamps, bayheads (611), ponds, marshes (641 and 642), grassy Wet Prairies (643), sphagnum bogs, sluggish streams (510), ditches, canals, and Lakes (520) with abundant floating or emergent vegetation (644) (NatureServe 2009)		N/A Viviparous	Forages through submerged vegetation for food (Willson)	Dens in hydrophytic vegetation (Behler and King 2008)	Feeds on leeches, small fish and amphibians (Winne 2005); feeds on small aquatic invertebrates and small salamanders (Ashton Jr. and Ashton 1988); worms, leeches, tadpoles, small amphibians, and small fishes (Mount 1975, Behler and King 1979)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Nesting	Foraging	Denning	Wetland Dependent?
Sistrurus miliarius barbouri	Dusky Pygmy Rattlesnake	Resident (Bartlett and Bartlett 2003)	Borders of Cypress (621), Lakes (520), Freshwater Marshes (641) (Behler and King 2008); Streams and Waterways (510), swamps, riparian corridors (Bartlett and Bartlett 2003); Hydric Pine Flatwoods (625), Mixed Wetland Hardwoods (617) (Ashton Jr. and Ashton 1988)	Palmetto Prairies (321), Mesic Oak (414), Herbaceous (Dry Prairie) (310) (King and Wray 1996), Mixed Pine (415) (Behler and King 2008); - upland scrub (436), Pine and Hardwoods, Longleaf Pine - Xeric Oak (412) (Meadows and Willson)	N/A Viviparous	Borders of Cypress (621), Lakes (520), Freshwater Marshes (641) (Behler and King 2008); Streams and Waterways (510), swamps, riparian corridors (Bartlett and Bartlett 2003); Hydric Pine Flatwoods (625), Mixed Wetland Hardwoods (617) (Ashton Jr. and Ashton 1988); Palmetto Prairies (321), Mesic Oak (414), Herbaceous (Dry Prairie) (310) (King and Wray 1996), Mixed Pine (415) (Behler and King 2008); - upland scrub (436), Pine and Hardwoods, Longleaf Pine - Xeric Oak (412) (Meadows and Willson)	Will use gopher tortoise burrows and tends to hide under leaf litter (Meadows and Willson)	Feeds on small rodents, mammals, and birds (Ashton Jr. and Ashton 1988); lizards and frogs (Meadows and Willson)
Sternotherus minor minor	Loggerhead Musk Turtle	Resident (NatureServe 2009)	Prefers flowing water conditions and rarely leaves the water except to bask (Carr 1952; Tinkle 1958; Iverson 1977); areas include Spring runs (550), creeks (510), oxbows, swamps and sinkhole ponds (Ernst *et al.* 1994); shallow Lake (520) margins, canals, areas with a soft bottom (NatureServe 2009)	Uplands adjacent to water bodies (see NatureServe 2009)	Nests have been found in Florida woods at bases of stumps and logs (Ernst and Barbour 1972)	Spring runs (550), creeks (510), oxbows, swamps and sinkhole ponds (Ernst *et al.* 1994)		Eats aquatic invertebrates, carrion, small vertebrates, and plant material (NatureServe 2009); may shift from primarily insectivorous diet to primarily mollusk diet with increasing size (NatureServe 2009); may feed on worms and invertebrates on land (Ashton and Ashton 1985, Ernst and Barbour 1972); primary food source includes gastropods (Tinkle 1958), but may also encompass submerged aquatic vegetation (Cox and Marion 1978)
Sternotherus odoratus	Common Musk Turtle	Resident (Seidel *et al.* 1981)	Typically utilizes Lakes (520), ponds, swamps and Rivers (510) (Ernst and Barbour 1972); inhabits virtually any permanent body of freshwater having a slow current and soft bottom (NatureServe 2009)	Uplands adjacent to water bodies (see NatureServe 2009)	Nest found in moist soils 3 - 10 m from water (Ernst 1986); eggs are laid up to about 50 m from water in soil; under logs, stumps, and vegetable debris, and in walls of muskrat houses, sometimes on open ground (NatureServe 2009)	Usually feeds in water on bottom (NatureServe 2009)	Hibernates in bottom mud or debris, under rocks, or in holes in banks, may congregate when hibernating (NatureServe 2009)	Yes, feeds mainly on algae, leeches, snails, crayfish, larval and adult aquatic insects, tadpoles and adult frogs, and dead fish (Ernst and Barbour 1972; Ernst 1986); eats primarily aquatic invertebrates but also plants, carrion, fishes, and amphibian larvae (NatureServe 2009); small individuals eat mainly small aquatic insects, algae, carrion (Ernst and Barbour 1989)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Nesting	Foraging	Denning	Wetland Dependent?
Storeria dekayi victa	Florida Brown Snake	Resident (Bartlett and Bartlett 2003)	Moisture retaining bottomlands, Wetland Hardwood Forests (610) (Bartlett and Bartlett 2003); Freshwater Marshes(641), Saltwater Marshes (642), Wetland Coniferous Forests (620), Margins of Swamps (Behler and King,2008); Margins of Wetlands (600) (Thomas and Willson); Cypress (621) (Ashton Jr. and Ashton1988)	Upland Coniferous Forest (410), Upland Hardwood Forest (420), Hardwood-Conifer Mixed (434), Herbaceous (Dry Prairie) (310) (NatureServe 2009)	N/A Viviparous	Moisture retaining bottomlands, Wetland Hardwood Forests (610) (Bartlett and Bartlett 2003); Freshwater Marshes(641), Saltwater Marshes (642), Wetland Coniferous Forests (620), Margins of Swamps (Behler and King,2008); Margins of Wetlands (600) (Thomas and Willson); Cypress (621) (Ashton Jr. and Ashton1988); Upland Coniferous Forest (410), Upland Hardwood Forest (420), Hardwood-Conifer Mixed (434), Herbaceous (Dry Prairie) (310) (NatureServe 2009)	Will sometimes hide under leaf litter or logs (Thomas and Willson); terrestrial burrower, found under logs, rocks, and other debris (Florida Museum of Natural History)	Earthworms, slugs, other invertebrates, and small salamanders (NatureServe 2009); feeds nearly exclusively on slugs and earthworms (Thomas and Willson, Ashton Jr. and Ashton 1988, Behler and King 2008)
Storeria occipitomaculata obscura	Florida Red-bellied Snake	Resident (Overduijin)	Mixed Wetland Hardwoods (617) (Ashton Jr. and Ashton 1988); margins of Wetlands (600) (Overduijin); sphagnum bogs (Behler and King 2008)	Pine-Mesic Oak (414) (Ashton Jr. and Ashton 1988)	N/A Viviparous	Mixed Wetland Hardwoods (617) (Ashton Jr. and Ashton 1988); margins of Wetlands (600) (Overduijin); sphagnum bogs (Behler and King 2008); Pine-Mesic Oak (414) (Ashton Jr. and Ashton 1988)	Will burrow into leaf mold/detritus and under rotting logs (Ashton Jr. and Ashton 1988); terrestrial burrower, and prefers moist environments where it is found under dense vegetation, logs, rocks, and other debris (Florida Museum of Natural History)	Feeds on slugs primarily (Semlitsch and Moran 1984); nearly exclusively on slugs (Overduijin); earth worms and snails are also very common food items (Harding 1997)
Thamnophis sauritus sackenii	Peninsula Ribbon Snake	Resident (Bartlett and Bartlett 2003)	Freshwater Marshes (641), Wet Prairies (643) (Ashton Jr. and Ashton 1988); Saltwater Marshes (642), edges of Lakes (520), bogs (Baker and Willson); edges of Streams and Waterways (510), ditches, swamps (Bartlett and Bartlett 2003)	Sand Other Than Beaches (720), Pine Flatwoods (411) (King and Krysko 1999)	N/A Viviparous	Freshwater Marshes (641), Wet Prairies (643) (Ashton Jr. and Ashton 1988); Saltwater Marshes (642), edges of Lakes (520), bogs (Baker and Willson); edges of Streams and Waterways (510), ditches, swamps (Bartlett and Bartlett 2003)		Yes, feeds on amphibians and fish as primary prey (Baker and Willson); also feeds on frogs, salamanders (Behler and King 2008)

Table 3.2.3 Summary of Selected Characteristics of the Wetland Dependent Birds of the Matanzas Basin Study Area

Species	Common Name	Resident/ migrant/ overwintering	Preferred Habitat Type		Life History needs dependent on wetlands			Primary Food Source
			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Agelaius phoeniceus	Red-winged Blackbird	Resident and migrant (Yasukawa and Searcy 1995).	Inland ponds and sloughs (616), freshwater marshes (641) (Stevenson and Anderson 1994, FWC 2003). Also may utilize 612 (FWC 2003).	Cropland and pastureland (210), woodland pastures (213), herbaceous - dry prairie (310) (Stevenson and Anderson 1994).	Prefers freshwater marshes (641) (FWC 2003, Stowe *et al.* 1968, Stevenson and Anderson 1994, Orians 1961), will nest in uplands (Robertson 1972, Orians, 1961, Stevenson and Anderson 1994.)	Will forage in freshwater marshes (641) and inland ponds and sloughs (616) but not exclusively (Stevenson and Anderson 1994, FWC 2003)		Consumes a variety of food sources, upland and wetland (Orians 1961).
Aix sponsa	Wood Duck	Resident and migrant (Hepp and Bellrose 1995).	Slough waters (560), wetland hardwood forests (610), inland ponds and sloughs (616), freshwater marshes (641) (Stevenson and Anderson 1994, Hepp and Bellrose 1995).	Mature forests (Gilmer *et al.* 1978) near water (Hepp and Bellrose 1995).	Mature forests (Gilmer *et al.* 1978), near water; wetland shrub (631), emergent aquatic vegetation (644) (Hepp and Bellrose 1995).	Inland ponds and sloughs (Stevenson and Anderson 1994), flooded timber and shallow wetlands with scrub/shrub and emergent vegetation (Hepp and Bellrose 1995).	May utilize tree-hollows (Stevenson and Anderson 1994), cavity nester, but does not excavate cavity, instead uses preformed cavities (Hepp and Bellrose 1995).	Yes. ~ 1/8 of diet is water dependent species (Cottam 1930 in Howell; Stevenson and Anderson 1994); sago pondweed important for all age classes (Hocutt and Dimmick 1971), seeds, fruits, and aquatic and terrestrial invertebrates are main foods taken (Hepp and Bellrose 1995).
Anas fulvigula	Mottled Duck	Resident (Moorman and Gray 1994).	Emergent aquatic vegetation (644), streams and waterways (510), wet prairies (643), and freshwater marshes (641) associated with major rivers (Lotter 1969, Johnson *et al.* 1991); mosquito impoundment areas (Stieglitz and Wilson 1968, LaHart and Cornwell 1969, Breininger and Smith 1990).		In Florida, nests in dense grass (*Paspalum vaginatum*, *Andropogon* spp.).(Stieglitz and Wilson 1968), and in tomato and watermelon fields (Beckwith and Hosford 1955).	Water < 30 cm deep among stands and beds of emergent aquatic vegetation (644) and in temporal freshwater ponds for seeds and invertebrates (White and James 1978, Thomas 1982).		Yes. Seeds of grasses, aquatic vegetation, rice, aquatic invertebrates, and a few small fish. Breeding females eat mostly aquatic invertebrates. During remigial molt: seeds of aquatic vegetation, invertebrates (Moorman and Gray 1994), invertebrates, especially midges (Chironomidae) and predaceous diving beetles (Dytiscidae) (Montalbano 1980.)
Anhinga anhinga	Anhinga	Resident and migrant (Frederick and Siegel-Causey 2000).	Lakes (520), slough waters (560), wetland hardwood forests (610), inland ponds and sloughs (616) (Stevenson and Anderson 1994); shallow, slow-moving sheltered waters with nearby perches and banks available for drying and sunning (Frederick and Siegel-Causey 2000).		Freshwater habitats with trees or shrubs growing close to the water's edge with small slow-moving water bodies nearby (Frederick and Siegel-Causey 2000).	Shallow freshwater habitats (Frederick and Siegel-Causey 2000).		Yes. Mainly fish, but also crayfish, amphibians, snakes, lizards, mollusks, leeches, and aquatic insects (J. J. Audubon in Bent 1922, Owre 1975, del Hoyo *et al.* 1992).
Aramus guarauna	Limpkin	Resident (Bryan 2002).	Stream and lake swamps bottomland (615), freshwater marshes (641), shorelines (652) (Stevenson and Anderson 1994, Robertson and Woolfenden 1992).		On piled floating vegetation especially water hyacinth (6443) and water lettuce (6441), in freshwater marshes (641) among tall marsh grasses (especially bulrush and sawgrass); in shrubs covered in vines (climbing hempweed (*Mikania scandens*), poison ivy (*Rhus radicans*), grape (*Vitis* spp.), and Virginia creeper (*Parthenocissus quinquefolia*)), among cypress knees; in crowns of cabbage palm trees, on live oak limbs, on high (to 14 m) bald-cypress branches (Bryan 2002).	Stream and lake swamps bottomland (615), inland ponds and sloughs (616), freshwater marshes (641), shorelines (652) (Stevenson and Anderson 1994, and Robertson and Woolfenden 1992).		Yes. Forages almost exclusively on apple snails,; also snails *Viviparus georgianus* and *Campeloma* sp., and freshwater mussels (Snyder and Snyder 1969, Bryan 1981). On St. Johns River, FL, feeds principally on moon snails (*Natica* sp.) and freshwater mussels (Unionidae) (Bryant 1859).

Species	Common Name	Resident/ migrant/ overwintering	Preferred Habitat Type		Life History needs dependent on wetlands			Primary Food Source
			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Ardea alba	Great Egret	Resident and migrant (McCrimmon *et al.* 2001).	Uses both freshwater wetlands and marine-estuarine habitats;including freshwater marshes (641), swamps (611, 612, 613, 614, 615), streams and rivers (510), ponds (530), lakes (520), impoundments, lagoons, tidal flats (651), canals anad ditches (510), and fish-rearing ponds, flooded agricultural fields (McCrimmon *et al.* 2001).	Occasionally in some upland habitats (McCrimmon *et al.* 2001).	Colonial nester with other Great Egrets or other waterbirds (Nesbitt *et al.* 1982, Spendelow and Patton 1988). Nests mostly swamps (611, 612, 613, 614, and 615), streams & rivers (510), ponds (530), lakes (520), estuaries, human-made impoundments, and on natural and dredge-material islands (McCrimmon *et al.* 2001).	Freshwater marshes (641), swamps (611, 612, 613, 614, 615), streams and rivers (510), ponds (530), lakes (520), impoundments, lagoons, tidal flats (651), canals and ditches (510), and fish-rearing ponds; flooded agricultural fields (McCrimmon *et al.* 2001).		Yes. Opportunistic; mainly fish, but also invertebrates, particularly crustaceans, amphibians, reptiles, birds, and small mammals. (McCrimmon, Ogden and Bancroft 2001, Baynard 1912, Howell 1924, Trautman 1940, Palmer 1962, Hoffman 1978, Schlorff 1978, Bancroft *et al.* 1990).
Ardea herodias	Great Blue Heron	Resident and migrant (Butler 1992).	Stream and lake swamps, bottomland (615), inland ponds and sloughs (616), freshwater marshes (641), treeless hydric savanna (646) (Stevenson and Anderson 1994), tidal flats (651), shorelines (652), saltwater marshes (642) (Butler 1992).	Upland hardwood forest (420) (Butler 1992).	Colonial nesters; nests mostly in trees in lowland swamp (615) or upland hardwood forest (620), islands, forest-bordered lakes and ponds, and riparian woodlands, including conifers (Butler 1992).	Streams and lake swamps (615), inland ponds and sloughs (616), freshwater marshes (641), treeless Hydric savanna (646) (Stevenson and Anderson 1994). Feeds mostly in slow-moving or calm freshwater, also along seacoasts (Butler 1992).		Yes. Predominantly fish (Parker 1980, Quinney and Smith 1979, Parker 1980, Hom 1983, Butler 1991). Mostly fish but also amphibians, invertebrates, reptiles, mammals, and birds (Palmer 1962, Kushlan 1978, Verbeek and Butler 1989), fish, insects, mammals, amphibians, and crustaceans (Willard 1977, Kushlan 1978, Peifer 1979).
Bubulcus ibis	Cattle Egret	Resident (Telfair II 2006).	Treeless hydric savanna (646) (Stevenson and Anderson 1994), in or near wet prairies (643) (Jenni 1969), coastal barrier, fresh and saltwater marsh (641 and 642), and dredge-material islands (743); periphery and islands in reservoirs (530), lakes (520), quarries and wetlands (600), swamps; riparian woodlands, with and without understory (Telfair II 2006).	Upland woodlands and groves, with and without understory; improved pasture (211), unimproved pasture (212) and woodland pastures (213) (Telfair II 2006).	Typically treeless hydric savanna (646) (Stevenson and Anderson 1994), 4 major types of colonies: (1) woodlands: upland woods or motts with or without understory and with or without adjacent streams or ponds; (2) swamps: trees and shrubs in water; (3) inland wooded islands: trees and shrubs on islands in inland waters; and (4) coastal islands: trees, shrubs, and herbaceous vegetation on natural islands and dredge-material deposit islands (Telfair II 2006); proximity to water not a requirement (Krebs *et al.* 1994.)	Prefers cropland and pastureland (210), improved pasture (211), other open lands (rural)(260), rangeland (300), herbaceous (dry prairie) (310), solid waste disposal sites (835) (Stevenson and Anderson 1994), in or around wet prairies (643) (Jenni 1969), surface-irrigated fields are important foraging areas during dry seasons (Singh *et al.* 1988).		Primarily invertebrates (Jenni 1973); mostly grasshoppers, crickets, spiders, flies, frogs, and noctuid moths; fish taken in shallow water during dry seasons (Ruiz 1985, Singh *et al.* 1988, Sodhi 1989); earthworms, especially in fall/winter (rainy season), can comprise as much as 44-80% of diet by weight (Siegfried 1971c, Heather 1982, Tejera and de Wilson 1990).
Buteo brachyurus	Short-tailed Hawk	Resident and overwintering (Miller and Meyer 2002.)	Dense wetland hardwood forest (610), wetland coniferous forest (620) (Millsap *et al.* 1989, Miller and Meyer 2002).	Upland forests (400), herbaceous dry prairie (310) (Miller and Meyer 2002).	Cypress swamp (621), mangrove swamp (612) (Moore *et al.* 1953), wooded swamps (610 and 620) (Brandt 1924, Millsap *et al.* 1989, 1996), open woodlands (400) and treeless hydric savannas (646) (Ogden 1974, 1988).	Edges of woodlands (cypress swamps (621), mangrove swamps (612) and pine forests (upland coniferous forests (410) and wetland coniferous forests (620)) (Miller and Meyer 2002).		Small birds; less frequently small rodents, snakes, and lizards (Miller and Meyer 2002).
Buteo lineatus	Red-shouldered Hawk	Resident (Dykstra *et al.* 2008).	Bottomland hardwood forest (615) and flooded deciduous swamps (Gum swamps- 613, cypress swamps -621) (Dykstra *et al.* 2008).	Upland mixed coniferous-deciduous forests (upland hardwood forests (430), longleaf pine - xeric oak) (412) (Dykstra *et al.* 2008, Bohall and Collopy 1984).	Near some form of water (water (500), wetlands (600) (Portnoy and Dodge 1979, Bosakowski *et al.* 1992, Moorman and Chapman 1996, Howell and Chapman 1997, Dykstra *et al.* 2000, 2001a, McLeod *et al.* 2000, Balcerzak and Wood 2003)	Typically hunts from a perch, captures prey in open areas, from surface of water and from the ground (Dykstra *et al.* 2008, Coward 1985).		Small mammals, reptiles, and amphibians, occasionally birds and invertebrates such as earthworms (Dykstra *et al.* 2008, FWC 2003.)

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			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Butorides virescens	Green Heron	Resident (Davis and Kushlan 1994).	Streams and waterways (510), mangrove swamps (612), inland ponds and sloughs (616), freshwater marshes (641), shorelines (652) (Monroe *et al.* 1993, Stevenson and Anderson 1994).	May nest in dry woods or orchards, but usually near water (Davis and Kushlan 1994).	Secluded nest sites in swamps (wetland hardwood forest (610), wetland coniferous forest (620), marshes (fresh and saltwater marshes [641 and 642]), lakes (520), ponds, storm-water control impoundments, retention basins, dry woods (upland forests [400]) and orchards in farmlands (Bent 1926, Adams *et al.* 1985), with wetland feeding habitat nearby (Davis and Kushlan 1994), nest is usually on or over water but may be up to 0.8 km from standing water, may nest in both aquatic and terrestrial sites in same area (Kaiser and Reid 1987).	Prefers mixed wetland hardwoods (616), freshwater marshes (641), shorelines (652), intermittent ponds (653), but may utilize streams and waterways (510) or lakes (520) if emergent aquatic vegetation is available (Stevenson and Anderson 1994), saltwater marshes (642) (Clarke *et al.* 1984), mangrove swamps (612), improved pastures (210) (Bryant 1914).		Carnivorous, typically a fish-eating species (Davis and Kushlan 1994), fish species (Lovell 1958), fish constitute primary food; these include topminnows, minnows, sunfish, catfish , pickerel, carp, perch, gobies, shad, silverside, eels, and in urban areas and human-made ponds, goldfish (Brooks 1923).
Catoptrophorus semipalmatus	Willet	Resident and migrant (Stevenson and Anderson 1994).	Shorelines (652) (Stevenson and Anderson 1994), saltwater marshes (642) (Howe 1982).		Near coastal saltwater marshes (642) (Douglas 1996), prefers freshwater marshes (641) that border streams and waterways (510) and/or lakes (520) but will also utilize bays and estuaries (540) (Lowther *et al.* 2001), saltwater marshes (642) and/or sea grass (911) (Stevenson and Anderson 1994), on ground, along edge of saltwater marshes (642,) in cordgrass (6421) or in sand-dune areas utilizing American beachgrass (*Ammophila breviligulata*) (Bent 1929, Burger and Shisler 1978, Howe 1982).	Especially flooded agricultural (200) lands (Stevenson and Anderson 1994), saltwater marshes (642) (Howe 1982), oysterbeds (654) and mudflats, sparsely vegetated cordgrass saltwater marsh (6421), beaches (710) (Tomkins 1965, Hanson 1979), and along tidal creeks (Howe 1982).		Insects, small crustaceans, mollusks, polychaetes, occasionally small fish (Lowther *et al.* 2001).
Ceryle alcyon	Belted Kingfisher	Resident and migrant (Kelly *et al.* 2009).	Water-obligate species near shorelines of clear lakes (520), ponds, and estuaries (540) (Prose 1985), species favors streams and waterways (510), ponds, lakes (520), and estuaries (540) or calm marine waters in which prey are clearly visible (Kelly *et al.* 2009).	Sand and gravel pits and vertical earth exposures (for digging burrows) (Kelly *et al.* 2009).	Earthen banks void of vegetation are preferred and generally near water, but ditches, road cuts, landfills, and sand or gravel pits, sometimes distant from water, are also acceptable (Kelly, 2009)	streams and waterways (510), ponds, lakes (520), and Estuaries (540) or calm marine waters in which prey are clearly visible (Kelly *et al.* 2009)		Yes, fish (Roberts 1932, Bent 1940, Salyer and Lagler 1946, Cornwell 1963, Davis 1980, Prose 1985); mollusks, crustaceans, insects, amphibians, reptiles, young birds, small mammals, even berries (Coues 1878, Forbush 1925, White 1939b, Bent 1940, Salyer and Lagler 1946, Terres 1968)
Charadrius wilsonia	Wilson's Plover	Resident and wintering (Corbat and Bergstrom 2000).	Strictly coastal areas (Corbat and Bergstrom 2000), frequents areas located near mud flats, inlets and bays and estuaries (540) (Stevenson and Anderson 1994).	Beaches (181, 710, and 720) especially where backed by dunes, mud flats, spoil islands and estuaries (540) (Stevenson and Anderson 1994).	Open areas of sandy islands and edges of dunes in areas with high salinity (Tomkins 1944), beaches (181, 710, 720) (Corbat and Bergstrom 2000).	Relies on species in or adjacent to mud flats, inlets, estuaries (540) (Stevenson and Anderson 1994), shorelines (652) (Bergstrom 1988).		Yes, crustaceans, particularly fiddler crabs, some insects (Strauch and Abele 1979, Morrier and McNeil 1991, Thibault and McNeil 1994, 1995).
Coccyzus americanus	Yellow-billed Cuckoo	Migrant and breeding (Hughes 1999, FWC 2003).	Deciduous forests, cypress swamps (621), hammocks, dense thickets along canals and ponds (500) (FWC 2003.)	Deciduous forests, dense thickets along roads (FWC 2003), prefers open woodland with clearings and low, dense, scrubby vegetation; often associated with watercourses (Hughes 1999.)	Not necessarily near water in eastern deciduous forests that are consistently humid during summer (Gaines and Laymon 1984).	Open areas, woodland, orchards, and adjacent streams (Hughes 1999.)		Primarily large insects: caterpillars, katydids, cicadas, grasshoppers, and crickets (Nolan and Thompson 1975, Laymon 1980).

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			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Corvus ossifragus	Fish Crow	Resident (McGowan 2001).	Primarily coastal, along beaches, fresh and saltwater marshes (641, 642), and estuaries (540) into pine flatwoods and riverine forests. Usually found near water, fresh or salt, rivers (510) or lakes (520) (McGowan 2001).	Agricultural areas (200), and urban and suburban residential (110) and commercial areas (140) (McGowan 2001).	Primarily coastal, along beaches, marshes (641, 642), and estuaries (540) into pine flatwoods and riverine forests. Usually found near water, fresh or salt, rivers (510) or lakes (520) (McGowan 2001).	Often on ground and around edge of water (500), also forages in trees, especially for birds' nests (McGowan 2001).		Omnivorous. Carrion, crabs, and other marine invertebrates, eggs of birds and turtles, nestling birds, insects, and fruits (Barrows 1888, Jackson and Walker 1997).
Dendroica dominica	Yellow-throated Warbler	Migrant, breeding, resident (Hall 1996).	Heavily wooded stream bottomlands or swamps (615) (Hall 1996).	Upland pine or mixed pine-hardwood forests (410, 434) (Hall 1996.)	Cypress swamp (621), live oak stands (427), mixed pine-deciduous forests, particularly those with large amounts of Spanish moss (Hall 1996).	Cypress swamp (621), live oak stands (427), mixed pine-deciduous forests; particularly those with large amounts of Spanish moss (Hall 1996).		Arthropods, particularly Lepidoptera larvae, Diptera, and scale insects (Bent 1953).
Egretta caerulea	Little Blue Heron	Resident (Knoder *et al.* 1980).	Cypress swamps (621), stream and lake swamps (bottomland) (615) and marine-estuarine (mangrove- [612] dominated) habitats, ponds, lakes (520) (Knoder *et al.* 1980).	Dredged-material (743) islands (Knoder *et al.* 1980).	Black mangrove (612) (Maxwell and Kale 1977b), Brazilian pepper (422) (Rodgers 1980b), buttonbush and willow (Jenni, 1969), tends to nest in lower shrubs, bushes, and small trees, usually in less accessible sites below the canopy that are protected (McCrimmon 1978).	Forages in various freshwater and marine-estuarine wetland habitats, rarely in upland pasture sites (Jenni 1969), generally forages in shallow water, 5–15 cm deep (Willard 1977), and often uses densely vegetated foraging sites (Jenni 1969).		Opportunistic, takes small fish, many invertebrates (especially crustaceans), and small amphibians (Schorger in Palmer 1962, Hanebrink and Denton 1969, Domby and McFarlane 1978, Kushlan 1978c, Telfair 1981, Rodgers 1982, Niethammer and Kaiser 1983, Bancroft *et al.* 1990).
Egretta rufescens	Reddish Egret	Resident (Paul *et al.* 1979, Paul *et al.* 1975, Stevenson and Anderson 1994).	intertidal flats (651), occasionally open beaches (610) and reefs (Voous 1983); red or black mangroves (612), Brazilian Pepper (619) (Paul 1996)		Colonial (Cahn 1923, Bent 1924, Bancroft 1927); In Florida in red or black mangroves (612) or, less often, in Brazilian pepper (619); frequently nests over water, above interior lagoon of mangrove key or over creek or pocket where mangroves from both sides converge (Paul 1996)	Broad open flats 5–15 cm deep, with barren sand or mud substrate with limited vegetation, algal mat commonly present in mainland lagoons, keys, and salt barrens of Florida; also forages on sparsely vegetated mangrove (612) flats among seedlings (Lowther and Paul 2002).		Yes - primarily feeds on small (mean mass about 1 g) fish (Lowther and Paul 2002)
Egretta thula	Snowy Egret	Resident (Parsons and Master 2000).	Streams and waterways (510), lakes (520), freshwater marshes (641), coastal surf and tidal marshes (Stevenson and Anderson 1994), typically occupy areas in or near 643 (Jenni 1969), saltmarsh pools (642), tidal channels, shallow bays (540), and mangroves (612) (Parsons and Master 2000).	Occasionally moist or dry upland forests (400) (Stevenson and Anderson 1994.)	Estuarine (540), freshwater swamps (610, 620), stream bottomlands (615), and mangroves (612) (Parsons and Master 2000.)	Streams and waterways (510), lakes (520), freshwater marshes (641), coastal surf and saltwater marshes (642) (Stevenson and Anderson 1994), wet prairies (643) (Jenni 1969).		Earthworms, annelid worms, aquatic and terrestrial insects, crabs, shrimp, prawns, crayfish, other crustaceans, snails, freshwater and marine fish, frogs/toads, and snakes/lizards (Kushlan 1978a, 1978b).
Egretta tricolor	Tricolored Heron	Resident (Stevenson and Anderson 1994.)	Coastlines, especially saltwater marshes (642) and tidal flats (651) (Stevenson and Anderson 1994), typically occupy areas near wet prairies (643) (Jenni 1969), coastal habitats, including estuaries (540), mangrove swamps (612), river deltas, but also frequently in freshwater areas (Frederick 1997).		Estuaries (540), mangrove swamps (612), river deltas, but also frequently in freshwater areas (Frederick 1997).	Small fishes comprise most of its diet, also aquatic insects, grasshoppers, crayfish, amphibians, small reptiles, and mollusks (Stevenson and Anderson 1994), coastline habitats where water level drops rapidly (Jenni 1969).		Yes, small fishes make up >90% of diet in nearly all regions, insects, crustaceans, and frogs taken probably only when superabundant (Frederick 1997).

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			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Elanoides forficatus	Swallow-tailed Kite	Migrant (breeding) (Meyer 1995).	Hydric pine flatwoods (625), hydric pine savanna (626), slash pine swamp forest (627), cypress (621), wet prairie (643), pine fringe of wetland hardwood forests (610) and freshwater marshes (641) (Cely 1979, Robertson 1988, Cely and Sorrow 1990, Meyer and Collopy 1990).	Upland coniferous forests (410) (Meyer 1995).	Pine fringe of wetland hardwood forests (610) and freshwater marshes (641) (Meyer 1995, Meyer and Collopy 1990).	Forages in branches, foliage, and stems of deciduous trees, shrubs, and emergent vegetation in streams and waterways (510), lakes (520), slough waters (560), and freshwater marshes (641) (Meyer 1995).	Open stands of cypress (621) or pine in standing water, isolated from human disturbance (Meyer 1993).	52–85% of prey items consist of insects, frogs, and nestling birds (Sutton 1955, Snyder 1974, Meyer and Collopy 1990.)
Empidonax virescens	Acadian Flycatcher	Resident (Stevenson and Anderson 1994).	Requires relatively undisturbed mature forest throughout its range, swampy woodlands, including bald cypress (621) (Christy 1942, Sprunt and Chamberlain 1970, Oberholser 1974).	Upland forests (400) (Whitehead and Taylor 2002).	Stream bottomland forest (615), nest site often associated with water, along stream course (510), on lower slope of ravine or sink hole, in forested swamp, usually over open area (e.g. water, trail), coniferous forests (410) (Whitehead and Taylor 2002), bald cypress (621) (Christy 1942, Sprunt and Chamberlain 1970, Oberholser 1974).	Stream bottomland forest (615), coniferous forests (410), bald cypress (621) (Whitehead and Taylor 2002).		Non specific, insects, insect larvae, and other arthropods (Whitehead and Taylor 2002).
Eudocimus albus	White Ibis	Resident (Kushlan and Bildstein 2009).	Freshwater and estuarine wetlands, typically cypress swamps (621), bottomland hardwood (615) and mangrove swamps (612), as well as fresh and saltwater marshes (641 and 642), flooded pastures (210), and marshes at the edges of lakes (500) (Kushlan and Bildstein 2009).	Uplands with soft substrate to allow foraging (e.g. lawns) (Kushlan and Bildstein 2009).	Colonial, nests on barrier, marsh, and spoil (742) islands on the coast, and on islands in lakes (520) inland, also in gallery forest and in stands of trees within marshes (641, 642) and mangrove swamps (612) (Kushlan and Bildstein 2009), nest sites are in interior and coastal wetlands, including those within wetland forested mixed (630) (Bailey 1978).	Freshwater wetlands (600) (Bildstein *et al.* 1990, Johnston and Bildstein 1990), shallow seasonal sedge marshes (653) and shallow cypress swamps (621), lawns, pastures (211), and shallow ponds, saltwater marsh (642) mangrove swamp (612) (Custer and Osborn 1978, Kushlan 1979a, Henderson 1981, Bildstein 1983).	Ibises are known for frequent shifts in roost and colony sites (Bildstein *et al.* 1990, Gawlik *et al.* 1998),	Yes, aquatic crustaceans and insects, also fish (Kushlan and Bildstein 2009), freshwater crayfish and estuarine crabs (Nesbitt *et al.* 1975, Kushlan and Kushlan 1975, Kushlan 1979a, Bildstein 1983).
Fulica americana	American Coot	Resident, wintering, and migrant (Alisauskas and Arnold 1994, Am. Ornithol. Union 1998).	Freshwater wetlands, almost any form or size of waterbody may be used, including lakes (520), ponds, canals, sloughs (560), sewage ponds, slower-moving rivers (510), and swamps with some open water (Bent 1926, Kiel 1955, Harrison 1978, Sugden 1979, Fitzner *et al.* 1980, Sutherland and Maher 1987, Alisauskas and Arnold 1994).	Agricultural (200) fields and upland grassy areas (Bent 1926).	Freshwater wetlands with heavy stands of emergent aquatic vegetation (644) with open water interspersed throughout vegetation (Brisbin and Mowbray 2002).	Shallow freshwater (depth <6 m), migratory and wintering coots use saline and brackish habitats (Swiderek *et al.* 1988), dry land, sometimes far from water (Ripley 1977), here, graze on grasses and sprouting cultivated crops (Bent 1926).	Sleeping and roosting not often directly observed in wild birds, as most nighttime roosts are in heavy emergent macrophyte cover. On wintering grounds, regularly spend night in large communal roosts in dense stands of cattails (and other emergent macrophytes (Brisbin and Mowbray 2002).	Aquatic and non-aquatic plant material, principally pond-weeds, sedges, algae, and wild and domestic grasses (Jones 1940), heavy grazing of hydrilla (6451) (Esler 1990), aquatic invertebrates (mollusks, crustaceans, insects and their larvae) and vertebrates (fish, tadpoles, even some carrion) (Brisbin and Mowbray 2002).
Gallinula chloropus	Common Moorhen	Resident (Bannor 2002).	Freshwater marshes (641), lakes (520), reservoirs (530), and streams and waterways (510) where emergent plant cover ranges from extensive to minimal (Bannor 2002).	Commonly forages on lawns, fields, and golf courses (182) adjoining water (Bent 1926, Bull *et al.* 1985, Amos 1991).	Most nests are in robust emergent aquatic vegetation (644) (Beecher 1942, Fredrickson 1971).	Freshwater, obtains food from water surface and leaves of floating plants (Bent 1926, Cogswell 1977), commonly forages on lawns, fields, and golf courses (182) adjoining water (Bent 1926, Bull *et al.* 1985, Amos 1991).		Sedge (Cyperaceae) seeds and snails are most important (Wetmore 1916, Mulholland and Percival 1982, O'Meara *et al.* 1982, Haag *et al.* 1987).
Geothlypis trichas	Common Yellowthroat	Resident and wintering (Guzy and Ritchison, 1999).	Densely vegetated freshwater wetlands (Lowther 1993a, 1993b, 1993c).		Densely vegetated freshwater marshes (641) and upland areas (Stewart 1953, Hofslund 1959).	Forages for insects and spiders on ground and in low vegetation (Guzy and Ritchison, 1999) and in trees (Rosenberg *et al.* 1982).		Primary food sources are insects and spiders (Guzy and Ritchison, 1999).

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			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Grus canadensis pratensis	Sandhill Crane	Resident (Stys 1997.)	Freshwater marsh (641) (Tacha *et al.* 1992), transition areas between wetlands and upland habitats favored (Nesbitt and Williams 1990).	Wide-open prairies (310 and 643) (Walkinshaw 1973), sod farms (242), Improved pasture (211), golf courses (182) (Stys 1997).	Freshwater marshes (641) (with maidencane, pickerelweed, smartweeds, and rushes as the dominant vegetation) (Walkinshaw 1976, Nesbitt and Williams 1990, Depkin *et al.* 1994), typically nest over freshwater (attached or floating nests), but will nest on dry ground (Layne 1982a).	Improved pasture (211), open upland coniferous forests (410), pastureland (210), live oak (427), and freshwater marshes (641) (Walkinshaw 1949, 1973; Layne 1981, 1983; Bishop 1988).	Shallow freshwater marshes (641) (Tacha *et al.* 1992).	Omnivorous, diet includes animal and plant matter from wetlands and uplands (Stys 1997).
Haematopus palliatus	American Oystercatcher	Resident (Nol and Humphrey 1994).	Saltwater marshes (642), shorelines (652), exclusively marine environments (Nol and Humphrey 1994).	Beaches (181 and 710) and dredge spoil areas (743) (Nol and Humphrey 1994).	Saltwater marsh (642) with cordgrass, upland dunes, beaches (710), and dredge spoil areas (743) (Zaradusky 1985, Lauro and Burger 1989, Humphrey 1990).	Restricted to tidal flats (651), oyster bars (654) and/or mussel reefs (Nol and Humphrey 1994).		Yes, bivalves, mollusks, and worms—almost exclusively shellfish and other marine invertebrates that inhabit intertidal areas (Nol and Humphrey 1994.)
Haliaeetus leucocephalus	Bald Eagle	Resident and migrant (Stevenson and Anderson 1994, Curnutt1996, Mojica 2006).	Shallow open freshwater and saltwater habitats (FWC 2008, Beuhler 2000).	Upland forests (400), wetland hardwood forests (610), wetland coniferous forests (620), wetland forested mixed (630) (FWC 2008, Beuhler 2000.)	Nests occur in mature and old-growth forest (large super-canopy trees) with some habitat edge, relatively close (usually <2 km) to water with suitable foraging opportunities (Beuhler 2000).	Shallow open freshwater and saltwater habitats (FWC 2008, Beuhler 2000), roads and highways (814), solid waste disposal sites (landfills) (835) (Millsap *et al.* 2004).	Select "super-canopy" roost trees adjacent to shorelines (652), open and accessible and typically located away from human disturbance (Beuhler, 2000).	Opportunistic (FWC, 2008), 78% fish (mostly catfish), 17% birds (mostly American coot) (McEwan and Hirth 1980).
Himantopus mexicanus	Black-necked Stilt	Migrant and wintering (Robinson et. al 1999).	Edges of saltwater marshes (642), sewage ponds, or shallow inland wetlands, but usually in fresher parts of wetland with emergent aquatic vegetation (644) (including cattails, bulrush, and sedges), also flooded lowlands or permanently flooded pastures (211) (Robinson et. al 1999).	Uplands surrounding fresh and saltwater habitats (Robinson et. al 1999).	Often over water (fresh or salt) on small islands or vegetation clumps (Telfer 1975, Robinson et. al 1999).	Fresh and saltwater habitats (Robinson et. al 1999, Hamiliton 1975).		Yes, aquatic invertebrates, also fish (Robinson et. al, 1999, Hamilton 1975, Wetmore 1925).
Ixobrychus exilis	Least Bittern	Resident (Gibbs, Reid, Melvin, Poole and Lowther. 2009).	Freshwater and brackish marshes (641 and 642) with dense, tall growths of aquatic or semiaquatic vegetation (particularly *Typha, Carex, Scirpus, Sagittaria,* or *Myriscus*) interspersed with clumps of woody vegetation and open water, occasionally in saltwater marshes (641) and mangrove swamps (612) (Gibbs, Reid, Melvin, Poole and Lowther 2009).		Freshwater, nests typically built among dense, tall stands of emergent or woody vegetation (typically *Typha, Carex*, and *Scirpus*, occasionally *Phragmites, Sagittaria, Salix, Cephalanthus*, and *Rhizophora*) (Weller 1961, Palmer 1962.)	Emergent aquatic vegetation (644) along deep, open waters (Weller 1961, Swift 1989, Frederick *et al.* 1990).		Yes, small fish and insects (Gibbs *et al.* 2009), also snakes, frogs, tadpoles, salamanders, leeches, slugs, crayfish, insects (mainly Odonata and Orthoptera), small mammals (shrews and mice), and vegetable matter (Warren 1890, Bent 1926, Howell 1932, Weller 1961, Palmer 1962.)
Larus atricilla	Laughing Gull	Resident (Robertson and Woolfenden 1992).	Shorelines (652) and estuaries (540) (Burger 1996).		Sandy beaches (181, 710, 720) and islands (Bent 1921, Bongiorno 1970, Nisbet 1971, Buckley *et al.* 1978, Schreiber *et al.* 1979, White *et al.* 1983a, Burger and Gochfeld 1985).	Typically shorelines (652) at edge of water; plowed fields (Burger 1983, 1988; Burger and Wagner 1995), lakes (520) and freshwater marshes (641), saltwater marshes (642), impoundments and pools with different water depths (Burger *et al.* 1982, Burger 1988).	Roosts on inland lakes (520), bays and estuaries (520), and impoundments, as well as on open ocean (Stone 1937).	Broad diet, aquatic and terrestrial invertebrates, including earthworms, flying insects, beetles and other insects, snails, crabs, crab eggs, crab larvae, fish, squid, garbage, offal, and berries such as mulberries and blueberries (Bent 1921, Burger 1988, Patton 1988, Burger and Wagner 1995).

Species	Common Name	Resident/ migrant/ overwintering	Preferred Habitat Type		Life History needs dependent on wetlands			Primary Food Source
			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Laterallus jamaicensis	Black Rail	Resident (Eddleman *et al.* 1994).	"High" saltwater marsh (642), shallow freshwater marshes (641), wet prairies (643) (Eddleman *et al.* 1994).		Wet prairies (643), dense freshwater marshes (641), and thick saltwater marsh (642) vegetation near upper limits of high tides (Stephens 1909, Harlow 1913).	Presumably on or near substrate at edges of stands of emergent aquatic vegetation (644), saltwater marsh (642) both above and below high-tide line (Weske 1969).		Yes, small (<1 cm) aquatic and terrestrial invertebrates, seeds (Eddleman *et al.* 1994), snails (Gastropoda), insects (Weske 1969).
Mycteria americana	Wood Stork	Resident (Coulter *et al.* 1999).	Freshwater and marine-estuarine forested habitats (Rodgers *et al.* 1996), gum swamps (613), cypress swamps (621), stream and lake swamps (bottomland) (615) (Coulter *et al.* 1999).		Cypress swamps (621), gum swamps (613), willow (618), bottomland hardwood swamps (615) (Coulter *et al.* 1999).	Most available wetlands, natural and artificial wetlands where prey species are available and water depths are appropriate (<50 cm, often 10–30 cm) (Coulter *et al.* 1999), northeast Florida, palustrine forested (18.2%), estuarine emergent wetland (13.2%), lacustrine emergent wetland (13.2%), and palustrine emergent wetland (11.6%) (Rodgers 1987b).	Trees, generally over water (Pearson *et al.* 1992, Bryan 1995).	Yes, aquatic organisms, mostly fish, some plant material (seeds), insects, snails, crustaceans, grass shrimp, and crab, amphibians (largely tadpoles), reptiles (snakes and small alligators), birds (young rails and grackles) and mammals (woodrats, mice), and shrews (Coulter *et al.* 1999).
Nyctanassa violacea	Yellow Crowned Night Heron	Resident.	In coastal areas, nests on barrier, spoil (743), and bay (540) islands; inland in swamps (610), forested wetlands (610), and forested uplands (400) near lakes (520), rivers, and creeks (510) also in wooded swamps (610), mangroves (612), and along edges of lagoons (Watts 1995.)	Plowed fields (211) (Mumford and Keller 1984) and on residential lawns (Wiltraut 1994).	Often over inundated swamps, creeks (510), and canals (510) (Golsan and Holt 1914, Drennen *et al.* 1982).	Tidal marshes (642), tide pools, exposed mudflats, beaches (181 and 710), ponds, rivers and creeks (510), also in shallow water such as tidal creeks, surf, swamps, and mangroves (612)(Watts 1995), occasionally in upland sites such as plowed fields (211) (Mumford and Keller 1984) and on residential lawns (Wiltraut 1994).		Fresh- and saltwater crustaceans (Watts 1995).
Nycticorax nycticorax	Black Crowned Night Heron	Resident (Davis 1993).	Fresh, brackish, and saltwater situations appear equally suitable (Palmer 1962), swamps, streams and waterways (510), margins of pools, ponds, lakes (520), lagoons, tidal flats (651), saltwater marsh (641), man-made ditches, canals, ponds, reservoirs (30), and wet agricultural fields (Davis 1993).	Individuals sometimes use dry grasslands (Cramp 1977, Hancock and Kushlan 1984).	Nest colonially (Bailey 1915, Allen 1938, Nickell 1966), most colony sites are on islands, in swamps, or over water (Davis 1993).	Prefers shallow, weedy pond margins, creeks, and marshes (Davis 1993).		Opportunistic, leeches, earthworms, aquatic and terrestrial insects including moths, prawns and crayfish, mussels, squid, freshwater and marine fish, amphibians, lizards, snakes, rodents, birds, eggs, carrion, plant materials, garbage/refuse at landfills (Bent 1926, Kushlan 1978).
Pandion haliaetus	Osprey	Resident (Poole *et al.* 2002).	Fresh and saltwater habitats (Poole *et al.* 2002).		Wide variety of natural and artificial sites (Bent 1937, Cramp and Simmons 1980, Palmer 1988, Edwards and Collopy 1988, Poole 1989a, Ewins 1996), common features, generally, proximity to water, especially good feeding areas, openness, allowing easy access to nest, safety from ground predators, achieved by height or over-water location (islands, flooded trees, channel markers), sufficiently wide and stable base to accommodate the large nest (Poole *et al.* 2002).	Varies greatly; along coasts in saltwater marshes (642), lagoons and ponds, Estuaries (540), silted river mouths, coral reefs, inland: forages along streams and waterways (510), freshwater marshes (641), reservoirs (530), and natural ponds and lakes (520) (Poole *et al.*2002)		Yes, live fish at least 99% of prey items recorded in almost every published account, wide variety of species taken (Poole *et al.*2002).

Species	Common Name	Resident/ migrant/ overwintering	Preferred Habitat Type		Life History needs dependent on wetlands			Primary Food Source
			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Parula americana	Northern Parula	Resident (Moldenhauer *et al.* 1996).	Found in canopy and subcanopy of streams and lake swamps (bottomland) (615), especially where Spanish moss is found (Moldenhauer *et al.* 1996).		Most nests are built in hanging bunches of Spanish moss thus, nesting sites are most often in areas where these epiphytes grow, preferred nesting sites are usually near water, e.g., river bottoms, sloughs, swamps (Moldenhauer *et al.*1996).	Mainly mid- to upper-forest canopy, out on the tips of the foliage rather than near the trunk, less often on small (up to 5 mm in diameter) live twigs, occasionally forages in foliage of understory or hawks insects on the wing, rarely feeds on the ground (Bent 1953, Morse 1967).		Mostly insects and spiders (Moldenhauer *et al.* 1996).
Pelecanus occidentalis	Brown Pelican	Resident and migrant (NatureServe 2009).	Streams and waterways (510), Atlantic Ocean (571), wetland scrub (631), tidal flats (651), shorelines (652), mangrove swamps (612) (NatureServe 2009, Shields 2002).	Coastal scrub (322) (NatureServe 2009).	Mangrove s most common substrate for tree nests in Florida (Nesbitt 1996).	Shallow (<150 m depth) estuaries (540) and continental shelf, usually within 20 km of shore (Shields 2002).		Fish and some marine invertebrates (Shields 2002.)
Phalacrocorax auritus	Double-crested Cormorant	Resident and migratory (Hatch and Weseloh 1999).	Streams and waterways (510), lakes (520), reservoirs (530), bays and estuaries (540) (Hatch and Weseloh 1999).		Nests on the ground or in trees in freshwater habitat (Hatch and Weseloh 1999).	Generally feeds in shallow, open water (<8 m deep) (500) and close to shore (<5 km away) (Hatch and Weseloh 1999.)		Feeds opportunistically on fishes, sometimes aquatic invertebrates and rarely small vertebrates other than fishes (Hatch and Weseloh 1999).
Plegadis falcinellus	Glossy Ibis	Resident (Davis and Kricher 2000).	Uses a wide variety of inland wetland habitats, and to a lesser extent coastal lagoons and Estuaries (540) (Davis and Kricher 2000).		Mainly freshwater marshes (641), river-edge marshes, but also commonly observed in brackish and saltwater marshes (642), mudflats, mangrove swamps (612) and ponds (Davis and Kricher 2000).	Shallow freshwater (Frederick and McGehee 1994).		Yes, primarily aquatic invertebrates, including aquatic beetles (Coleoptera), water boatmen (Corixidae), dragonfly (Odonata) larvae, fly (Diptera) larvae, crickets and grasshoppers (Orthoptera), caddisflies (Trichoptera), worms (oligochaetes and polychaetes), leeches (Hirudinae), and various small mollusks, such as gastropods, mussels (Mytilidae), and clams (del Hoyo *et al.* 1992).
Podilymbus podiceps	Pied-billed Grebe	Resident (Muller and Storer 1999).	Freshwater marshes (641), lakes (500), and sluggish rivers (510), and, in winter, brackish estuaries (540), still bays (540), sloughs (560) (Bent 1919, Miller 1942, Yocum *et al.* 1958, Chabreck 1963, McCowan 1973, Faaborg 1976, Cramp and Simmons 1977, Kantrud and Stewart 1984, Muller 1995, Smith *et al.* 1997, Boesman 1998, J. O. Byskov in Fjeldså 1981).		Floating platform, most often placed among tall emergent aquatic vegetation (644), two overriding factors affect nest-site selection: (1) water depth >25 cm to allow for escape, feeding, and construction of floating platform; (2) emergent vegetation density, no preference as long as these two requirements were met (Krapu *et al.* 1970, Otto 1983b).	Yes, opportunistic as to kind and size of prey, takes most readily available, including fishes, crustaceans (especially crayfish [*Cambarus* spp.]), and aquatic insects and their larvae, also frogs and a large variety of fishes, insects, and other invertebrates, takes most food by diving either in open water or among aquatic vegetation, but picks some food from vegetation or the surface of water, or even catches in midair (Muller and Storer 1999).		Opportunistic as to kind and size of prey, takes most readily available, including fishes, crustaceans (especially crayfish [*Cambarus* spp.]), and aquatic insects and their larvae (Muller and Storer 1999).
Porphyrio martinica	Purple Gallinule	Resident and wintering (Am. Ornithol. Union 1998).	Primarily freshwater marshes (641), shallow edges of lakes (520), and impoundments (primarily coastal, but also inland), with stable water levels and dense stands of floating vegetation (Helm 1994).		Primarily freshwater marshes (641), shallow edges of lakes (520) (West 2002).	Feeds in a circular pattern near periphery of emergent vegetation (Bell 1976).		Seeds, flowers, fruits, and other nutritious parts of aquatic plants (Helm 1994), animal material when available, especially arthropods, annelids, and mollusks, sometimes >50% of diet in spring and summer (Mulholland and Percival 1982).

Species	Common Name	Resident/ migrant/ overwintering	Preferred Habitat Type		Life History needs dependent on wetlands			Primary Food Source
			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Protonotaria citrea	Prothonotary Warbler	Resident (Thompson and Ely 1992, Dunn and Garrett 1997).	Standing or slow-moving water, including seasonally flooded bottomland hardwood forest (615), cypress swamps (621), and large rivers (510) or lakes (520) (Walkinshaw 1953, Blem and Blem 1991), mangrove swamps (612) (Russell 1980, Lefebvre *et al.* 1992, 1994).	Residential areas (110 to 130), wooded stream corridors, pasture (211) lands near coastal areas (Keast and Morton 1980, Faaborg and Arendt 1984).	Nests in abandoned Downy Woodpecker hole or other natural cavity in dead snag or branch of live tree, cypress knees where available (Petit 1999), also known to use abandoned open nests of other species (Conway 1946, Petit and Petit 1988b), nest site almost always over or within 5 m of standing water or in low-lying, easily flooded areas (Kahl *et al.* 1985, Blem and Blem 1991).	Bottomland hardwood forest (615), cypress swamps (621), mangrove swamps (612) (Petit 1999).		Primarily insectivorous throughout annual cycle (butterflies and moths [Lepidoptera], flies [Diptera], beetles [Coleoptera], and spiders [Araneae]), but also mollusks (Mollusca) and isopods (Isopoda) (Petit 1999).
Quiscalus major	Boat-tailed Grackle	Resident (Post *et al.* 1996).	Freshwater (641) and saltwater marshes (642) (Post *et al.* 1996).	Contiguous open upland habitats (Post *et al.* 1996).	Freshwater marshes (641), rivers (510), lakes (520), impoundments, or ponds, upland areas near water (Post et al 1996), most nests found in freshwater or brackish marshes in emergent vegetation or small bushes growing in water, usually on islands or narrow peninsulas, alligators often present (Audubon 1834, McIlhenny 1937, Bancroft 1983, Post and Seals 1991), dense groves of mixed saw-palmetto (*Serenoa repens*) and wax myrtle (*Myrica cerifera*) in middle of pastures (Post *et al.* 1996).	Wetlands and uplands, wide variety of aquatic and terrestrial substrates used; salt and Freshwater, beaches (181, 710), roadsides (814), parking lots (818), garbage dumps 835), cultivated fields, and cattle feedlots (Post *et al.* 1996).		Omnivore, arthropods, crustacea, mollusks, frogs, turtles, lizards, grain, fruit, tubers, and food scavenged from humans and domestic animals (Post *et al.* 1996).
Rallus elegans	King Rail	Resident (Poole *et al.* 2005).	Tidal freshwater and brackish marshes (641 and 642), nontidal freshwater marshes (641), successional stages of marsh-shrub swamp (6417), cattail (6412) (Poole *et al.* 2005).	Upland fields near water (Poole *et al.* 2005).	Shallow water in tidal and nontidal marshes (641 and 642); broad roadside ditches with cattails, grasses, and sedges, occasionally shrub swamps (631) (Poole et al 2005).	Usually obtain food from aquatic habitats, but when feeding on land near water often carry food to water and immerse it before ingestion (Poole et al 2005).		Yes, crustaceans most important food, aquatic insects, fish, frogs, grasshoppers, crickets, and seeds of aquatic plants (Poole et al 2005).
Rallus longirostris	Clapper Rail	Resident (Eddleman and Conway 1998).	Saltwater marshes (642), mangrove swamps (612) (Poole *et al.* 2005), coastal wetlands dominated by cordgrass (6421), pickerelweed (641), or mangroves (612) (Meanley 1985).		Fresh- and saltwater marsh (642, 641), mangroves (612) (Eddleman and Conway, 1998).	Emergent vegetation or mangroves (612), or along edges between marsh and mudflats (Clark and Lewis 1983, Meanley 1985, Zembal and Fancher 1988).		Highly opportunistic, eats small crabs, slugs, minnows, aquatic insects, grasshoppers, small vertebrates, seeds (Simmons 1914), amphipods (Test and Test 1942), other bird's eggs (Segre *et al.* 1968), and occasionally immobilized small birds (Spendelow and Spendelow 1980, Jorgensen and Ferguson 1982.)

Species	Common Name	Resident/ migrant/ overwintering	Preferred Habitat Type		Life History needs dependent on wetlands			Primary Food Source
			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Rostrhamus sociabilis plumbeus	Snail Kite	Resident.	Large inland freshwater marshes (641), edges of shallow lakes (520), and other flat water courses with marsh edge where apple snails can be found (Sykes *et al.* 1995).		Nest is almost always built over water (Sykes 1987b), inland flooded freshwater marshes (641) and other freshwater wetlands (Sykes *et al.* 1995).	Forages over open-water patches dispersed among Emergent Aquatic (644) marsh vegetation, shallow Lake (520) edge, ponds, ephemeral wetlands (653), or along shallow banks of rivers (510), Borrow Pits (742), canals (Sykes *et al.*1995)		Yes, primarily apple snails (Cottam and Knappen 1939, Stieglitz and Thompson 1967, Snyder and Snyder 1969, Sykes and Kale 1974, Sykes 1987a).
Rynchops niger	Black Skimmer	Resident (Gochfeld and Burger 1994).	Almost exclusively coastal (Gochfeld and Burger 1994).		In Florida, nests mainly on natural sandy (181, 710, 720) or on dredge spoil (742) islands and on berms along highways (Schreiber and Schreiber 1978), occasionally on gravel roofs (in Florida since 1986) (Gore 1991, Greene and Kale 1976, Fisk 1978, Gore 1987).	Mainly tidal waters of bays and estuaries (540), lagoons, rivers (510), and salt marsh pools (642), creeks, and ditches (510) (Valiela 1984).		Yes, variety of fish, particularly killifish (Fundulus spp.), herrings, pipefish (Sygnathus sp.) (Bent 1921, Burger and Gochfeld 1990), also may take small crustaceans (Tomkins 1933, Leavitt 1957).
Scolopax minor	American Woodcock	Resident and wintering (Keppie and Whiting 1994).	Bottomland hardwoods (615) (Keppie and Whiting 1994).	Upland mixed pine-hardwoods (415), mature longleaf pine (411) recently burned (Keppie and Whiting 1994), pastures and open fields (NatureServe 2009).	Closely associated with young, second-growth hardwoods and other early-successional habitats that are a result of periodic forest disturbance (Straw *et al.* 1994), ideal habitat consists of young forests and abandoned farmland mixed with forested land (Keppie and Whiting 1994).	Young hardwoods on moist soils (NatureServe 2009).		Invertebrates comprise 80% of diet by volume (Sperry 1940) and frequency of occurrence, particularly earthworms (Keppie and Whiting 1994).
Sterna antillarum	Least Tern	.	Rivers (510), estuaries (540), tidal flats (651) and shorelines (652) (Ganier 1930, Downing 1973, Massey 1974, Jackson 1976, Burger 1984, Sidle *et al.* 1988, Burger and Gochfeld 1990a, Smith and Renken 1991).	Beaches (181, 710) (Burger and Gochfeld 1990a).	Beaches (181, 710), usually nests on ridges or other slightly elevated spots on sand (Burger and Gochfeld 1990a).	Shallow-water bays (540), lagoons, estuaries(540), river and creek (510) mouths, tidal marshes (651), and lakes (520), sloughs (560), freshwater marshes (641), ponds, and reservoirs (530) (Thompson, *et al.* 1997).		Yes, primarily small fishes, but also shrimp and occasionally other invertebrates (Thompson *et al.* 1997), >50 fish species listed as prey (Atwood and Kelly 1984).
Sterna maxima	Royal Tern	Resident (Buckley and Buckley 2002).	Coastal wetlands (Buckley and Buckley 2002).	Beaches (181, 710) and shorelines (Buckley and Buckley 2002).	Sandy substrate, four site requisites: (1) absence of quadruped predators; (2) inaccessibility and excellent visibility of surroundings; (3) extensive areas of adjacent shallows for feeding; (4) location at or near oceanic inlet (Buckley and Buckley 2002).	Forages over shallow inshore saltwater, forages heavily in back bays (540) and lagoons and tidal creeks (Buckley and Buckley 2002).		Yes, fish, augmented by crustaceans, particularly shrimp (Buckley and Buckley 2002).
Sterna nilotica	Gull-billed Tern	Breeding (Molina *et al.* 2009).	Coastal beaches (710), fresh and saltwater marshes (641 / 642), estuaries (540) (Molina *et al.*2009).	Sandy beaches (181, 710), plowed fields (210) (Molina *et al.* 2009).	Sandy beaches (181, 710) or on sandy barrier islands in coastal waters, especially near ocean inlets (Portnoy 1977, Chaney *et al.* 1978, Schreiber and Schreiber 1978, Parnell and Soots 1979).	Beaches (181. 710) and salt marshes (642), plowed fields (210) (Bogliani *et al.* 1990) and shrubby habitats (Rohwer and Woolfenden 1968).		An opportunistic feeder on many kinds of terrestrial and aquatic animals (Molina *et al.* 2009), marine and terrestrial invertebrates often comprise major portion of diet (Quinn and Wiggins 1990, Erwin *et al.* 1998a, Molina and Marschalek 2003, Molina 2009), also takes crayfish, lizards, amphibians, fish, occasionally chicks of other birds (Molina *et al.* 2009).

Species	Common Name	Resident/ migrant/ overwintering	Preferred Habitat Type		Life History needs dependent on wetlands			Primary Food Source
			Wetland	Upland	Nesting	Foraging	Roosting	Wetland dependent?
Strix varia	Barred Owl	Resident (Mazur and James 2000).	Forested wetlands (610 and 620) (Mazur and James 2000).	Upland forests (400) (Mazur and James 2000).	Mature and old forest typical nest habitat, including a wide range of forest types, both conifer and hardwood (Bent 1938, Devereux and Mosher 1984, Johnson 1987, Nicholls and Fuller 1987, Takats 1998), nest sites found in areas with well-developed understory (Devereux and Mosher 1984).	Forested wetlands (610 and 620), upland forests (400) (Mazur and James 2000).		An opportunistic predator, consuming small mammals and rabbits, birds up to the size of grouse, amphibians, reptiles, and invertebrates (Mazur and James 2000).

Table 3.2.4 Summary of Selected Characteristics of the Wetland Dependent Mammals of the Matanzas Basin Study Area

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning / Roosts	Wetland Dependent?
Castor canadensis	Beaver	Resident (Natureserve 2009)	Streams and Waterways (510), Lakes (520), Reservoirs (530), Wetland Hardwood Forest (610), Stream and Lake Swamps (615), Freshwater Marshes (641), Wet Prairies (643), Emergent Aquatic Vegetation (644) (Natureserve 2009)	N/A	Reproductive and cover requirements for the beaver are the same as for denning (Allen 1982)	Most of the food source requires aquatic habitat to grow (Allen 1982)	Build lodges in shallow waters, banks, or on islands, using tree branches and mud for sleeping and raising young, must be near deeper water for food source (Natureserve 2009)	Herbivore, primary food source woody plants including willow, sweetgum, pond lilies, duckweed, and algae (Natureserve 2009)
Eptesicus fuscus	Big Brown Bat	Resident (NatureServe 2009)	Riparian habitats including Stream and Lake Swamps (615) (Natureserve 2009)	Various wooded and semi-open habitats, including cities, much more abundant in regions dominated by deciduous forest (Upland Hardwood Forest (420) and Mixed Hardwoods (438)) than in coniferous forest areas (Natureserve 2009); cities, towns, and rural areas, but is least commonly found in heavily forested regions (Kurta 1995)	Maternity colonies form in attics, barns and occasionally tree cavities (Natureserve 2009)	Forages over land or water (Schmidly 1991)	Riparian habitats including (615) (Natureserve 2009)	An insectivore that is a generalist in foraging habitat; forages over land or water, clearings and lake edges; may forage around lights in rural areas, seems to prefer foraging among tree foliage rather than above or below the forest canopy (Schmidly 1991)
Lasionycteris noctivagans	Silver Haired Bat	Migrant-winter (Natureserve 2009)	Riparian (Streams and Lakes Swamps (615)) habitats, prefers forested (frequently coniferous) areas adjacent to Lakes (520), ponds, and streams (510) (Natureserve 2009)	Forest - Upland Conifer (410), Upland Hardwood (420), Mixed Hardwood (438), during migration, sometimes occurs in xeric areas (Natureserve 2009)	Summer roosts and nursery sites are in tree foliage, cavities, or under loose bark, sometimes in buildings, young are born and reared in tree cavities or similar situations (Natureserve 2009)	Forages for small to medium-size flying insects over small water bodies within forested areas (Natureserve 2009)	Standing snag/hollow trees within existing habitat (Natureserve 2009)	Insectivore - small to medium-size flying insects over small water bodies within forested areas (Natureserve2009).
Lasiurus borealis	Eastern Red Bat	Resident (Natureserve 2009)	Riparian habitats (Natureserve 2009)	Forested areas, wooded hedgerows, and areas with large shade trees (e.g., city parks), summer roosts usually are in tree foliage or in Spanish moss, 1.5 -6 m above ground; site must be open underneath to allow easy exit and entry (Natureserve 2009); standing snag/hollow tree (Natureserve 2009)	Solitary females roosts with young in tree foliage (Natureserve 2009)	Forested areas near forest canopy at or above treetop level (Schmidly 1991); along Streams (510) or Lake (520) margins (Natureserve 2009)	During the day they commonly roost in edge habitats adjacent to Streams and Waterways (510), open fields, and in urban areas (Constantine 1958, 1959, 1966, Kunz 1971, Mumford 1973)	Insectivore -classes represented include Homoptera, Coleoptera, Hymenoptera, Diptera, and Lepidoptera have been found in the stomachs of red bats (Mumford 1973, Ross 1967)
Lasiurus cinereus	Hoary Bat	Non-breeding resident - Migrant (InfoNature 2007)	Prefers deciduous and coniferous forests (410) and woodlands (InfoNature 2007)	Prefers deciduous and coniferous forests (410) and woodlands (InfoNature 2007)	Solitary females with young roost among tree foliage; female may use same site in successive years (Natureserve 2009)	Hunts relatively large insects in open areas in meadows, over streams and rivers (510), or above stands of trees at canopy level (InfoNature 2007)	Hibernating individuals have been found on tree trunks, in a tree cavity, in a squirrel's nest, and in a clump of Spanish-moss (InfoNature 2007)	Insectivore - forages near roosting areas (InfoNature 2007)
Lasiurus seminolus	Seminole Bat	Resident (Wilkins 1987)	Lowland forests and Stream and Lake Swamps (615) (Ivey 1959, Jennings 1958, Moore 1949, Zinn 1977); Spanish moss important (Natureserve 2009)	Upland Coniferous Forest (410), Upland Hardwood Forest (420), Hardwood- Conifer Mixed (434), grassland/herbaceous, old field, savanna (Natureserve 2009); Spanish moss important (Natureserve 2009)	Roosting is more common in pine trees, especially during parturition and lactation (Constantine 1958 and 1966, Barbour and Davis 1969, Menzel *et al.* 1998)	Forages over water, clearings, and woods (Natureserve 2009)		Insects (Barbour and Davis 1969); inlcuding homopterans (Jassidae), dipterans (Dolichopodidae, Muscidae), and coleopterans (Scolytidae; Sherman 1939)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning / Roosts	Wetland Dependent?
Lutra canadensis	River Otter	Resident (Natureserve 2009)	Streams and waterways (510), Lakes (520), Bay and Estuary (540), Wetland Hardwood Forest (610), Stream and Lake Swamps (615), Inland Ponds and Sloughs (616), Cypress (621), Wetland Scrub (631), Freshwater Marshes (641), Wet Prairies (643), Emergent Aquatic Vegetation (644) (Boyle 2006)	Uplands near wetland habitats (Natureserve 2009)	Uses dens of other aquatic mammals to give birth (beaver dens) (Boyle, 2006)	Primary food source is fish thus foraging occurs in the water (Hill, 1994)	Den in hollow logs, rock crevices, abandoned beaver lodges and bank dens (Natureserve 2009)	Yes, feeds opportunistically on aquatic animals, particularly fishes (mostly slow-moving, mid-size species), frogs, crayfish, turtles, insects, etc., sometimes birds and small mammals. In coastal waters eats marine species (Natureserve 2009)
Lynx rufus	Bobcat	Resident (Natureserve, 2009)	Wetlands (600) (MyFWC.com, 2009)	Upland Forests (400) (MyFWC.com, 2009)	Young are born in a den in a hollow log, under a fallen tree, in a rock shelter, or similar site (Natureserve 2009)	Uses wetlands to obtain food source but will also forage in upland areas (Mallow 2009)	N/A	Prefers small mammals, especially lagomorphs, occasionally birds, other vertebrates, and carrion (Natureserve 2009)
Myotis grisescens	Gray Bat	Resident (NatureServe 2003)	Forested riparian habitats (Natureserve 2009)	Gray bats are restricted entirely to areas with caves or cave-like habitats, limestone karst areas of the southeastern United States (Tuttle 1986, U.S. Fish and Wildlife Service 1997)	Maternity caves often have a stream flowing through them (Natureserve 2009)	Foraging is generally parallel to streams, over the water at heights of 2 to 3 m (LaVal *et al.* 1977)		Insectivore - feeds mostly upon flying insects, including mayflies and beetles (Lacki *et al.* 1995)
Myotis lucifugus	Little Brown Bat	Resident (NatureServe 2009)	Forested and non-forested wetlands (600 and 615) (Natureserve 2009)	Upland Hardwood Forest (420), Unimproved Pasture (212), Cropland and Pastureland (210), Tree Crops (220), Herbaceous Dry Prairie (310), and Shrub and Brushland (320) (Natureserve, 2009).	Has adapted to using human-made structures for resting and maternity sites; also uses caves and hollow trees (Natureserve 2009)	Foraging habitat requirements are generalized; usually forages in woodlands near water (Natureserve 2009); often hunts over water or along the margins of Lakes (520) and Streams (510) (Natureserve 2009)	Standing snag/hollow trees, caves and has adapted to using human made structures for roosting (Natureserve 2009)	Consumes flying insects, especially mosquitoes, midges, caddisflies, moths, various hoppers, and smaller beetles, sometimes spiders (Whitaker and Lawhead 1992)
Neofiber alleni	Round Tailed Muskrat	Resident (Natureserve 2009)	Vegetated Non-Forested Wetlands (640), Freshwater marshes (641), Wet Prairies (643 -Salt or Freshwater with water depth between 6- 18 inches (Birkenholz 1972); dense stands of maidencane and pickerelweed provide preferred habitat (Layne 1978)	Herbaceous Dry Prairie (310) (Birkenholz 1972)	Dome-shaped houses, used for shelter and rearing young, are built among emergent vegetation; most house repair and new construction occur in spring (Natureserve 2009)	Primary food source is maidencane, *Saggittaria, Pontederia, Nympha*, etc.found in 641-Freshwater marshes; Construct feeding stands on emergent vegetation (Birkenholz, 1972)	Dome-shaped houses, used for shelter and rearing young, are built among emergent vegetation; most house repair and new construction occur in spring (Natureserve 2009)	Yes, roots and stems of aquatic and semiaquatic vegetation; major food plants include arrowheads, pickerelweed, water lilies, maidencane, cut-grass, sedges, and wet grasses (Natureserve 2009)
Neotoma floridana	Eastern Woodrat	Resident (Natureserve 2009)	Stream and Lake Swamps (615), Wetland Coniferous Forests (620), Wetland hardwood forests (610) (Bunch 2009); Florida - greatest abundance in ecotones between dry and wet hammocks (Pearson 1952)	Upland forests (400), Pine Flatwoods (411) (Bunch 2009); Upland Hardwood Forest (420), Hardwood-Conifer Mixed (434), Upland Coniferous Forest (410) (Natureserve 2009)	Wet areas in hammocks and densely vegetated swamps, where nests are built in hollow trees or along stream banks in dense tangles of cabbage palmetto (Golley 1962, Hamilton and Whittaker 1979).	Foraging range (up to approximately 200 m from the nest site) where hard and soft mast is available (Natureserve 2009)		Frugivore, Granivore, Herbivore (Natureserve 2009); seeds, nuts, fruits, fungi, buds, stems, roots, and foliage occasionally eats invertebrates (Schwartz and Schwartz 1981)
Neovison vison lutensis	Mink	Resident (Natureserve 2009)	Saltwater Marshes (642) and estuarine zone at the mouths of Streams and Waterways (510) (Layne 1978, Humphrey and Setzer 1989)	Upland immediately adjacent to wetland (Natureserve 2009)	Dens in muskrat burrow, abandoned beaver den, hollow log, hole under tree roots, or in burrow dug by mink in streambank (Natureserve 2009)	Favors forested, permanent or semipermanent wetlands with abundant cover, marshes, and riparian zones (Natureserve, 2009)	Dens in muskrat burrow, abandoned beaver den, hollow log, hole under tree roots, or in burrow dug by mink in streambank (Natureserve 2009).	Small mammals, other vertebrates (e.g., waterfowl), crayfish, and small vertebrates associated with aquatic/riparian ecosystems (Natureserve 2009)

Species	Common Name	Resident/ Migrant/ Overwintering	Preferred Habitat Type					Primary Food Source
			Wetland	Upland	Reproduction	Foraging	Denning / Roosts	Wetland Dependent?
Ochrotomys nuttalli	Golden mouse	Resident (Natureserve 2009)	Stream and Lake Swamps (615), Mixed Wetland Hardwoods (617), Cypress (621) (Hofman 1986)	Upland Forest (400) (Hofman 1986)	Builds nests and feeding platforms on the ground and above ground in the understory, young are born in nests that usually are a few inches to 15 feet above ground in bushes and vines (Natureserve 2009)	Forages in trees (Natureserve 2009)		Primarily eats insects, seeds, nuts, and grains (Linzey 1968)
Oryzomys palustris	Marsh rice rat	Resident (Natureserve 2009)	Stream and Lake Swamps (615), Freshwater Marshes (641), Saltwater Marshes (642) (Hofman 1986)	Cropland/hedgerow, Grassland/herbaceous (Natureserve 2009); uplands bordering wetlands may be important as refuges during high tides (Kruchek 2004)	Nests are placed in grassy vegetation under debris, or woven in aquatic emergents a foot or more above the high water line (Natureserve 2009)	Food source comes from primary wetland dependant [vegetative] species (Kruchek 2004)		Granivore, Invertivore, prefers rice, seeds of herbaceous plants (Natureserve 2009); when available (in season), arthropods make up 75% of diet (Negus *et al.* 1961)
Procyon lotor	Raccoon	Resident (Natureserve 2009)	Wetland Hardwood Forest (610), Wetland Coniferous Forests (620), Vegetated Non-Forested Wetlands(640) (Dewey2001)	Upland Forests (400), Upland Coniferous Forests (410) (Goldman1950)	Dens under logs or rock, in tree hole, ground burrow, or in bank den (Armstrong 1975)	Often forages along streams, obtains most food on or near ground near water (Natureserve 2009)	Dens under logs or rock, in tree hole, ground burrow, or in bank den (Armstrong 1975)	Opportunistic omnivore; eats fruits, nuts, insects, small mammals, bird eggs and nestlings, reptile eggs, frogs, fishes, aquatic invertebrates, worms, garbage, etc.--whatever is available (Natureserve, 2009)
Sorex longirostris	Southeastern shrew	Resident (Natureserve 2009)	Cypress (621), Bay Swamps (611), Wetland Hardwood Forests (610) (French 1980)	Slash Pine (410), Pine Flatwoods (411), Longleaf Pine Sandhills (412), 1994s, Xeric Hammocks (421), Sand Pine Scrub (436) (French, 1980)		Most of the food source requires aquatic habitat (Natureserve 2009)	Will burrow in wetlands or uplands (French 1980)	Important food items include spiders, lepidoptera (butterfly/moth) larvae, slugs and snails, vegetation, coleoptera, earthworms and centipedes. (Natureserve 2009)
Sylvilagus palustris	Marsh rabbit	Resident (Natureserve2009)	Freshwater Marshes (641), Saltwater Marshes (642) (Chapman 1981); riparian habitat, inland Lakes (520) (Natureserve 2009)	Uplands adjacent to wetlands (Natureserve 2009)	Nests usually are in grassy vegetation adjacent to water bodies Natureserve 2009)	Freshwater Marshes (641), Saltwater Marshes (642), riparian habitat, inland Lakes (520) (Natureserve 2009)		Feeds on a variety of plant material (grasses, forbs, leaves, twigs), much of it aquatic emergent (Thompson 2008); primarily eats wetland dependant species but if unavailable will eat upland plants such as *Smilax* (Chapman 1981)
Ursus americanus	Black bear	Resident (Natureserve 2009)	Cypress (621), Mixed Wetland Hardwoods (617), Wetland Hardwood Forest (610) (Maehr 2001)	Pine Flatwoods (411), Cabbage Palm Forest (428), Mixed Hardwoods (438), Upland Scrub (436), Pine and Hardwoods (Maehr 2001	Young are born in a den in dense cover or hollow tree, in hardwood swamp or dense thicket (Wooding and Hardisky 1992)	Will forage in wetland if unsuitable upland habitat present (Maehr 2001)	Dens in thick shrub/vines cover in remote wetlands or uplands sometimes in hollow trees (Maehr and Wooding 1992)	Opportunistic omnivore, fruits and hearts of saw palmetto and cabbage palm, and the fruits of swamp tupelo, oaks, blueberry, and gallberry (Natureserve 2009)

3.2.1. Amphibians - Additional Information

Ambystoma cingulatum **- Flatwoods Salamander**

Flatwoods salamanders are listed as threatened by the federal government (USFWS, 1997c), The main threat to this species appears to be habitat alteration (Means et al., 1996).

Conservation Recommendations: Protect natural upland habitat, with no roads or firebreaks, for at least 1.5 mi. (2.5 km) around breeding ponds, and maintain broad natural connections among breeding sites. Eliminate or control feral hogs, which disrupt habitat and may even eat salamanders. (FNAI 2001)

Salamanders of the *Ambystoma cingulatum/bishopi* complex migrate up to hundreds of meters between breeding and nonbreeding habitats; Ashton (1992) mentioned movements of over 1,700 meters. Migrations to breeding sites occur at night in conjunction with rains and passing cold fronts from mid-fall through early winter (Means 1972, Anderson and Williamson 1976) (Nature Serve 2009)

Observations of home range size are limited to Ashton (1992) who determined that the activity range of one individual encompassed 1,500 m2 (AmphibiaWeb 2009).

Bufo quercicus **- Oak Toad**

Oak toads prefer areas without permanent water and well to poorly drained soils (Fred Punzo - AmphibiaWeb 2009)

Bufo terrestris **- Southern Toad**

Southern toads tolerate humans well, and Ashton and Ashton (1988) note that they are a common yard and garden toad.

Hyla cinerea **- Green Treefrog**

Movements from upland habitats into adjacent wetlands have been reported (Goin 1958).

Hyla gratiosa **- Barking Tree Frog**

Barking treefrogs burrow into sandy substrates in Georgia and Florida and use gopher tortoise (*Gopherus polyphemus*) burrows and other burrows for overwintering (Neil 1952, Joseph C. Mitchell, AmphibiaWeb)

Hyla squirella **- Squirrel Tree Frog**

Neill (1951a) noted that many squirrel treefrogs found in bromeliad plants are recently metamorphosed animals.

***Plethodon grobmani* - Southeastern Slimy Salamander**

Southeastern slimy salamanders do not require pristine habitats or old-growth forests and are often found under discarded rubbish. There may be a minimum size wood lot necessary as they are absent from small wood lots (Lazell, J 1994. Recognition characters and juxtaposition of Florida and Mississippi slimy salamanders (Plethodon glutinosus complex). Florida Scientist 57:129–140).

Home Range Size. Individuals are sedentary, rarely moving > 60 cm from their original capture and release sites (Highton, R. 1956. The life history of the slimy salamander, *Plethodon glutinosus*, in Florida. Copeia 1956:75–93.).

Southeastern slimy salamanders are relatively resilient to disturbances, such as those associated with timbering operations, and are frequently found in second-growth forests and relatively small, fragmented woodlots (Lazell 1994; D.A.B., personal observation (David A. Beamer, Department of Biology, East Carolina University, Greenville, North Carolina 27858).

As with all species of *Plethodon*, southeastern slimy salamanders do not migrate or have large home ranges. Thus, they can exist in habitats of smaller size than many other amphibian species. However, there may be a minimum size habitat necessary, as they are absent from small wood lots (Lazell, 1994).

***Pseudacris nigrita* - Southern Chorus Frog**

These frogs prefer xeric habitats that are only occasionally inundated (Schwartz 1957a; Duellman and Schwartz 1958).

***Pseudacris ornata* - Ornate Chorus Frog**

Means and Means (2000) found that the number of breeding populations of ornate chorus frogs in the Munson Sand Hills of panhandle Florida occur in much lower densities on silvicultural lands than in nearby native habitat. They hypothesized that elimination or severe alteration of the upland habitat, resulting from intensive soil disturbance, is the principal reason. This is corroborated by a 1996–'98 rare amphibian survey conducted at 444 sites on industrial forest lands in south Georgia, south Alabama, and north Florida (Wigley et al., 1999). This study revealed that ponds where ornate chorus frogs were found had a substantially lower frequency of intensive site preparation in pond edges and surrounding upland habitats than those ponds where this species was not detected. Further, ornate chorus frogs were substantially less likely to be present if bedding had been used in primary upland stands. (Nature Serve 2009)

Home Range Size. About 100 m2 (Ashton and Ashton, 1988).

***Rana capito* - Gopher Frog**

Home Range Size. - Franz et al. (1988) documented a 2-km movement between an upland retreat and a breeding site in Florida. Phillips (1995) followed two adults for 43 d at a Georgia site and found that both remained within a 10-m radius of the specific burrow they selected. Blihovde (1999) also found strong burrow fidelity, especially among females, at sites monitored in central Florida.

In terrestrial habitats, rarely is > 1 individual in occupancy of a single burrow (Wright and Wright 1949; R. Franz, personal communication).

The greatest threat to gopher frogs is the loss and alteration of both upland and wetland habitats resulting from commercial, residential, silvicultural, and agricultural development, as well as from fire suppression. Exclusion and suppression of fire from wetlands and the concomitant build-up of peat may also threaten gopher frogs by increasing water acidity past tolerance levels (Smith and Braswell 1994). The introduction of predacious fish into gopher frog breeding ponds may render these ponds useless for successful reproduction. In areas where gopher frogs rely heavily on the burrows of gopher tortoises for refuge, tortoise declines may reduce gopher frog populations as well. The practice of removing tree stumps ("stumping") in silvicultural areas further reduces the availability of subterranean retreats. (Nature Serve 2009)

***Rana catesbeiana* - Bullfrog**

Today many native bullfrog populations appear to be declining, with habitat loss and degradation, water pollution, and pesticide contamination (see "Conservation" below) commonly invoked as causal factors (United States, Bury and Whelan). Wetland drainage, shoreline development, and damage to the wetland fringes of lakes from home building and recreation have greatly decreased bullfrog habitat quality and availability in many areas (Bury and Whelan 1984).

***Rana grylio* - Pig Frog**

Pig frogs, unlike most other anuran species, are positively affected by residential development. For example, Delis et al. (1996) found higher abundances of pig frogs in a developed area that was once pine flatwoods than an adjacent pine flatwoods habitat. (Nature Serve 2009)

***Scaphiopus holbrookii* - Spadefoot Toad**

Home Range Size. Eastern spadefoot toads have an average home range of 10.1 m2 (108.4 ft2; Pearson, 1955).

***Siren intermedia* - Lesser Siren**

Lesser sirens are primarily aquatic, but they have been found on land beneath brush piles and under logs and can move overland on occasion, as they will colonize artificial ponds that have never had a direct connection with natural habitats (Minton, 1972, 2001). Although lesser sirens survive droughts by aestivation in an underground cocoon, they may also migrate to other water bodies. During an unprecedented drought in Louisiana, a lesser siren was collected under oak leaves in flat, mixed woodland about 600 m from the fringe of marshes and cypress swamps (its normal habitat) which border Lake Pontchartrain (Viosca 1924b). Further, it is possible that lesser sirens forage on land or migrate to other habitats during rains. (Nature Serve 2009)

3.2.2. Reptiles - Additional Information

***Drymarchon corais couperi* - Eastern Indigo Snake**

During warm weather, the indigo snake will utilize a range of 370 acres on average; during cold weather, the indigo snake will only utilize 50 or fewer acres (Bartlett and Bartlett 2003).

***Farancia abacura abacura* - Eastern Mud Snake**

When Barometric pressure is low, the snakes may move from one body of water to the next (Bartlett and Bartlett 2003)

***Nerodia floridana* - Florida Green Watersnake**

Savannah River Ecology Laboratory states populations inhabiting isolated wetlands are more severely impacted by drought than any other watersnake. (Bloom, Deigel et al. 1995, Willson et al. 2006)

***Storeria dekayi victa* - Florida Brown Snake**

Prefers moist, but not wet habitats (Bartlett and Bartlett 2003)

***Storeria occipitomaculata obscura* - Florida Redbelly Snake**

Research at the Savannah River Ecology Lab has shown that this species tracks the changing wetland boundaries of wetlands as they fill and dry, probably due to the fact that the slugs (primary food source) are reliant on the wetland. (Overduijin, Semlitsch and Moran 1983, Willson and Dorcas 2004)

3.2.3. Birds - Additional Information

***Agelaius phoeniceus* - Red-winged Blackbird**

The structure of the marsh vegetation is an important feature in the breeding ecology of Red-winged Blackbirds (Robertson 1972).

Breeding populations of Red-winged Blackbirds respond to the differences in vegetation structure, phenology, and other associated niche parameters by nesting earlier, more synchronously, and in greater density in marsh than in upland habitat (Robertson 1972).

Red-winged Blackbirds nest in a wide variety of habitat, but most nests are located in emergent vegetation, particularly cattails (Orians 1961).

Marsh nesting populations had greater success than those in uplands because of a smaller proportion of nests destroyed by predators. Predation pressure in marshes was negatively correlated with the depth of water beneath the nest, and the synchrony and density of nests in marshes in some cases has a swamping effect on local predator populations. The structure and phenology of marsh compared with upland vegetation is an important factor in determining nesting density and synchrony (Robertson 1972).

***Aix sponsa* - Wood Duck**

Breeding: Interspersion of flooded shrubs, water-tolerant trees, and small areas of open water resulting in about 50–75% cover are favored. Scrub/shrub wetlands with overhead cover of downed timber and woody shrubs such as buttonbush (*Cephalanthus occidentalis*), willow (*Salix* spp.), and alder (*Alnus* spp.) are used extensively (McGilvrey 1968, Tolle 1973, Hepp and Hair 1977). Wetlands with dense stands of emergent plants such as bur-reed (*Sparganium americanum*), arrow arum (*Peltandra virginica*), duck potato (*Sagittaria* spp.), smartweeds (*Polygonum* spp.), and American lotus (*Nelumbo lutea*) are also important (Hepp and Bellrose 1995).

Artificial Nesting Structures: Readily used and may enhance local populations (Bellrose 1955, Soulliere 1990a). May be made or placed so as to provide safer nest sites than natural cavities (Hepp and Bellrose 1995).

Lack of wetland foods often results in ducks seeking acorns in upland groves, nuts in orchards, grains in harvested fields (Bellrose and Holm 1994).

Birds prefer sites close to or over water and near good brood-rearing areas; depending on availability of cavities, will use nest sites within 2 km of water (Bellrose 1976b).

***Anas fulvigula* - Mottled Duck**

Mottled Ducks also inhabit mosquito control impoundments in coastal areas (Stieglitz and Wilson 1968, LaHart and Cornwell 1969, Breininger and Smith 1990).

This duck selects water < 15 cm deep and inhabits the same locations and environments year-round, except when using more permanent wetlands during remigial molt and when forced to move to more permanent wetlands during the winter dry-season (Fogarty and LaHart 1971, Johnson et al. 1991, Gray 1993, Johnson 1973).

***Anhinga anhinga* - Anhinga**

Nests are nearly always over water, often in colonial nesting situations, usually with perches nearby (Frederick and Siegel-Causey 2000).

Generally not found in extensive areas of open water, though may nest on edges of open bays and lakes (Frederick and Siegel-Causey 2000). Breeding colonies generally found in fresh water, often in association with other waterbirds, such as herons, egrets, ibises, storks, and cormorants; may breed in saltwater colonies and feed in fresh water (e.g., Tampa Bay, Florida; Cuthbert Lake, Florida) Stevenson and Anderson 1994).

***Aramus guarauna* - Limpkin**

Wetland conversion for agriculture, flood control, and development has been the largest conservation threat in Florida (Bryan 2002).

***Buteo brachyurus* - Short-tailed Hawk**

Some have suggested that Short-tailed Hawks need extensive forest tracts for nesting (e.g., Ogden 1988).

Nesting: No clear preferences demonstrated. Moore et al. (1953) reviewed all published observations of Florida nests and found 9 of 12 (75%) were in either cypress swamps or mangrove swamps. Actual location of nest site quite variable, including interior of densely wooded swamps (Brandt 1924; Millsap et al. 1989, 1996), lake margins at edge of swamps (Nicholson 1951), hammock edge (Scott 1889), and open woodlands and savannah (Ogden 1974, 1988). Will nest in pine forest <5 km from coast (Pennock 1890) or in trees overhanging water in mangrove estuaries (Sprunt 1939; E. Inigo pers. comm., Miller and Meyer 2002).

Known hunting ranges in Florida are characterized by the juxtaposition of long woodland edges with large expanses of adjacent open country (Ogden 1974, 1988).

***Buteo lineatus* - Red-shouldered Hawk**

In general, amphibians and snakes made up a greater proportion of the diet in the south than in the north (Dykstra et al. 2008).

Nest is often located near some form of water (e.g., a pond, stream, or swamp), probably to facilitate access to prey (Portnoy and Dodge 1979, Bosakowski et al. 1992, Moorman and Chapman 1996, Howell and Chapman 1997, Dykstra et al. 2000, 2001a, McLeod et al. 2000, Balcerzak and Wood 2003).

Red-shouldered Hawks demonstrate dietary flexibility, switching prey from year to year, depending on availability (Bednarz and Dinsmore 1982, Townsend 2006).

***Ceryle alcyon* - Belted Kingfisher**

Clear water and an unobstructed view of prey are essential for successful foraging; species often absent from muddy or turbid waters; may abandon usual fishing areas when water becomes muddy after heavy rains (Davis 1980).

***Egretta caerulea* - Little Blue Heron**

Although the overall population effect cannot be directly quantified, altered hydroperiods and habitat conversion have caused and continue to cause the greatest threats to this species. Physical destruction of breeding sites and wintering areas results in dispersion, relocation, or direct losses of colonial birds. Physical alteration of staging areas may result in similar but less discernible impacts. The continued population decline, despite the protection of colony sites, suggests that preservation of important foraging habitat has not been successful (Rodgers and Smith 1995).

***Egretta rufescens* - Reddish Egret**

Coastal development in Florida has decreased quantity and quality of suitable habitat for this species (Lowther and Paul 2002).

***Elanoides forficatus* - Swallow-tailed Kite**

More important than topography or specific vegetation communities is physical structure of vegetative landscape. Key feature is association of tall, accessible trees for nesting with open areas that provide sufficient small, easily subdued prey. May be small stands or tree islands in prairie-like setting; low-density forest of uneven structure interrupted by open areas of shrub, swamp, or marsh vegetation; or denser forest, frequently interspersed with various sorts of openings (Meyer 1995).

In Southeast U.S., nesting and foraging habitat includes various combinations of pine (*Pinus*) forest (including small, low-density stands), hydric pinelands (s. Florida slash pine [*Pinus elliottii*] forest with understory of wetland plants), pine fringe of floodplain and hardwood swamp forests, cypress (*Taxodium*) swamp, wet prairies, freshwater and brackish marshes, hardwood hammocks, tall trees edging sloughs and bayous, mixed cypress-hardwood swamp forest, and mangrove (*Avicennia*) forest (Cely 1979, Robertson 1988, Cely and Sorrow 1990, Meyer and Collopy 1990). Edges of pine forest adjoining riparian and swamp forests are particularly important on coastal plain; wider variety of sites are used in peninsular Florida (Meyer 1995).

Radio-tracking analysis of habitat use versus availability in South Carolina (Cely and Sorrow 1990) and Florida (Meyer and Collopy 1990), and discriminant function analysis of vegetation surrounding 48 nests (Meyer 1993), showed selection for hardwood and cypress swamps. Classification schemes for these tests, however, were insensitive to low densities and small patch sizes for individual cover types, thus masking importance of large pines as preferred nest trees (Meyer 1995).

In Florida, forages in branches, foliage, and stems of deciduous trees, shrubs, and emergent vegetation of rivers, lakes, ponds, marshes, and sloughs (e.g., oaks [*Quercus*], bays [*Magnolia, Gordonia, Persea*], maples [*Acer*], pond apple [*Annona*], myrtle [*Myrica*], willows [*Salix*], galberry [*Ilex*], coco plum [*Chrysobalanus*], fire flag [*Thalia*], pickerelweed [*Pontederia*], arrowhead [*Sagittaria*]), fronds of palm trees (mostly cabbage palm [*Sabal palmetto*]) and saw palmetto [*Serenoa repens*], undisturbed surface of open water, over fires, and in thermals (Meyer 1995).

Nesting and premigration communal roosts in Florida are usually in open stands of cypress or pine in standing water, isolated from human disturbance (Meyer 1993). Snags are used frequently but by no means exclusively (Meyer 1995).

***Empidonax virescens* - Acadian Flycatcher**

This species is considered to be area-sensitive (Freemark and Collins 1992) and negatively impacted by habitat fragmentation (Askins et al. 1990). It is vulnerable to forest fragmentation because it experiences high rates of parasitism by cowbirds and nest depredation in fragmented landscapes (Robinson et al. 1995). In addition, reproductive success may be lower in large forest fragments that have a high density of internal disturbances such as clearcuts and wildlife openings (Whitehead and Taylor 2002).

***Eudocimus albus* - White Ibis**

Because of salt stress, nestlings do not develop normally on brackish water crustaceans, so nearby freshwater feeding sites are essential for successful breeding at coastal colonies (Johnston and Bildstein 1990).

***Gallinula chloropus* - Common Moorhen**

Density of submerged and floating vegetation is important (Brackney 1979, Chabot 1996).

***Grus candensis pratensis* - Florida Sandhill Crane**

At night, Sandhill Cranes roost in shallow herbaceous wetlands. Roost sites are characterized by standing water 4-12 inches deep surrounded by deeper water or large expanses of marsh (Tacha et al. 1992).

Florida Sandhill Cranes are increasingly becoming residents of suburban settings (e.g. golf courses, airports). It appears that Sandhill Cranes can become acclimated to living in close proximity to people. Types of development that can provide suitable habitat for Sandhill Cranes include horse farms, cattle farms, sod farms, nature trail areas, golf course roughs and other types of development that retain grasslands and small herbaceous wetlands (Stys 1997).

Nesting: Throughout most of the species' range the presence of standing water with emergent aquatic vegetation is an important characteristic of the site. Water depth under active nests has ranged up to 99.1 cm for nests built over open water (Thompson 1970). Mean water depth at 100 central Florida nests: 26.7 cm (Dwyer 1990).

Feed primarily on land or in shallow marshes with emergent vegetation (Tacha et al. 1992).

Nesting cranes flush when people approach within 10 to 250 feet of the nest, and, once flushed, the birds remain off the nest for 15 minutes to three hours (Dwyer and Tanner 1992).

The Florida Fish and Wildlife Conservation Commission recommend a 400-foot noise disturbance buffer zone around Sandhill Crane nests to prevent crane nesting from being disrupted (Stys 1997).

***Haliaeetus leucocephalus* - Bald Eagle**

Nesting - In some cases, distance to water is not as critical as the quality of the foraging area that is present (Beuler 2000). Quality of foraging areas defined by diversity, abundance, and vulnerability of the prey base (Livingston et al. 1990), structure of aquatic habitat, such as the presence of shallow water (MacDonald and Austin-Smith 1989), and absence of human development and disturbance (McGarigal et al. 1991).

Size of forest tract holding the nest tree may be unimportant if tract is isolated from human development and disturbance. Minimum distance from a nest to human development in some populations is <100 m; average distance in most populations, however, is >500 m and reflects habitat selection away from these developments (Andrew and Mosher 1982, Fraser 1985, Fraser et al. 1985, Anthony and Isaacs 1989, Wood et al. 1989, Livingston et al. 1990). Forested tracts with nests have relatively open canopies, some form of habitat discontinuity or edge, or high levels of foliage-height diversity that provide access to nest trees (Gerrard et al. 1975, McEwan and Hirth 1979, Anthony and Isaacs 1989, Wood et al. 1989).

Bald Eagle nesting habitats are protected by law, but little or no emphasis has yet been placed on the preservation of roosting or foraging habitats (Mojica 2006).

Perch-tree species used are highly variable, including both coniferous and deciduous species if present. Most perch trees used are live trees, although dead trees preferred if available (Stalmaster 1987, Buehler et al. 1992a). Selects a wider range of tree species and sizes for perching than for nesting or roosting (Stalmaster 1987).

In suitable area, nest tree generally one of largest trees available with accessible limbs capable of holding nest (Herrick 1924, Andrew and Mosher 1982, Swenson et al. 1986, Anthony and Isaacs 1989, Wood et al. 1989, Livingston et al. 1990). A large, super-canopy nest tree provides good flight access to the nest and good visibility of surrounding area (Buehler, 2000).

***Himantopus mexicanus* - Black-necked stilt**

Stilts tend to use wetlands with more emergent vegetation than avocets, especially flooded fields. However, both species congregate on human-made evaporation ponds to consume abundant brine flies. Although use of evaporation ponds might seem to ensure that suitable habitat will be available for stilts in the future, these ponds also accumulate contaminants in their food webs (Robinson et al. 1999).

Winter Range: In Florida (Dinsmore 1977) impounded settling ponds rimmed with knotgrass (*Paspalum vaginatum*) and saltbush (*Baccharis* sp.).

***Larus atricilla* - Laughing Gull**

Nesting habitat is degraded when offshore sandy or rocky islands are developed, bringing increases in large gulls and mammalian predators. Foraging habitat is degraded when estuaries and coastal areas used for foraging are developed, when human activities increase, or when foods are overharvested (Burger 1996).

***Pandion haliaetus* - Osprey**

Habituates quickly and easily to nearby human activity (Poole et al. 2002).

***Pelecanus occidentalis* - Brown Pelican**

Primarily warm coastal marine and estuarine environments year round. Generally rare inland, but regular postbreeding visitor to inland waters in Southwest U.S. (Am. Ornithol. Union 1998) and central Florida (McNair 2000); resident at Salton Sea, California (Sturm 1998), and Lake Okeechobee, Florida (Smith and Goguen 1993). Usually breeds on small, predator-free coastal islands within 30–50 km of consistent, adequate food supply (Briggs et al. 1981, Anderson et al. 1982, U.S. Fish Wildl. Serv. 1983). Along Atlantic and Gulf coasts of U.S., breeds mainly on barrier, natural estuarine, or dredge-spoil islands, except in Florida, where mangrove islets predominantly used (Wilkinson et al. 1994).

Usually forages in shallow waters within 20 km of nesting islands during breeding season, up to 75 km from nearest land during nonbreeding season, rarely beyond (Briggs et al. 1981, 1983). Offshore foraging range limited by need for undisturbed, dry nocturnal roosting site. Unable to remain on water >1 h without becoming waterlogged; returns to shore to roost each night and loaf during the day after foraging (Schreiber and Schreiber 1982). Sandbars, pilings, jetties, breakwaters, mangrove islets, and offshore rocks and islands important roosting and loafing sites (Schreiber and Schreiber 1982, U.S. Fish Wildl. Serv. 1983, Briggs et al. 1983).

***Podilymbus podiceps* - Pied-billed Grebe**

Between arrival of white settlers and mid-1980s, coterminous U.S. has lost about 55.7% of its wetlands (reduced from about 894,000 km^2 to about 396,000 km^2) to draining, dredging, filling, leveling, and flooding. Twenty-one states have lost ≥50% of their wetlands, 10 states >70%

(Dahl and Johnson 1991). Loss of breeding and wintering habitat must have had profound effects on Pied-billed Grebe population, but reports are anecdotal. Outdoor recreational activities contribute to disturbances and nest failure (Andrle and Carroll 1988, Gibbs and Melvin 1992).

***Porphyrio martinica* - Purple Gallinule**

Degradation of habitat: extensive wetland losses from 1950s to 1970s in Louisiana, Florida, Texas, Arkansas, and Mississippi (Tiner 1984, Eddleman et al. 1988), an area corresponding closely with breeding range of Purple Gallinule. This loss offset to some (unknown) degree, however, by human-created habitats: rice fields, national wildlife refuges, and water-conservation impoundments. Helm (1982) observed that a trend toward rapidly maturing rice varieties, however, may not allow sufficient time for completion of nesting cycle resulting in losses (Helm 1982, West and Hess 2002).

Species may have benefited from introduction of exotic aquatic plants. Water hyacinth and hydrilla, scourges of inland boaters and fishermen, provide food and habitat for Purple Gallinule, and may provide needed isolation for breeding. Lakes on interior Florida ridges, once vegetation-free with sandy shores, now contain diverse aquatic vegetation through eutrophication and invasion (F. Lohrer pers. comm.). These lakes provide major breeding and wintering habitat for this gallinule. The common practice of removing emergent vegetation from ponds to improve fishing and hunting may harm Purple Gallinule reproduction, but only anecdotal data on this (Helm 1982, West and Hess 2002).

***Protonotaria citrea* - Prothonotary Warbler**

Because the species has specific habitat needs in breeding and wintering areas, the greatest threats to its survival are degradation and destruction of its habitat. Logging and agricultural conversion of bottomland hardwood forests throughout the southeastern United States have been detrimental to breeding populations (Petit 1999).

Exhibits area sensitivity, avoiding forests <100 ha in area and avoiding waterways with wooded borders <30 m wide (Kahl et al. 1985).

Readily uses nest boxes (Petit et al. 1987).

***Rallus elegans* - King Rail**

Loss of wetlands is by far the most critical threat to populations. Reid (1989) discusses this issue: "The Mississippi River corridor has historically formed important breeding and migratory habitat for King Rails…Major degradations to this ecosystem have occurred in the last century and include constriction of banks that modify flow and flood capacity, dike construction that impacts channel direction, and addition of toxicants through point and non-point pollution. Perhaps the greatest direct threat to King Rail habitats has been the large reduction in herbaceous floodplain wetlands through agricultural, urban, and industrial developments. Today, most quality wetland habitats remain on public refuges." (Poole et al. 2005).

***Rallus longirostris* - Clapper Rail**

Interference with tidal flow is the most common mode of habitat degradation for Clapper Rails (Meanley 1985, Eddleman and Conway 1994). Effects of this problem include drying of habitats such that high marsh or terrestrial plants replace low marsh plants favored for nesting and foraging by Clapper Rails, lowering of salt content, invasion of habitat by common reed (*Phragmites australis*), or permanent flooding of marshes by construction of impoundments. Nonetheless, large areas of suitable habitat remain on the East Coast (Eddleman and Conway 1998).

***Rynchops niger* - Black Skimmer**

Currently, human disturbance and intrusion are major factors affecting skimmer colonies (Schreiber and Schreiber 1978).

***Scolopax minor* - American Woodcock**

Some early debate on whether regional habitat area was decreasing or not (e.g., Owen 1977 vs. Cushwa et al. 1977). Consensus is that quantity and probably quality of habitat are decreasing as the rate of change of farm land into young growth forests decreases (Dobell 1977). Habitat change across Woodcock range is suspected cause of region-wide declines in abundance. Breeding sites (singing grounds) probably not limited in north (DMK); rather, effect of habitat on population likely occurs via other life history activities. Loss of even-aged forest management (low variation tree age structure, often initiated by large scale natural disturbances [fire, insects] or clearcut harvesting) in south may discriminate against this species (Pursglove 1992); draining bottomland hardwoods and swampy areas also degrade habitat (Keppie and Whiting, Jr. 1994).

Generally considered an edge species (Nature Serve 2009).

***Stelgidopteryx serripennis* - Northern Rough-winged Swallow**

Like Bank Swallow, may benefit from growth and expansion of human populations. Nesting once limited to natural sites: erosion banks, naturally occurring crevices, or abandoned burrows of other species. Has now adapted to various human structures and disturbances for nest sites. Between 30 and 60% of nests in Canada located in human-altered habitats: road cuts, gravel pits, buildings, walls, etc. (Erskine 1979, Campbell et al. in press).

Notable for tolerance of human disturbance in general vicinity of nest and ability to maintain itself near civilization (DeJong 1996).

3.2.4. Wintering Birds - Additional Information

***Ammospiza maritime* - Seaside Sparrow**

As a maritime wetland specialist, the Seaside Sparrow represents a potentially valuable "indicator" of continued ecological integrity of certain types of coastal marshes and has already proven sensitive to habitat modification in Florida. (Post and Grenlaw 1994)

In much of its range, a specialist on *Spartina alternifolia*. For this reason, not only are these birds sensitive indicators of the health of tidal wetlands, but they are also vulnerable to habitat modification. Saltmarsh protection is paramount for their survival. (Nature Serve 2009)

***Calidris minutilla* - Least Sandpiper**

Shallow water depth important habitat selection factor (Safran et al. 1997), rarely wades in water > 2–4 cm deep or forages on pure sand beaches (Colwell and Landrum 1993, Paulson 1993).

On marine coasts, timing and duration of foraging usually regulated by tidal cycles (Couch 1966, Baker and Baker 1973, Gerstenberg 1979, Robert et al. 1989), but an uncharacteristic lack of responsiveness to tidal cycles in some areas has been noted (Burger 1984: 7).

In inland wetlands, foraging confined entirely to moist or saturated muddy shorelines with shallow water up to 4 cm deep (Baldassarre and Fischer 1984, Hands et al. 1991, Skagen and Knopf 1994); chironimid pupae taken from surface at water's edge or against algal mats (Brooks 1967). On coast, moves to inland flooded fields at high tide to feed in saturated ground on worms forced to surface by rain (Gerstenberg 1979).

***Circus cyaneus* - Northern Harrier**

Areas of short vegetation, e.g., heavily grazed pasture and harvested fields, are underused, whereas idle and abandoned (often wet) fields with vegetative cover are used more than expected (Linner 1980, Bildstein 1987, Preston 1990).

Average number of roost members about 20, although reported means vary widely (2–85). Single-bird roosts exist but are short-term (< 4 days) (Bildstein 1979b, Bosakowski 1983). Numbers of birds using individual communal roosts fluctuate throughout the winter, with reciprocal shifts in numbers of birds in different locations signaling movements of birds from one site to another (Bildstein 1976, Christiansen and Reinert 1990).

3.2.5. Mammals - Additional Information

***Castor canadensis* - Beaver**

Beavers require low gradient streams, ponds, small mud bottomed lakes which they modify for denning purposes (Nature Serve, 2009).

Beavers prefer stable water flows and level. Poor quality habitat for the Beaver has greatly fluctuating flow of water and levels (Nature Serve, 2009).

Beavers will use the floodplains and backwaters of 9th order or higher streams (Nature Serve, 2009).

Food species present are less important than habitat quality for the species. Physiographic and hydrographic factors are more important (Nature Serve, 2009).

Beavers can usually control water depth and stability on small streams, ponds, and lakes; however, larger rivers and lakes where water depth and/or fluctuation cannot be controlled are often partially or wholly unsuitable for the species (Allen, 1982).

Suitable habitat for Beavers must contain all of the following: (1) stable aquatic habitat providing adequate water; (2) channel gradient of less than 15%; and, (3) quality food species present in sufficient quantity (Williams1965).

Beavers will live in close proximity to man if all habitat requirements are met (Rue 1964). However, railways, roads, and land clearing often are adjacent to waterways and may be major limiting factors affecting Beaver habitat suitability (Slough and Sadleir 1977).

Beaver ponds and their associated wetlands provide habitat for a wide variety of animals, such as insects, spiders, frogs, salamanders, turtles, fish, ducks, rails, bitterns, flycatchers, owls, mink and otters. Dead standing trees killed by flooding provide preferred nesting habitat for colonies of great blue herons and cavity-nesting birds, such as the wood duck and hooded merganser. Beaver ponds also filter and trap sediments and excess nutrients, serve as water storage and recharge areas, and provide opportunities for canoeing, fishing, wildlife observation and waterfowl hunting (Wildlife in Connecticut: Informational Series, 2009).

Lasiurus borealis - Eastern Red Bat

May hunt 500-900 meters from its roosting site (Jackson 1961).

Lasiurus seminolus - Seminole Bat

The ecological distribution of *L. seminolus* generally corresponds with that of epiphytic Spanish moss, *Tillandsia usneoides*, in which these bats frequently roost (Barbour and Davis, 1969).

Lynx rufus - Bobcat

The Bobcat is equally at home in deep forest, swamps, and hammock land. Thick patches of saw palmetto and dense shrub thickets are important as den and resting sites in Florida. (myFWC.com, 2009)

Females tend to use higher quality habitats more than males, because they have the need to obtain a lot of prey from smaller areas when rearing kittens. Such helps to offset the high energetic demands of providing for dependent kittens (Mallow, 2009).

Various habitats including deciduous-coniferous woodlands and forest edge, hardwood forests, swamps, forested river bottomlands, brushlands, deserts, mountains, and other areas with thick undergrowth. Large tracts of habitat are most favorable. Primarily terrestrial. When inactive, occupies rocky cleft, cave, hollow log, space under fallen tree, etc.; usually changes shelter daily. Young are born in a den in a hollow log, under a fallen tree, in a rock shelter, or similar site (Nature Serve 2009).

***Neofiber alleni* – Round Tailed Muskrat**

Home range is less than 2.5 acres (Nature Serve 2009).

***Neotoma floridana* - Eastern Woodrat**

David Webster (UNC-Wilmington) suggested that the species is habitat-specific and confined to particular soil types. Preferred habitat in North Carolina consists of low-lying deciduous forests with a dense cover of palmetto (*Sabal minor*). The Rocky Point, Pender County, population is restricted to an unusual woodland dominated by dense shrub layer of *Sabal major* established on a unique soil (Pender Series) with a very shallow, acidic A-horizon and a slightly alkaline B-horizon (Webster et al. 1987). The habitat there appears to be similar to the palmetto forests of Florida where woodrats are relatively abundant (Nature Serve, 2009).

Eastern woodrats appear to be most abundant in areas of dense vegetation at wetland/upland ecotones and require the availability of abundant hard and soft mast. Hard mast availability within the foraging range (up to approximately 200 m from the nest site) may be particularly important for over-winter survival. Preservation and perpetuation of well-stocked, mature stands of mast-producing hardwoods is important to the maintenance of woodrat populations (Nature Serve 2009).

In addition to including favorable habitat conditions, preserves should not be subject to high levels of human activity (Nature Serve 2009).

***Ochrotomys nuttalli* - Golden Mouse**

Average home range is less than an acre (Nature Serve 2009).

***Oryzomys palustris* - Marsh Rice Rat**

Adults were more common in tidal marsh and upland habitats than juvenile Marsh Rice Rat (Kruchek 2004).

***Procyon lotor* - Raccoon**

Raccoons require ready access to water and are extremely adaptable to other habitat factors (Dewey 2001).

Raccoons can live in various habitats; usually in moist situations, often along streams and shorelines. They build dens under logs or rock, in tree holes, ground burrow, or in banks (Armstrong 1975).

Raccoons also have the habit of dunking their food items in water when available, leading some people to believe that raccoons "wash" their food before eating it. It is more likely through that this "washing" of food items by a Raccoon is simply its way of feeling and inspecting the food with its tactile senses before swallowing (Western North Carolina Nature Center, 2009).

***Sorex longirostris* - Southeastern Shrew**

Southeastern Shrews live in various habitats ranging from bogs and damp woods to upland shrubby or wooded areas. They prefers moist to wet areas, usually bordering swamps, marshes, or rivers, and most often associate with heavy ground cover (French 1980).

They generally reside underground or under ground cover. Southeastern Shrews might respond favorably to disturbances that allow dense ground cover to thrive (Pagels *et al*. 1982).

***Sylvilagus palustris* - Marsh Rabbit**

Prefers relatively undisturbed marshes (Handley 1991).

***Ursus americanus floridanus* - Florida Black Bear**

Intense forestry practices involving even-age timber management over large areas probably reduce habitat suitability for bears (Maehr and Wooding 1992). Large-scale winter burning may reduce food resource diversity by increasing saw palmetto and reducing blueberry and runner oak; summer burning may encourage the latter species and should be considered in managing areas occupied by bears (Maehr and Wooding 1992).

Large undeveloped wooded tracts preferred (Nature Serve 2009).

3.3. Task 3: Identify Upland and Wetland Habitats that are needed to Maintain the Abundance and Diversity of Aquatic and Wetland-dependent Wildlife

This section summarizes the habitat requirements for the amphibians, reptiles, mammals, and birds found in the Matanzas River study area. This information is then combined with the results from Task 4 in assessing habitat buffer requirements.

3.3.1. Amphibians in the Matanzas River Study Area

All amphibians found in the study area require freshwater for at least part of their life cycles. Frogs and toads lay and fertilize their eggs in freshwater. Salamanders typically fertilize their eggs internally but then most species lay their eggs in water. The larval stage of frogs, toads, and most salamanders is aquatic, and therefore the animals depend on freshwater for their life cycles. Two species potentially found in the study area, the Southern Dusky Salamander and the Slimy Salamander are exceptions. They typically lay their eggs in a moist environment such as in a decaying log or moss. The larvae do not have the aquatic stage, but they require a moist environment. While amphibian reproduction generally requires water, most amphibians in the study area do not actually live in the water as adults and require the wetland edge, transition zone, or upland habitats.

3.3.2. Reptiles in the Matanzas River Study Area

All reptiles potentially found in the study area require upland environments for reproduction because they lay their eggs on land and many species will spend the winter on land. However many species are aquatic or wetland-dependent. An obvious example would include the many species of turtles. With the exception of the gopher tortoise, all the turtles found in the area are aquatic. Several species of snakes potentially found in the study area depend on aquatic and wetland habitats for their preferred prey, but the snakes live in upland or wetland edge environments. For example, the four species of water snakes (genus *Nerodia*) potentially found in the area feed primarily on fish and amphibians (the Atlantic saltmarsh snakes feeds mainly on fish and crustaceans) but are most commonly seen while at the edge of the water or on overhanging branches.

3.3.3. Mammals in the Matanzas River Study Area

While most mammals use wetlands, very few are considered obligate wetland species. In Florida only three species are considered obligate wetland users (Hart and Newman 1995). These animals are the round-tailed muskrat, marsh rabbit, and marsh rice rat.

The 1990 report by Brown et al. notes that the EPA's Environmental Monitoring and Assessment Program (EMAP) has elected not to use mammals as bio-indicators due to characteristics such as high mobility, low species richness, and lack of habitat specificity.

3.3.4. Birds in the Matanzas River Study Area

The surveys that provide the data for this report were conducted in June and July 2009 so the only species observed were permanent or summer residents. The tables in Section 3.2 above include the habitat summaries for permanent, summer, and winter resident species.

3.3.5. References

Brown, Mark T., Joseph Schaefer, and Karla Brandt. 1990. Buffer zones for water, wetlands, and wildlife in east central Florida. Center for Wetlands, University of Florida Publication #89-07. Florida Agricultural Experiments Stations Journal Series No. T-00061.

Burt, William H. and Richard P. Grossenheider. 1980. A field guide to the mammals of north America north of Mexico. Third edition. New York: Houghton Mifflin Company.

Conant, Roger and Joseph T. Collins. 1998. A field guide to reptiles & amphibians of eastern and central North America. Third edition, expanded. Houghton Mifflin Harcourt. 616 pages.

Hart, R. and J.R. Newman. 1995. The Importance of isolated wetlands to fish and wildlife in Florida. Project report for Nongame Wildlife Program project NG88-102, Florida Game and Fresh Water Fish Commission, Tallahassee, FL.

Kaufmann, Kenn. 1996. Lives of North American birds. New York: Houghton Mifflin. 675 pages.

3.4. Task 4: Identify and Rank the Quality of Upland and Wetland Habitat Available within the Study Area

During the 2009 wet-season wildlife surveys, the upland and wetland habitats encountered were evaluated based on features that are a measure, or indicator, of the wildlife value of each site. These site-specific habitat evaluations were based upon the indicators listed below and were used to rank the quality of the habitats. These measures of habitat ranking and aquatic/wetland-dependent wildlife use will be further evaluated relative to differences in buffer widths.

- Vegetation communities.
- Hydrology of the wetlands.
- Absence of disturbance to the habitat.
- Refuge (other than vegetation) for wildlife.
- Species richness.
- Presence of listed (state or federally protected) species.
- Connectivity between adjacent habitats.
- Value assigned by the Florida Fish and Wildlife Conservation Commission (FFWCC) Integrated Wildlife Habitat Ranking System (IWHRS).
- Uniqueness of the habitat in the study area.

Each wetland site was scored 1-5 for each of the nine criteria listed above, with 5 being the most favorable. The buffers were not scored on hydrology. The first six indicators were based upon field observations. The habitat connectivity, IWHRS value, and uniqueness values were based upon analysis of GIS data and aerial photography.

The vegetation community of each site was evaluated based on the presence of healthy vegetation in the expected canopy levels. The hydrology of wetlands was ranked based on the presence of standing water, or indicators that the sites are inundated for an appropriate period during the wet season. These hydrologic indicators included wetland vegetation, adventitious rooting, stain lines, lichen lines, and muck. Absence of disturbance was scored based on absence or presence of damage by hogs, trash, or other human-caused effects other than the nearby development. Connectivity between habitats was based upon examination of aerial photography. Habitats that were small and isolated were given a low score while habitats that were larger and connected to similar habitats were ranked higher. Refuge for wildlife was scored based upon the availability of shelter that small animals could use. Examples include fallen trees, detritus, and rocks. Species richness was scored based on the number of species of amphibians, reptiles, birds, and mammals located at the site during the surveys. The score for presence of listed species was based upon the number of listed species observed and the number of individuals located. The value assigned by Florida Fish and Wildlife Conservation Commission (FFWCC) Integrated Wildlife Habitat Ranking System (IWHRS) was included as an additional component. The IWHRS scores habitats from 0-10. For the purposes of ranking the quality of habitats in this study, the IWHRS scores were divided by 2 to be consistent with the 1-5 scoring system used here. In one case (site B3), the IWHRS rank was based on open water (scored zero in that system). The IWHRS score for this site was changed to 1 (prior to the division by 2), which is the next lowest value. The uniqueness of each site was based upon what percentage of the Matanzas study area each habitat type composes. For wetlands, only wetland habitats were considered. The acreage of each wetland habitat was divided by the area of the largest wetland habitat in the study area (treeless hydric savannah). If the transect's wetland habitat type made up .01% - 20% of the study area's total treeless hydric savannah area the score was a 5; 21% - 40% was scored a 4; 41% - 60% was scored a 3, and so on. For the upland buffers the habitats were normalized using the most common upland habitat in the study area, forest regeneration areas. FLUCCS classifications of urban development or roads were ignored and a uniqueness value of 1 was given to those buffers. These were transects with very small buffers.

The FFWCC's 2008 IWHRS is a Geographic Information System (GIS) that combines ten ecological aspects that together determine a habitat score that represents habitat quality. The ten data layers include spatial heterogeneity, roadless habitat patch size, strategic habitat conservation areas, listed species locations, species richness, Florida Natural Areas Inventory habitat conservation priorities, managed lands, distance to managed lands, landscape connectivity, and Florida Forever Board of Trustees/Save Our Rivers lands. IWHRS is described in Appendix E. The GIS data are available from the FFWCC website (http://research.myfwc.com/features/view_article.asp?id=29713).

Habitat in the study area is listed in Table 3.4.1. The quality rank of wetlands and upland buffers along each transect are listed in Table 3.4.2 and 3.4.3, respectively. The habitat type is named according to the Florida Land Use and Cover Classification System (FLUCCS). In some cases the habitat type listed in the FLUCCS GIS data was determined to be incorrect after field observations were completed. For example, it is more helpful to call the buffer zone at transect D4 an Upland Hardwood Forest than to refer to it as Parks and Zoos. These habitat names are changed in these tables. These tables do not include transects that were surveyed during the initial dry-season work and subsequently dropped from the study plan (e.g. transect A1).

Photographs of the transects are attached in Appendix F. Additional photographs of interest are attached in Appendix G.

Table 3.4.1
Habitat in the Matanzas River Study Area

Habitat	Acres	Percent of Total
Treeless Hydric Savannah	9,509	15
Mixed Wetland Hardwoods	8,273	13
Pine Flatwoods	6,652	11
Streams And Waterways	6,432	10
Saltwater Marshes	6,295	10
Cypress	4,152	7
Hydric Pine Flatwoods	3,463	6
Shrub And Brushland	3,310	5
Hardwood - Coniferous Mixed	2,822	5
Wetland Forested Mixed	2,340	4
Herbaceous (Dry Prairie)	1,909	3
Mixed Rangeland	1,814	3
Upland Hardwood Forests	1,681	3
Reservoirs	1,305	2
Wet Prairies	820	1
Bay Swamps	521	1
Freshwater Marshes	428	1
Non-Vegetated Wetlands	154	<1
Woodland Pastures	153	<1
Longleaf Pine - Xeric Oak	131	<1
Mangrove Swamps	109	<1
Sand Pine	94	<1
Enclosed Saltwater Ponds Within A Salt Marsh	89	<1
Lakes	35	<1
Emergent Aquatic Vegetation	15	<1
Cabbage Palm Hammock	5	<1
Total	62,512	100

Table 3.4.2
Quality Rank of the Wetlands along each Study Transect

Transect	Buffer Category	Habitat	Hydro-logy	Vegeta-tion	Disturb-ance	Connectivity	Refuge	Species Richness	Listed Species	IWHRS Value/2	Unique-ness	Total
A2	0-50	Saltwater Marshes	5	5	5	4	1	3	0	2.5	2	27.5
A4	0-50	Saltwater Marshes	5	5	4	3	1	3	2	3	2	28.0
20	0-50	Saltwater Marshes	5	5	4	4	2	4	1	2	2	29.0
B3	51-100	Saltwater Marshes	5	2	3	1	1	2	0	0.5	2	16.5
C1	101-300	Saltwater Marshes	5	5	4	5	4	5	0	2.5	2	32.5
C4	101-300	Saltwater Marshes	5	5	5	4	2	3	1	2.5	2	29.5
19	101-300	Saltwater Marshes	5	5	5	4	2	5	5	2.5	2	35.5
D4	301-500	Saltwater Marshes	5	5	4	5	2	4	3	2.5	2	32.5
B2	0-50	Mixed Wetland Hardwoods	1	2	3	1	4	1	0	1	1	14.0
I1	0-50	Wet Prairie	4	4	3	1	1	1	0	1.5	5	20.5
I2	0-50	Hydric Pine Flatwoods	4	4	3	2	2	1	0	1.5	4	21.5
8	0-50	Mixed Wetland Hardwoods	3	3	4	4	3	2	0	3	1	23.0
B4	51-100	Cypress	5	5	5	4	2	3	0	1.5	3	28.5
C	51-100	Mixed Wetland Hardwoods	5	4	4	5	3	2	0	4	1	28.0
21	51-100	Cypress	5	4	4	2	2	2	0	3	3	25.0
22	51-100	Mixed Wetland Hardwoods	2	3	3	3	3	4	0	3.5	1	22.5
C2	101-300	Mixed Wetland Hardwoods	3	3	2	3	4	4	0	3.5	1	23.5
D1	101-300	Mixed Wetland Hardwoods	1	2	4	3	3	5	0	3.5	1	22.5
D2	101-300	Hardwood-Coniferous Mixed	2	3	4	2	4	2	0	2	4	23.0
2	101-300	Mixed Wetland Hardwoods	2	3	3	3	3	5	0	3	1	23.0
13	301-500	Treeless Hydric Savannah	5	5	5	2	2	3	0	3	1	26.0
18	301-500	Mixed Wetland Hardwoods	3	4	5	4	3	4	0	2.5	1	26.5
30	301-500	Wet Prairie	5	4	5	1	1	2	0	1.5	5	24.5
32	301-500	Cypress	4	4	5	3	2	2	0	2.5	3	25.5
E-Xd		Mixed Wetland Hardwoods	4	4	5	4	3	2	0	6	1	29.0
FD		Freshwater Marshes	5	5	5	2	1	5	0	7	5	35.0

Table 3.4.3
Quality Rank of the Upland Buffers along each Study Transect

Transect	Buffer Category	Habitat	Hydro-logy	Vegetation	Disturbance	Connectivity	Refuge	Species Richness	Listed Species	IWHRS Value/2	Uniqueness	Total
A2	0-50	Shrub and Brushland		2	2	1	1	1	0	1.5	1	9.5
A4	0-50	Lawn		1	1	1	1	1	0	1.5	1	7.5
20	0-50	Shrub and Brushland		2	3	1	1	1	0	2	1	11.0
B3	51-100	Shrub and Brushland		2	1	1	1	1	0	1	1	8.0
C1	101-300	Hardwood-Coniferous Mixed		4	4	3	3	5	0	3.5	5	27.5
C4	101-300	Shrub and Brushland		4	3	4	2	2	0	2	5	22.0
19	101-300	Shrub and Brushland		4	4	4	2	2	0	2	5	23.0
D4	301-500	Upland Hardwood Forest		5	2	4	4	5	0	2.5	5	27.5
B2	0-50	Shrub and Brushland		2	2	1	2	1	0	0.5	1	9.5
I1	0-50	Pine Flatwoods		2	2	1	1	3	0	1.5	4	14.5
I2	0-50	Pine Flatwoods		2	2	1	1	3	0	2.5	4	15.5
8	0-50	Shrub and Brushland		1	1	1	1	5	0	3	1	13.0
B4	51-100	Shrub and Brushland		2	1	1	1	4	0	1	1	11.0
C	51-100	Hardwood-Coniferous Mixed		2	2	1		3	0	3	5	16.0
21	51-100	Coniferous Plantations		2	2	4	1	3	0	3.5	1	16.5
22	51-100	Pine Flatwoods		3	4	3	2	4	1	3.5	4	24.5
C2	101-300	Hardwood-Coniferous Mixed		3	4	1	2	4	0	3	5	22.0
D1	101-300	Hardwood-Coniferous Mixed		3	4	2	3	3	0	2.5	5	22.5
D2	101-300	Hardwood-Coniferous Mixed		3	4	1	2	2	0	1.5	5	18.5
2	101-300	Hardwood-Coniferous Mixed		3	4	1	2	4	0	2	5	21.0
13	301-500	Forest Regeneration Area		3	2	3	1	4	0	3	1	17.0
18	301-500	Hardwood-Coniferous Mixed		4	5	3	3	5	0	2	5	27.0
30	301-500	Coniferous Plantations		2	2	4	1	5	0	3.5	1	18.5
32	301-500	Forest Regeneration Area		3	2	1	2	4	0	2	1	15.0
E-Xd		Mixed Rangeland		4	4	5	2	2	0	5	5	27.0
FD		Mixed Rangeland		5	4	5	2	5	0	6	5	32.0

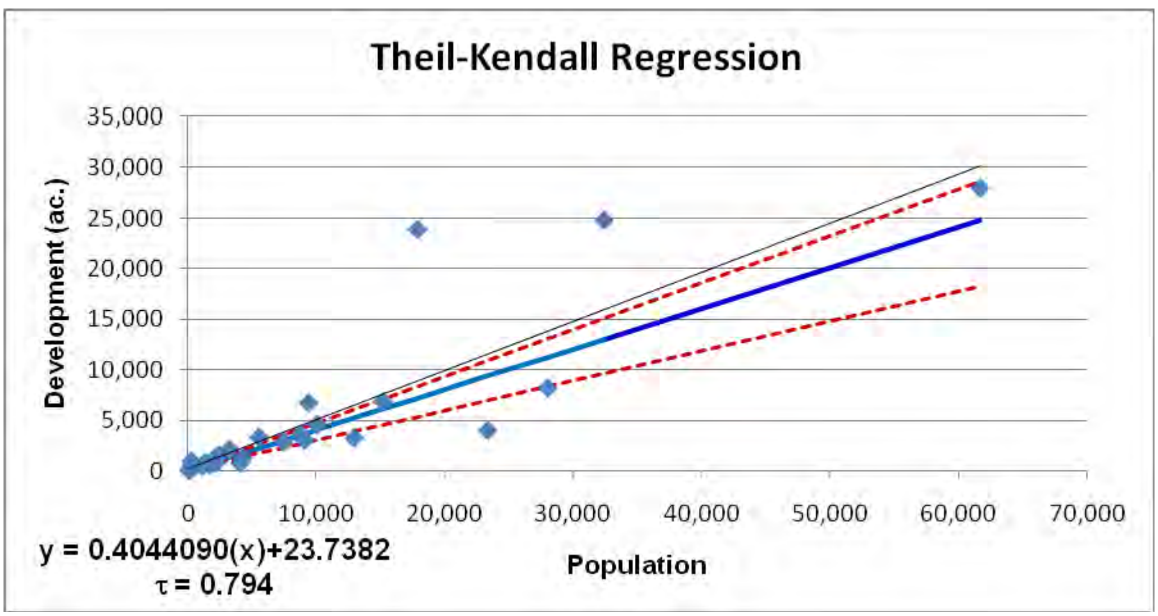
3.5. Task 5: Would Future Development Affect Wetland-dependent Wildlife?

3.5.1. Predicted Development Map for 2035

Areas of development and estimates of population growth were calculated for the years 1990, 2000, and 2008 in order to predict future development in the basin through the year 2035. The study area was divided into 10 units of equal area and total population and area of development were determined for each unit and time period. Population data for 1990 and 2000 were obtained from the US Census Bureau. Estimated population for 2008 was calculated from residential power customer data-files provided by Florida Power and Light. The number of residential customers in each unit was multiplied by average household size relative to the respective county[1]. Total populations and areas of development were also determined for a more extensive, outside region (the outlying portion of Flagler County) to provide an adequate range of data required for proper analysis.

A nonparametric linear regression was performed and a correlation coefficient computed that indicated a strong and significant relationship between population and area of development (Figure 3.5.1). The Bureau of Economic and Business Research (BEBR) 2035 projections for St. Johns and Flagler Counties were multiplied by the average percent contribution of the study area population to that of each county[2]. The resulting product (future population of the study area) was input into the line equation to predict the area of future development occurring within the Matanzas study area. Table 3.5.1.1 lists the calculated estimates of population and area of development in the basin.

Figure 3.5.1.1
Matanzas Population vs. Development Acres



[1] Source—BEBR Bulletin 152, January 2009. Number of Households and Average Household Size in Florida: April 1, 2008.
[2] Ratio of study area population to total county population derived from US Census (1990 & 2000) and relating FPL power customer population for 2008 to estimated county population contained in BEBR Bulletin 153, March 2009.

Table 3.5.1.1
Calculated Estimates of Population and Acreage to be Developed in the Matanzas River Drainage Basin by 2035

County	Estimated Population 2035	Estimated Acreage to be Developed by 2035
St. Johns	84,706	34,280
Flagler	69,731	28,223
Total	154,437	62,503

The predicted future development map was created by consulting several sources, including St. Johns and Flagler County future land use maps (FLUMs), environmental resource permits (ERPs), City of Palm Coast FLUM, and developments of regional impacts (DRIs). Public lands and conservation easements were displayed and avoided when evaluating areas likely to be developed in 2035 future development scenario. Tables 3.5.1.2 and 3.5.1.3 list the total acres to be developed in St. Johns County and Flagler County, respectively. Figure 3.5.1.2 shows the predicted development map for 2035 for the Matanzas River Drainage Basin.

Figure 3.5.1.2
Predicted Future Development Map for 2035 in the Matanzas River Drainage Basin

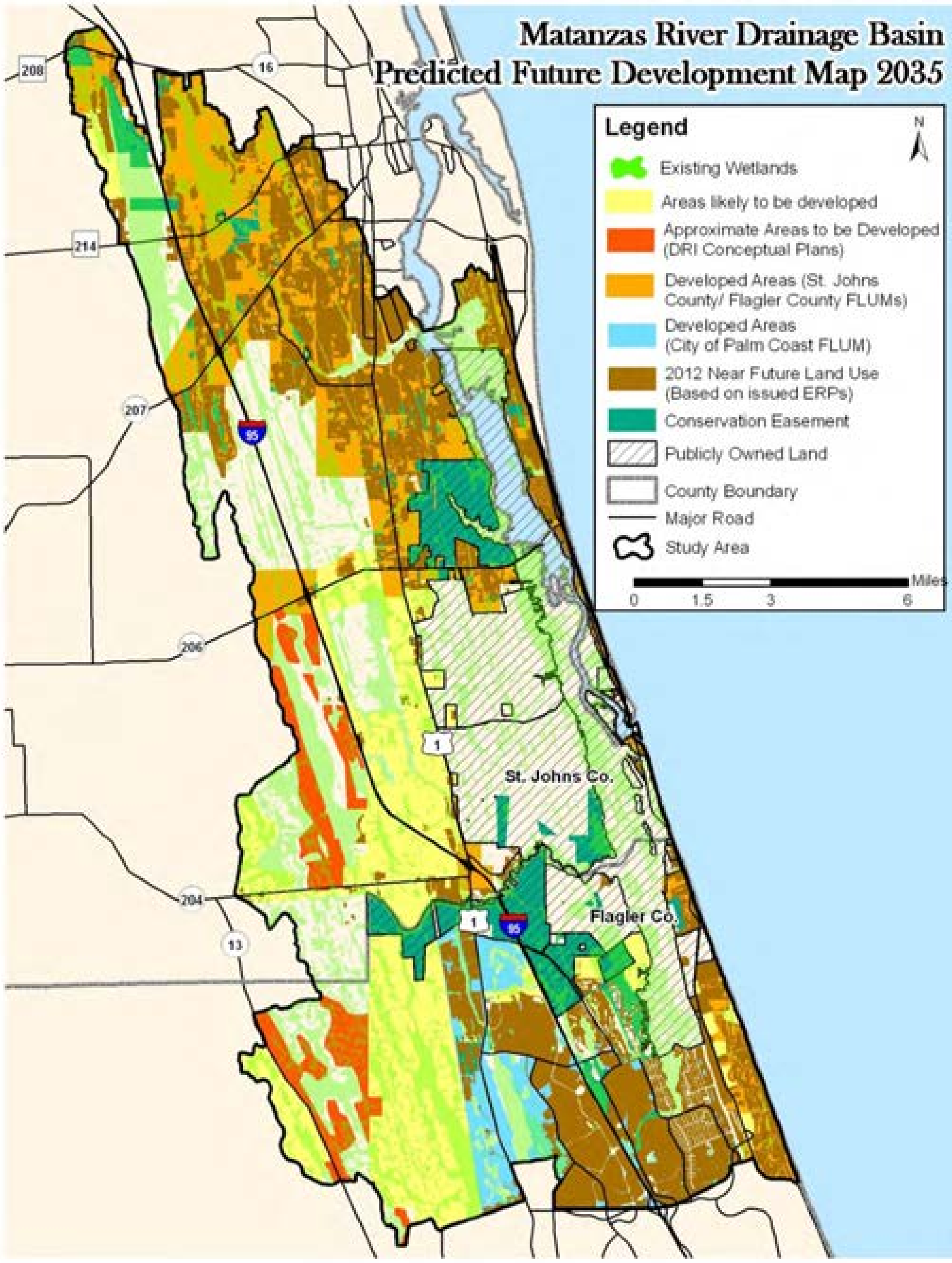


Table 3.5.1.2
Total Areas to be Developed in St. Johns County by 2035

Source	Total Areas to be Developed (ac)	Percent of Total
2012 Near Future Development	15,764	46
St. Johns County FLUM	9,571	28
DRI	1,889	6
Areas Likely to be Developed	6,985	20
Total	34,210	100

Table 3.5.1.3
Total Areas to be Developed in Flagler County by 2035

Source	Total Areas to be Developed (ac)	Percent of Total
2012 Near Future Development	11,890	49
Flagler County FLUM	654	3
City of Palm Coast FLUM	2,845	12
DRIs	1,728	7
Areas Likely to be Developed	6,981	29
Total	24,098	100

The FLUMs were obtained from the County and City government entities and incorporated into the predicted development map for 2035. There are approximately 13,000 acres of areas to be developed in the City of Palm Coast and St. Johns and Flagler Counties FLUMs. Most development from the FLUMs is located in the northeast section of the basin in St. Johns County.

The 2012 near future development was created from the SJRWMD 2004 land-use/land-cover layer by researching ERPs that were submitted to and approved by St. Johns and Flagler Counties, SJRWMD, FDEP, and USACOE through the year 2012. There is a total of 27,654 acres of existing and permitted development through the year 2012 within the Matanzas River Drainage Basin. A list of ERPs used to develop the future land use GIS layer can be found in Appendix I.

Conceptual development plans were consulted and used to estimate developed areas within DRIs. Three DRIs were incorporated into predicted development map for 2035, including the Old Kings Park DRI in St. Johns County and Old Brick Township and Neoga Lakes in Flagler County. Approximately 3,600 acres of development will result from DRIs within the Matanzas River Drainage Basin.

Areas likely to be developed were concentrated along paved transportation corridors such as county, state, or federal highways and near areas marked for development in the FLUMs, 2012 near future development, and DRIs. Areas likely to be developed made up about 24% of the total predicted development in the basin.

Table 3.5.1.4 compares the total developed areas from the calculated estimate and the predicted development map for 2035. Map-based areas total 34,210 acres of development in St. Johns County, which is a difference of -70 acres or -0.2% from the regression-based estimate of 34,280 acres. There is a map-based total of 24,098 acres of development in Flagler County and a difference of -4,125 acres or -14.6% from the regression-estimated 28,223 acres. This difference in Flagler County is due to the fact that there are no more developable areas to include in the 2035 predicted future development. All land that was not in a conservation easement, publicly-owned, or in a DRI conceptual plan was included. There is a difference of about -4,195 acres (-6.7%) between the calculated estimate of acres of development and the predicted development map in the basin.

Table 3.5.1.4
Comparison of Total Developed Areas from Calculated Estimate and 2035 Predicted Future Development Map

County	Calculated Estimate Total Areas to be Developed based on regression (acres)	2035 Future Development Map Total Areas to be Developed (acres)	Percent Difference
St. Johns	34,280	34,210	0.2
Flagler	28,223	24,098	14.6
Total	62,503	58,308	6.7

3.5.2. Amount of Wetlands within Footprint 2035 Development

Tables 3.5.2.1 and 3.5.2.2 list the acres of wetlands in predicted areas to be developed in St. Johns and Flagler Counties, respectively. An assumption was made based on previous development in the study area that there would be a 17% net loss of wetlands within areas to be developed. Based on that assumption, the total of wetland impacts in the basin is 2,142 acres.

Table 3.5.2.1
Acres of Wetlands in Predicted Areas to be Developed in St. Johns County by 2035

Source	Wetlands in Areas to be Developed (ac)	Impacted Wetlands in Areas to be Developed (ac)
2012 Near Future Development	47	8
St. Johns County FLUM	4,646	790
DRI	473	81
Areas Likely to be Developed	2,420	411
Total	7,586	1,290

Table 3.5.2.2
Acres of Wetlands in Predicted Areas to be Developed in Flagler County by 2035

Source	Wetlands in Areas to be Developed (ac)	Impacted Wetlands in Areas to be Developed (ac)
2012 Near Future Development	8	1
Flagler County FLUM	81	14
City of Palm Coast FLUM	751	128
DRIs	646	110
Areas Likely to be Developed	3,525	599
Total	5,011	852

3.5.3. Summary of Literature on Effects of Buffers on Wildlife Utilization

Riparian buffers have gained wide acceptance as tools for protecting water quality, maintaining wildlife habitat and providing other benefits to people and the environment (Wenger 1999). Much of the research and supporting information for buffer width is based upon stormwater management and water quality; however, studies have been conducted to attempt to determine appropriate buffer widths for habitat preservation and wildlife utilization of wetlands. A number of sources were reviewed and a summary of some of the findings is included in this section.

There are a number of alternative approaches to setting the buffer distance—usually defined in feet measured horizontally from the edge of the defined wetland. Many ordinances simply prescribe a fixed buffer distance for all wetlands subject to the ordinance (e.g., 75 feet or 100 feet). Others vary the prescribed distance depending upon the type of wetland or the quality of wetland from which the buffer is extended (e.g., 75 feet from least vulnerable wetland type; 100 feet from most vulnerable). Others further vary the buffer distance to account for slope toward the wetland—requiring wider buffers where slopes are steeper because negative impacts from land-disturbing activities, including concentrated water flows, are likely to increase with increasing slope. Some ordinances vary the buffer distances based on the type or intensity of land use—requiring larger buffers for more intensive land uses potentially affecting the wetland area. In contrast, some ordinances require or allow the zoning administrator to establish or vary buffers on a case-by-case basis. These ordinances usually prescribe the factors that must be taken into account and the information to be supplied by an applicant, but then rely on performance standards in the ordinance to drive the buffer distance decision (McElfish 2008). In another approach, Strommen et al. (2007) suggest an ordinance that regulates the entire drainage area contributing surface or subsurface flow to sensitive wetlands, with defined buffer protections within this area.

Included below is a discussion of some of the research and studies done in attempt to quantify wildlife buffers. While some include field gathered data and statistical analyses on one or more species, others simply incorporate data from other sources or general observations in an attempt to place a numeric value on the width or area required for habitat buffers.

Many of the buffer studies in scientific literature make conclusions on appropriate buffer sizes for wildlife habitat based on how far individuals range from the wetland or water body for breeding or other life-cycle needs. The Environmental Law Institute's (2003) review of the science found that effective buffer sizes for wildlife protection may range from 33 to more than 5,000 feet, depending on the species. Specific information on ranges for birds, mammals, reptiles, and amphibians has been developed:

- *Birds*: from 49 to over 5,000 feet (ELI 2003, Fischer 2000).
- *Mammals*: between 98 and 600 feet (ELI 2003).
- *Reptiles & Amphibians*: In a review of the literature, Semlitsch and Bodie (2003) found that core terrestrial habitat for reptiles associated with wetlands ranged between 417 and 948 feet, and for amphibians 521 and 951 feet. They suggest preserving core habitat plus an additional 164 foot (50 meter) buffer to minimize edge effects. However, little guidance was given concerning what type and density of buffer vegetation is acceptable for protecting particular species.

Birds

Over the last decade there has been an abundance of research on the use of riparian corridors by birds. Smith and Schaefer (1992) found small differences between bird populations in narrow (20-60 m/ 66-197 ft) and wide (75-150 m/246-492 ft) naturally vegetated buffers in an urbanized North Florida watershed. Area-sensitive species such as Acadian Flycatchers and Hooded Warblers were not found in the narrow buffers. Summer Tanagers were not recorded anywhere in the urbanized area, but they were found in a nearby undisturbed riparian forest. The researchers found that during spring, bird species diversity and evenness were less in Hogtown Creek**,** but average density was greater. The Hogtown Creek Watershed is located in the northwest and southwest quadrants of Gainesville and is one of the largest watersheds in the area, encompassing approximately 20 square miles of urban and suburban Gainesville. During winter, bird density and richness were greater in Hogtown Creek (summary from Wenger 1999).

Researchers have frequently reported bird densities and richness that are equal or greater in narrow buffers or clearcut areas. After clearcutting, bird diversity and abundance may increase because of the influx of open-habitat and edge-habitat birds (Triquet et al. 1990). This is an example of the edge effect: boundaries like forest edges (and riparian zones) tend to be especially rich in biodiversity. It is a management problem in some ecosystems to maximize both edge habitat and interior habitat. In addition, many species require more than one type of natural ecological system in which to complete their life cycles (Naiman et al. 1988). However, generally speaking, animals that exploit impacted areas and edges are more likely to be habitat generalists that are less in need of protection. Measurements of species richness and population density are less useful than indices of similarity between developed and undeveloped sites. Management on the local scale for maximum richness and density will almost certainly result in the loss of habitat specialists (Wenger 1999).

Fischer (2000) reviewed a number of earlier studies in an attempt to quantify the appropriate corridor widths required to manage riparian zones for avifauna, irrespective of wetland dependency. He summarized the literature review in the table 3.5.3.1.

Table 3.5.3.1
Recommended buffer widths for birds. Data from Fisher (2000)

Author	Location	Minimum Width	Benefit
Darveau et al. 1995	Canada	<60m	There was evidence that 50m wide buffer strips were required for forest dwelling birds. Bird populations may decline in strips before regeneration of adjacent clearcuts provide suitable habitat for forest birds
Hodges and Krementz 1996	Georgia	<100m	Riparian strips >100m were sufficient to maintain functional assemblages of the six most common species of breeding neotropical migratory birds.
Mitchell 1996	New Hampshire	>100m	Need >100m buffers to provide sufficient breeding habitat for area sensitive forest birds and nesting sites for Red-Shouldered Hawks
Tassone 1981	Virginia	>50 m	Many neotropical migrants will not inhabit strips narrower than 50m
Triquet et al. 1990	Kentucky	>100m	Neotropical migrants were more abundant in riparian corridors >100m. Riparian areas <100m wide were inhabited mainly by residents or short-term migrants
Spackman and Hughes 1995	Vermont	>150m	Riparian buffer widths of at least 150m were necessary to include 90% of bird species along mid-order streams
Kilgo et al. 1998	South Carolina	>500m	Although narrow bottomland strips can support an abundant and diverse avifauna, buffers of at least 500m are necessary to maintain the complete avian community
Keller et al. 1993	Maryland, Delaware	>100m	Riparian forests should be at least 100m to provide some nesting habitat for area sensitive species
Gaines 1974	California	>100m	Provide breeding habitat for CA Yellow-billed Cuckoo
vanderHaegen and DeGraaf 1996	Maine	>150m	Managers should leave at least 150 m buffer strips along riparian zones to reduce edge-related nest predation, especially in landscapes where buffer strips are important component of the existing mature forest
Whitaker and Montevecchi 1996	Canada	>50m	50m wide riparian buffers only supported densities <50% of those observed in interior forest habitats
Hagar 1999	Oregon	>40m	Although riparian buffers along headwater streams are not expected to support all bird species found in unlogged riparian areas, they are likely to prove the most benefit for forest-associated bird species if they are >40m

Fischer (2000) concluded that research has shown that riparian zones must meet certain minimum width criteria to provide suitable habitat for most bird species. To encourage a diverse avian community, riparian corridors should be as wide and long as possible, and relatively free from improved roads, human settlement, and other potential impacts. Where avian habitat is a management objective, riparian zones should be at least 100m wide, and wider zones may be warranted in some plant communities.

Mammals

Few studies have explicitly addressed the issue of how wide riparian buffers need to be to support mammal populations.

Boyd (2001) identified that a number of wetland-dependent mammals use uplands for foraging. These include the beaver, mink, muskrat and river otter. Beaver use upland areas with deciduous hardwoods within 200 m of the wetland (Whitlock et al. 1994). While most of their activity is focused within the high water mark, mink travel as far as 600 feet from water to hunt (Chase et al. 1995). Water shrews use crevices beneath boulders, tree roots or overhanging banks for cover (DeGraaf and Yamasaki, 2001). Species that use upland areas for nesting include the star-nosed mole, masked shrew and river otter (Whitlock et al. 1994).

Reptiles and Amphibians

Riparian zones are often rich in both diversity and abundance of reptiles and amphibians. Semlitsch (1998) summarized data from the literature on terrestrial habitat use by one group of pond-breeding salamanders, especially distances individuals traveled away from ponds. Data utilized in this analysis were obtained from published literature and unpublished dissertations for six species of pond-breeding, ambystomatid salamanders in five states. Only data collected from direct monitoring of migratory activity (with radioactive tags or radio transmitters) or from direct observation of marked or, in one case, unmarked individuals originating from a known breeding pond were included in the analysis. The results provide a basis for setting terrestrial buffer zones determined from actual habitat use by adult and juvenile salamanders. The mean distance salamanders were found from the edge of aquatic habitats was 125.3 m for adults of six species and 70 m for juveniles of two of these species. Assuming that the mean distance encompasses 50% of the population, a buffer zone encompassing 95% of the population would extend 164 m (534 ft) from a wetland's edge into the terrestrial habitat. Semlitsch (1998) defends his recommended buffer zone of 164 m on the basis of direct biological evidence, and that it is more ecologically realistic than existing buffer zones.

Burke and Gibbons (1995) recommended a 902 feet (275 m) buffer to protect upland nesting and hibernation sites of freshwater turtle species around Carolina bays in west central South Carolina These ovoid isolated wetlands are of uncertain geologic origin and occur from Virginia to northern Florida (Sharitz & Gibbons 1982). They found that a buffer of 240 feet (73 m) protects all except the distal 10% of nesting and hibernation sites.

Pursuant to Boyd (2001), reptiles have the broadest range of uses for the upland. These include nesting, feeding, overland dispersal, movement to breeding ponds, basking, cover and aestivation. Many reptiles use areas adjacent to the wetland for basking or cover. The Northern Water Snake (*Nerodia s. sipedon)* uses open areas adjacent to the wetland for basking and shoreline vegetation and shallow water aquatic vegetation for protection from predators (Chase et al. 1995). All turtle species included in this document are upland nesters and generally require a specific substrate for that purpose. Distances traveled from the wetland for nesting range from 10-36 feet (3-11 m) for the common musk turtle (*Sternotherus odoratu)* to several kilometers for the common snapping turtle. The spotted turtle (*Clemmys guttata)* travels between 43 and 1,352 feet (13-412 m) into the upland for aestivation [average distance is 584 feet (178 m)]. Wood turtles (*Clemmys insculpta)* were found to nest 328-656 feet (100-200 m) from water (Whitlock et al. 1994) within areas of well-drained sandy soil or sandy loam. Without this critical upland habitat, reproduction is not possible.

Also from Boyd (2001), most amphibians are terrestrial for much of their lives and rely on the wetland for breeding and larval development. They depend upon upland areas for over-wintering. The distances traveled to hibernacula can be as far as 2,700 feet (823 m) for the Spotted salamander *Ambystoma maculatum* (Whitlock et al. 1994). Salamanders from the Ambystomatid genus including spotted, blue-spotted (*Ambystoma laterale)*, Jefferson (*Ambystoma jeffersonianum)*, and marbled salamander (*Ambystoma opacum)* are all upland hibernators (Semlitsch, 1998) and require specific upland vegetation. Spring peepers (Pseudacris c. cruciferers), wood frogs *(Rana sylvatica)* and Fowler's toads (*Bufo fowleri)*, also use upland habitat for overwintering. Other uses of the upland by amphibians include movement for breeding or dispersal, feeding and cover. Dispersal among pools is important for amphibian populations. In a study by deMaynadier and Hunter (1998), they discuss the importance of understory and overstory components contributing to canopy closure for forest amphibians as well as an abundance of cover refugia such as deep, uncompacted forest litter. These habitat components are especially important to juvenile amphibians that have a high surface area to volume ratio and are more subject to desiccation. Habitat disturbances that affect microclimates, such as canopy removal, can severely limit the movement and migration of amphibians (deMaynadier and Hunter, 1999). Of the species included in their 1998 study, deMaynadier and Hunter found that Wood Frogs *Rana sylvatica* and Spotted Salamanders *Ambystoma maculatum* were among the species most sensitive to loss of interior forested habitat.

Buffer Quantification Using Wildlife Guilds

Brown et al (1990) defined a quantitative methodology for assessing the spatial requirement of species based upon separation of habitat specific wildlife into guilds. The authors determined that buffers were needed to protect the wetland habitat quality, wetland habitat quantity, and protect the wildlife from detrimental adjacent uses.

For wetland habitat quality, Brown et al. (1990) focused on minimizing groundwater drawdown and controlling sedimentation and turbidity. Those components focus primarily on water quality and therefore are not relevant to the purpose of this effort.

For habitat quantity, Brown et al. (1990) devised a stepwise methodology to make assumptions on the spatial requirements for individual species. Their methodology was as follows:

1. Develop wildlife species lists.

2. Determine the habitat types utilized by these species.

3. Further divide species into appropriate feeding and breeding zones (guilds) within each habitat.

4. Assign species to appropriate guilds in each habitat in which they occurred.

5. Develop a two-dimensional species-habitat matrix and plot species (see habitats* below).

6. Assign spatial requirement values to each species and compile these for each habitat.

*While the study did not address discrete wetland or habitat types, six major landscape associations were identified for the East Central Florida region and utilized in this study:

1. Pine flatwoods / isolated wetlands.
2. Pine flatwoods / flowing water wetlands.
3. Pine flatwoods / hammocks/hardwood swamps.
4. Sandhill communities / isolated or flowing water wetlands.
5. Pine flatwoods / salt marshes.
6. Coastal hammocks w/ salt marshes.

Brown et al. (1990) acknowledged that the buffer widths recommended in the report pertain to the protection of wetlands to the extent that they will merely satisfy the requirements of some individuals, and identified the following procedures for calculating wildlife habitat buffers.

1. Determine the wetland habitat type of the particular regionally significant wetland that is on or waterward from the proposed development site. For landscape situations where there is no vegetated wetland transitional area (i.e. marsh or swamp), the habitat determination should be made for the upland habitat (i.e. flatwoods, hammock, sandhill) that is adjacent to the aquatic system.
2. Determine the quality of the wetland habitat.

    High: the area is still in a relatively natural state.

    Medium: the area has been cleared for agricultural or silvicultural purposes but no permanent structures such as roads and buildings have been constructed.

    Low: the area has been cleared and developed with roads, buildings, and other permanent structures.

3. Select the buffer width from the following table for the previously determined habitat type and quality.

Table 3.5.3.2
Recommended buffer widths for various habitats. Data from Brown et al. (1990)

Habitat	Quality	Buffer Width
Salt and Fresh Water Marshes	High	322 feet
	Medium	322 feet and re-vegetate buffer into natural habitat
	Low	as wide as possible up to 322 feet
Cypress and Hardwood Swamps, Hammocks, and Flatwoods	High	550 feet
	Medium	550 feet and re-vegetate buffer into natural habitat
	Low	as wide as possible up to 550 feet
Sandhills	High	732 feet
	Medium	732 feet and re-vegetate buffer into natural habitat
	Low	as wide as possible up to 732 feet

4. Note that the wildlife buffers can include wetland as well as upland habitats. The wetland wildlife habitat buffer should begin at the waterward edge of the forested wetland or upland habitat that is adjacent to the aquatic system. A minimum 50-foot buffer upland strip for semi-aquatic reptile and over-wintering also should be included in each buffer (i.e. if the marsh or swamp wetland is wider than the recommended buffer, a 50-foot wide upland buffer strip should be added to the landward edge of the wetland).

5. If no trees are adjacent to the marsh (i.e. flatwoods), a 322-foot buffer is needed to prevent disturbance from human activities (minimum distance from humans tolerated).

6. Marsh areas frequently occur along flowing water systems (i.e. rivers). These marshes do not function as separate habitats unless they are large enough to support most wildlife species associated with marsh communities. For separate buffer considerations, these marsh systems must be at least 5 acres in size and vegetation must extend waterward from the waterward edge of the adjacent upland or forested wetland community for at least 50 feet.

The buffer width recommendations made by Brown et al. (1990) include not only the spatial requirements of individual and representative guild species, but also minimum distances for protection from adverse animal and human disturbances and protection from noise impacts. According to this study, while narrow buffers offer considerable habitat benefits to many species, protecting diverse terrestrial riparian wildlife communities requires some buffers of at least 100 m (~300 ft).

Buffers Based on Habitat Quality

Wetland functions, values, and sensitivity are attributes that will influence the necessary level of protection for a wetland. Those systems which are extremely sensitive or have important functions will require larger buffers to protect them from disturbances that may be of lesser threat to a different site. Where wetland systems are rare or irreplaceable (e.g., high quality estuarine wetlands, mature swamps, bogs), greater buffer widths would ensure a lower risk of disturbance(Castelle et al. 1992).

Spackman and Hughes (1995) concluded "…an appropriate corridor width for species conservation depends upon the stream and taxon of concern." In their study on mid-order streams in Vermont, they found that their data did not provide a single width as the appropriate corridor dimension for birds, mammals, and plants. An all-encompassing width of protected adjacent land was difficult to discern.

Semlitsch and Jensen (2001) concluded based on freshwater turtle data from Carlonia Bays and on Ambystoma salamanders information from the eastern United States that by applying biologically relevant criteria and bolstering the biological health of core terrestrial habitats, land managers could develop stratified habitat zones to guide protection resulting in more effective biodiversity conservation. The authors proposed using stratified criteria to include at least three terrestrial zones adjacent to core aquatic and wetland habitats:

1) Starting from wetland edge a first terrestrial zone to buffer the core aquatic habitat and protect aquatic resources (Aquatic Buffer).

2) Starting again from the wetland edge and overlapping the first zone, a second terrestrial zone would comprise the core terrestrial habitat defined by semi-aquatic focal species or species group use (Core Habitat).

3) Starting from the outward edge of the second zone, a third terrestrial zone would buffer the core terrestrial habitat from edge effects and surrounding land use practices (Terrestrial Buffer).

Some ordinances include a matrix of wetland types, slopes, habitats, and land use intensities, which are then used to define the extent of the buffer. For example, Sammamish, Washington, prescribes a set of buffers based on four distinct categories of wetlands initially defined by their wetland functions, and further modified by the habitat scores for each of these wetlands (McElfish et al. 2008).

Table 3.5.3.3
Recommended Buffer Widths for Various Wetland Categories
(Data from McElfish et al. (2008))

Wetland Category		Standard Buffer Width (ft)
Category I	Natural Heritage or bog wetlands	215
	Habitat score 29-36	200
	Habitat score 20-28	150
	Not meeting above criteria	125
Category II	Habitat score 29-36	150
	Habitat score 20-28	100
	Not meeting above criteria	75
Category III	Habitat score 20-28	75
	Not meeting above criteria	50
Category IV		50

Sammamish, Washington, ordinance: Wetlands rated according to the Washington State Wetland Rating System for

Western Washington (Washington Department of Ecology, 2004, or as revised).

Under this ordinance, Sammamish's development department may further increase the required buffer distance by the greater of 50 feet or a distance necessary to protect the functions and values of the wetland as well as to provide connectivity whenever a Category I or II wetland with a habitat score of 20 or greater is located within 300 feet of another Category I or II wetland, a fish and wildlife conservation area, or a stream supporting anadromous fish. Required buffers may be reduced if the impacts are mitigated and result in equal or better protection of wetland functions (S21A.50.290).

Alachua County, Florida, provides for a case-by-case performance-based standard buffer, but also provides for a numerical default value when sufficient information is not available to support a case-by-case determination. The buffer:

> "shall be determined on a case-by-case basis after site inspection by the County depending upon what is demonstrated to be scientifically necessary to protect natural ecosystems from significant adverse impact (5406.43)."

Alachua County requires the following factors to be considered in making the case-by-case determination: 1) Type of activity and associated potential for adverse site-specific impacts; 2) Type of activity and associated potential for adverse offsite or downstream impacts; 3) Surface water or wetland type and associated hydrologic requirements; 4) Buffer area characteristics, such as vegetation, soils, and topography; 5) Required buffer area function (e.g., water quality protection, wildlife habitat requirements, flood control); 6) Presence or absence of listed species of plants and animals; and 7) Natural community type and associated management requirements of the buffer (5406.43).

Where sufficient scientific information is not available, the Alachua County ordinance prescribes default values with an average buffer distance of 50 feet, and minimum of 35 feet for wetlands less than or equal to a half acre; 75 feet (minimum 50 feet) for wetlands greater than half acre; 150 feet (minimum 75 feet) where listed species are documented; and 150 feet (minimum 100 feet) where the wetland is an outstanding resource water ($406.43(c)).

3.5.4. Results from Wildlife Surveys in Matanzas Basin

Wetland-dependent Species

Analyses were conducted to determine relationships and patterns among the measured dependent variables (abundance, diversity and species richness) and the independent parameters (detailed previously in Section 2.5.1. All variables were tested for assumptions of normality using both log transformed and non-transformed data. The presented best-fit general linear model (GLM) results were all statistically significant ($p < 0.05$). As an additional test for patterns between abundance and various potentially significant forcing functions, a series of non-parametric analyses was also performed, and the results are shown in tabular form.

Relationships between potentially significant independent factors and the abundance, species diversity and species richness of wetland-dependent wildlife are shown for combined freshwater and saltwater transects, freshwater transects alone, and then saltwater transects alone.

Combined Freshwater and Saltwater Transects

Figures 3.5.4.1 through 3.5.4.2 graphically depict the observed relationships of both observed the total abundance and species richness of wetland-dependent organisms relative to upland buffer width. Figure 3.5.3 correspondingly depicts the relationship between the observed richness (number of taxa) of wetland-dependent species and the scaled cross product of buffer width and core wetland habitat score. Statistically significant relationship were not found using GLM procedures between either of these independent factors and calculated Shannon Diversity Index values.

Each graphic presents the observed data as blue dots, the resulting line (black/dashed) of the best-fit GLM model and both the calculated upper and lower 95 percent confidence intervals (blue/dashed lines). Each graphic also includes the calculated Rsquare (R^2) for the resulting model.

The analytical results indicated a number of statistically significant relationships with regard to relationships between the tested dependent and independent variables and among the four buffer width based transect categories.

- The application of GLM modeling indicated that a simple non-linear squared term for buffer width was the best-fit, explaining approximately 63% of the observed variation in the observed total abundance of wetland dependent taxa. The results indicated that transects with larger buffer widths generally were observed to have a greater number of wetland-dependent taxa using the applied standardized sampling efforts.

- In comparison, only 21 % of the observed variation in species richness was found to be explained by buffer-width. Independently, 40% of the species richness was found be linearly related to the calculated term accounting for the interaction of buffer width and wetland habitat score. Multiple regression results indicated that when these two terms were combined a statistically significant model accounting for 54% of the observed variation in species richness could be developed.

- While graphical plots indicated generally increases with both buffer width and wetland habitat score, no statistically significant relationships were observed using similar GLM procedures between the Shannon Diversity Index measure and any the tested independent variables.

Figure 3.5.4.1
Total Abundance of Wetland-dependent Organisms vs. Buffer Width

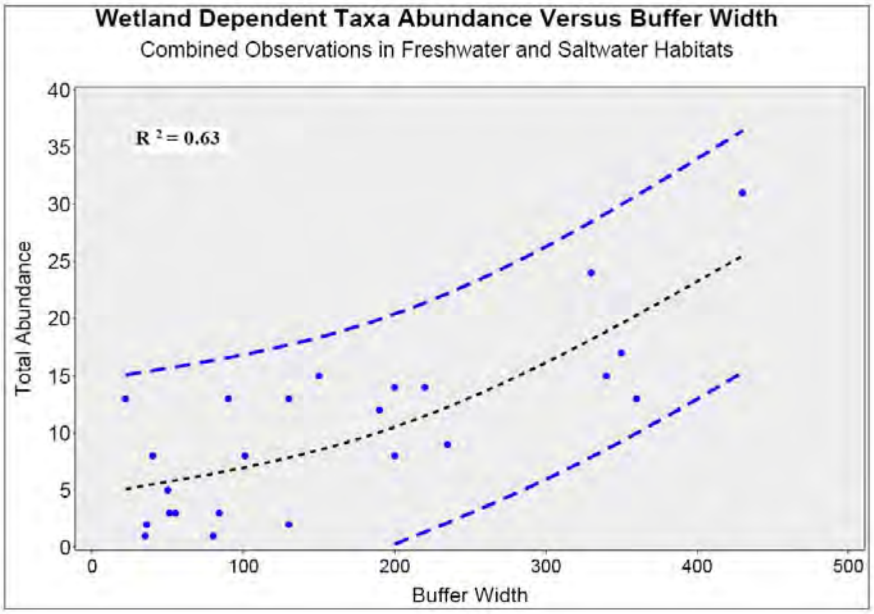


Figure 3.5.4.2
Species Richness of Wetland-dependent Organisms vs. Buffer Width

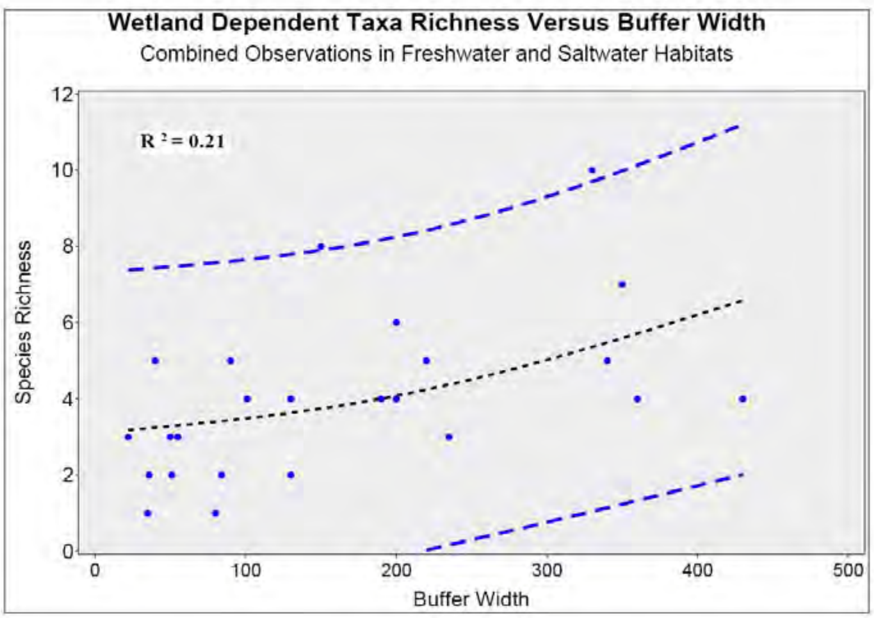
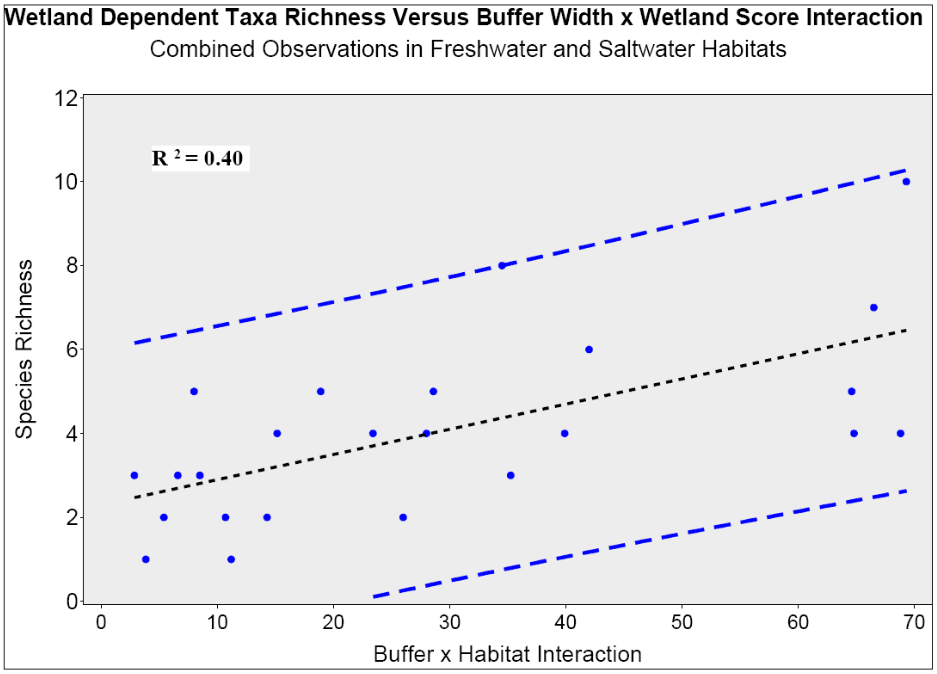


Figure 3.5.4.3
Species Richness of Wetland-Dependent Organisms vs. Buffer Width x Wetland Habitat Score Interaction



Comparisons among the applied statistical multiple range tests indicated significant differences in the observed abundance of wetland-dependent taxa between different buffer-width categories. The 301-500 foot buffer width category was statistically significantly different from the 0-50, 51-100 and 101-300 foot buffer width categories, in terms of the number of wetland-dependent species (i.e., species richness; see Figure 3.5.4.2).

The observed increases in the numbers and abundance of wetland dependent taxa with increasing buffer width and wetland quality are consistent with the summary findings (Castelle et al. 1992, Wenger 1992) previous discussed in section 3.5.3. Researchers have reported increases in the density, diversity and species richness of birds (Smith and Schaefer 1992), mammals (Boyd 2001), and both reptiles and amphibians (Burk and Gibbon 1995, Semlitsch 1998).

Freshwater Transects

Figure 3.5.4.4 shows the relationship between buffer width and observed total abundance of wetland-dependent wildlife for freshwater wetlands, while Figures 3.5.4.5 and 3.5.4.7 show the relationship between Shannon Diversity and species richness, and wetland width. Figure 3.5.4.6 shows the relationship between species richness the interaction between buffer widths and wetland habitat scores.

Figure 3.5.4.4
Total Abundance of Wetland-dependent Organisms vs. Buffer Width

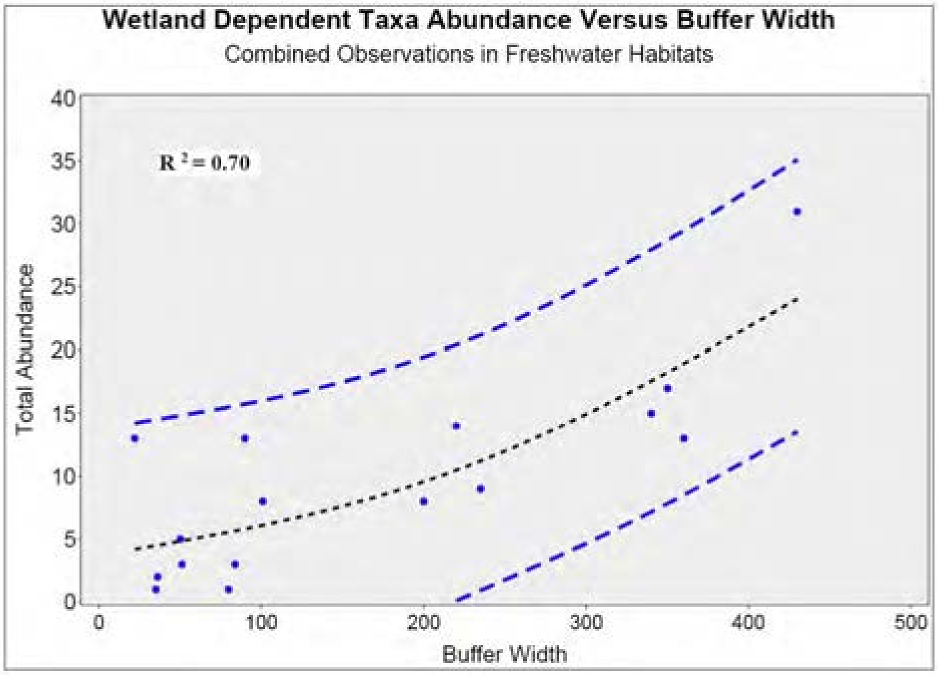


Figure 3.5.4.5
Diversity of Wetland-dependent Organisms vs. Wetland Width

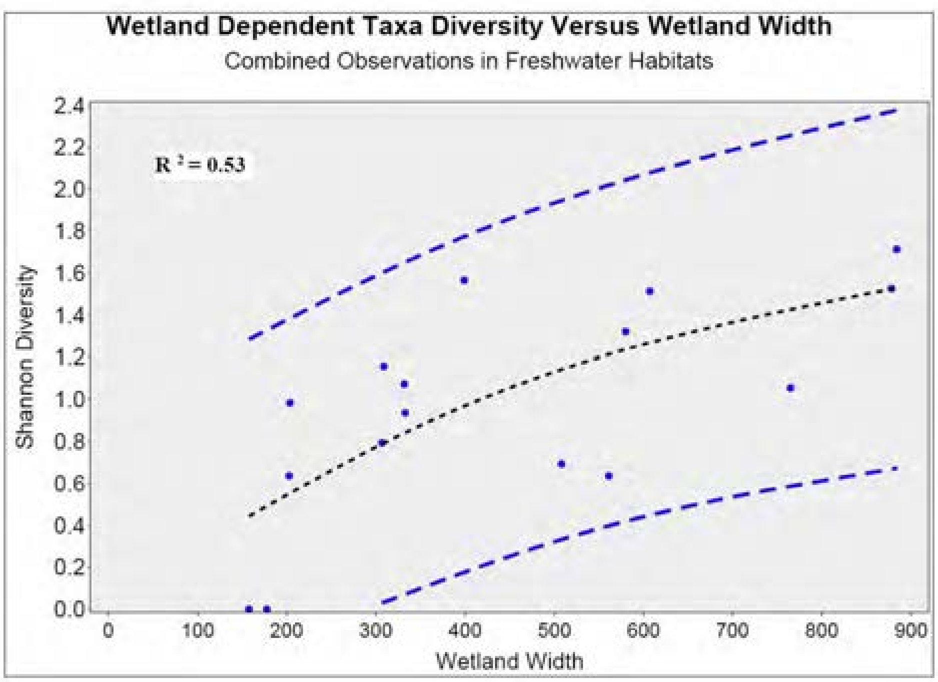


Figure 3.5.4.6
Species Richness of Wetland-dependent Organisms vs. Buffer Width x Wetland Habitat Score Interaction

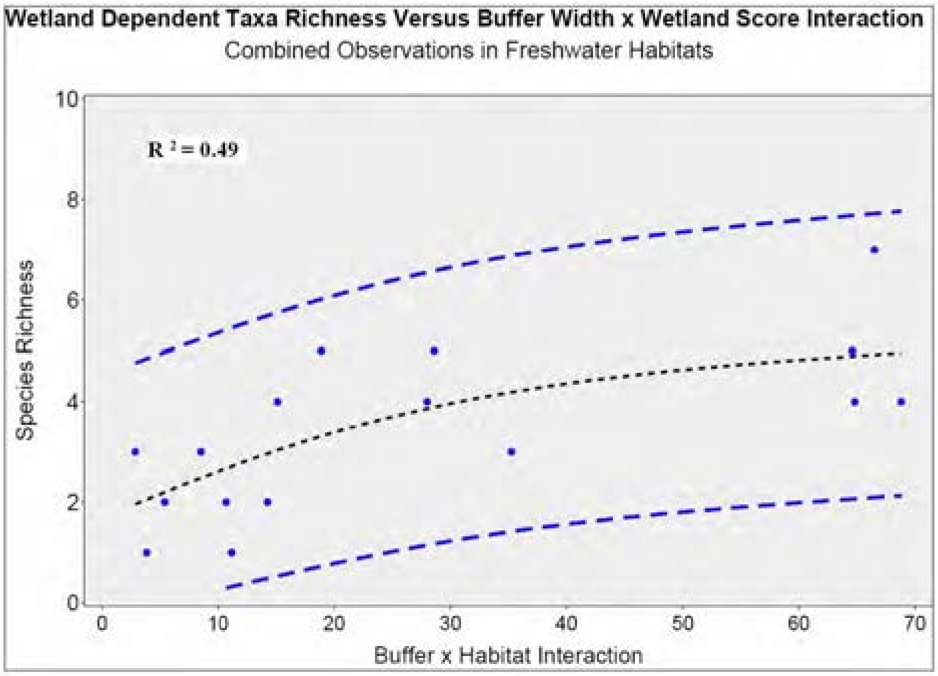
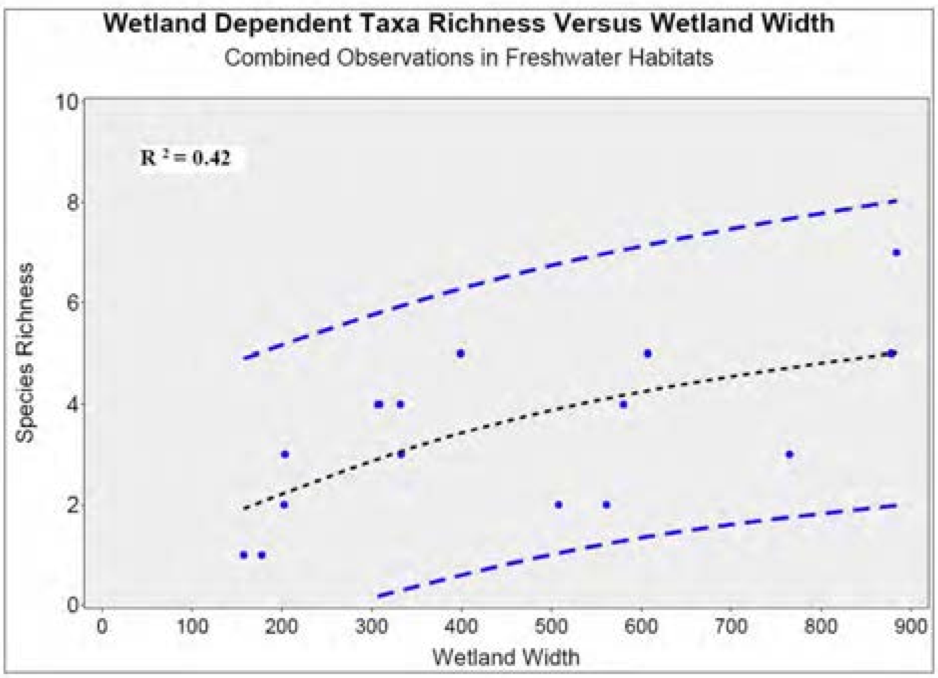


Figure 3.5.4.7
Species Richness of Wetland-dependent Organisms vs. Wetland Width



When the observed occurrences of wetland-dependent taxa for the 16 freshwater wetland transects alone are analyzed separately, the following relationships and patterns were found:

- The GLM modeling again indicated that a simple non-linear squared term for buffer width provided the best-fit model accounting for 70% of the observed variation in the observed total abundance of wetland-dependent taxa (Figure 3.5.4.4).

- Figure 3.5.4.5 shows that 53% of the diversity of wetland-dependent species observed in the freshwater transects could be explained by a non-linear term for the overall width of the wetland (or area).

- Approximately 49% of the observed variability in the species richness of wetland-dependent taxa was explained by a statistical model containing a term for the interaction of buffer width and wetland habitat score (Figure 3.5.4.6). Wetland width could also be used (Figure 3.5.4.7) to explain 42% of species richness. When these two terms were combined using multiple linear regression then 65% of the observed variation in species richness was explained.

Analyses using multiple range test statistical procedures applied to just the freshwater transects indicated that only the largest upland buffer width category (301-500 feet) was observed to have a greater abundance and species richness of wetland-dependent taxa, and no statistically significant difference was observed in Shannon Diversity among the four transect categories.

Saltwater Transects

When wetland dependent taxa from just the eight saltwater were analyzed separately, the data indicated the following relationships and patterns.

- A term for the interaction of buffer width and habitat score provided a best-fit linear model accounting for approximately 71% of the observed variation in the observed total abundance of wetland dependent taxa from the saltwater transects (Figure 3.5.4.8).

- As indicated in Figure 3.5.4.9, just over 56% of the observed variability in the species richness of wetland dependent taxa was explained by a statistical model containing a non-linear term squared term for buffer width.

- No statistically significant relationships were observed using GLM procedures between the Shannon Diversity Index measure and the tested independent transect metrics.

Figure 3.5.4.8
Total Abundance of Wetland-dependent Organisms vs. Buffer Width x Wetland Habitat Score Interaction

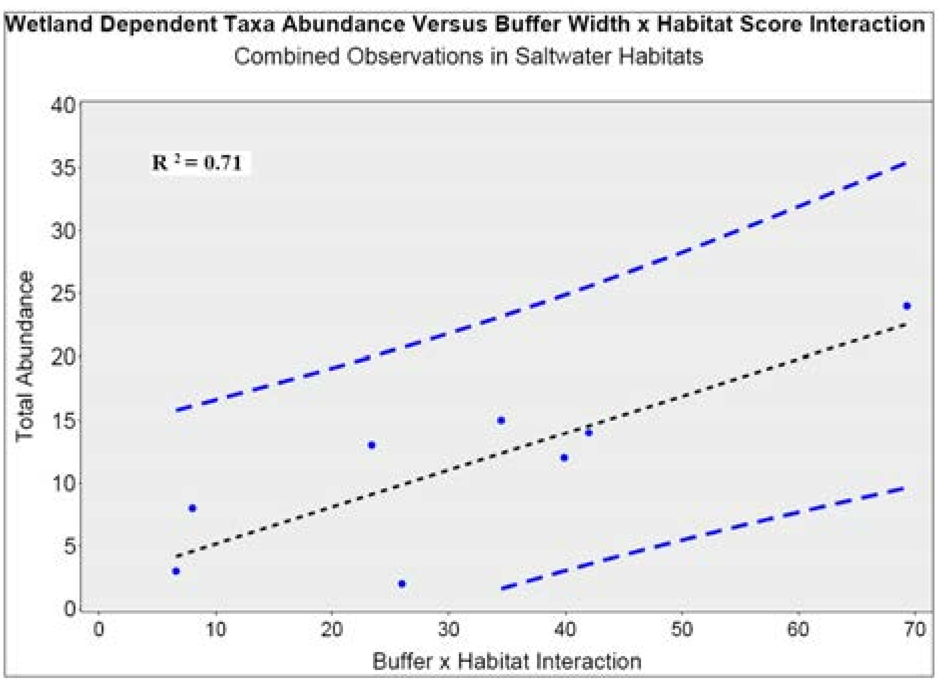


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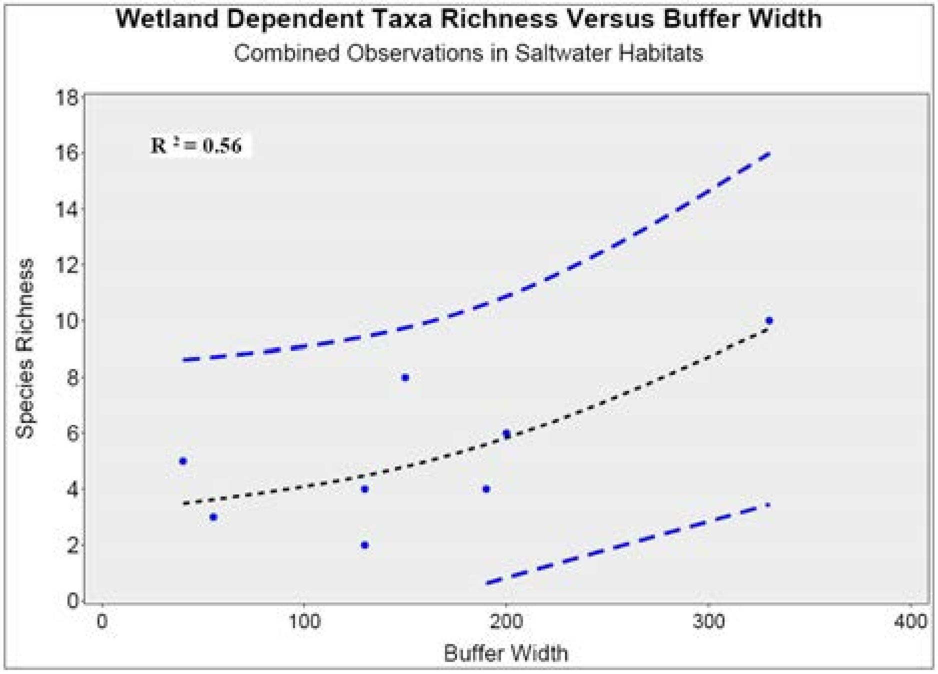
Figure 3.5.4.9
Species Richness of Wetland-dependent Organisms vs. Buffer Width



Application of multiple range test statistical procedures using just the observed wetland-dependent taxa from the eight saltwater transects showed that only the largest upland buffer width category (301-500 foot) exhibited statistically significant greater abundance and species richness, while no statistically significant difference was observed in Shannon Diversity among the four transect categories.

Freshwater Amphibians

A final series of graphical and statistical analyses were conducted to analyze the relationships between the observed abundance, species richness and diversity of amphibian taxa observed along the 16 freshwater monitoring transects. Due to their small size, amphibians (frogs and toads) provide an opportunity to investigate the relationships between buffer and wetland metrics and the numbers and types of wetland-dependent taxa having relatively limited mobility. A series of analyses analogous to those previously described were conducted for the five species of frogs and one toad species detected during the freshwater transect monitoring.

Figure 3.5.4.10 shows the relationship between buffer width and the total abundance of amphibians (observed in both buffer and wetland habitats) for freshwater wetlands. As indicated, approximately 67% of the variability in observed amphibian abundance could be explained by a non-linear term for buffer width. Figure 3.5.4.11 shows the linear relationship between the total abundance of observed amphibians (in both buffer and wetland habitats) vs. a buffer width times habitat score interaction accounted for 50% of the observed variation.

Statistically significant models could not be developed for either amphibian species richness or diversity using the tested independent transect terms tested.

Figure 3.5.4.10
Total Abundance of Wetland-dependent Organisms vs. Buffer Width

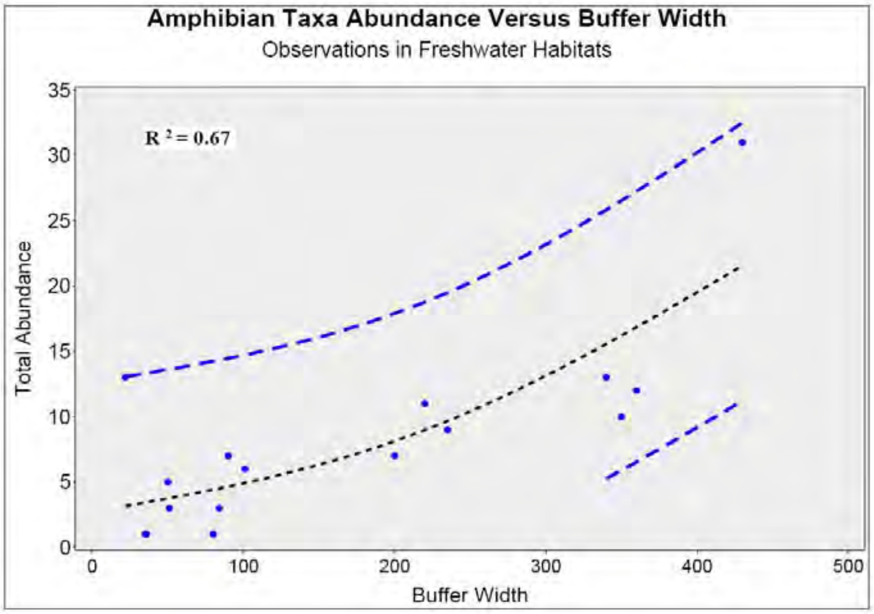
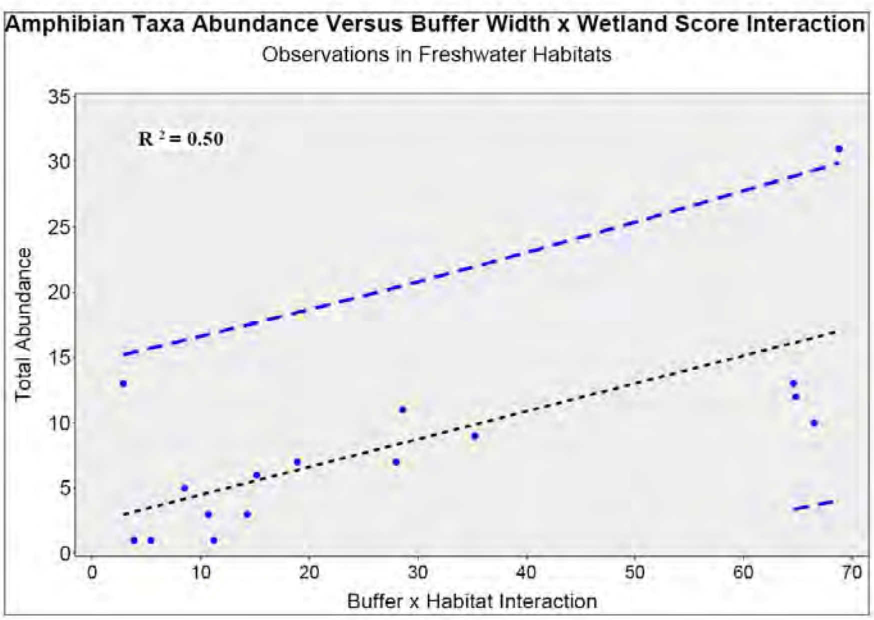


Figure 3.5.4.11
Total Abundance of Wetland-dependent Organisms vs.
Buffer Width x Wetland Habitat Score Interaction



Multiple range test statistical procedures were used to test for statistically significant differences in amphibian abundances, species richness and diversity among the four selected upland buffer categories (0-50, 51-100, 101-300 and 301-500 feet). Only the largest upland buffer width category (301-500 feet) was observed to have a greater abundance of individuals observed per standardized sampling effort. No statistically significant differences were found in either species richness or the Shannon Diversity Index among the four transect categories.

PRIMER Analysis

The results of the various ANOSIM tests are displayed in Table 3.5.4.1. There were four instances where a factor was found to have a statistically significant affect on the abundance of organisms observed. The factor Fresh vs. Saltwater was significantly different for both all data combined, as well as for all bird data alone. These results confirm the observation that the numbers of organisms observed differs between the fresh and saltwater wetlands sampled, justifying the approach of analyzing the data separately for these two different types of wetlands. Buffer width was found to have a significant effect on the "Amphibians in freshwater wetlands" dataset, and on the "all freshwater wetlands" dataset. However, the Global R values are relatively low, indicating that these relationships, while statistically significant, have limitations as to their predictive capabilities.

Table 3.5.4.1
The Results of ANOSIM Analyses on the Abundance of Organisms Observed

	Buffer Width		Wetland Width		Fresh v Saltwater		Wetland Core Score		Wetland Core Score*Buffer Width	
Dataset	P-Value	Global R	P-Value	Global R	P-Value	Global R	P-Value	Global R	P-Value	Global R
All Raw Data	0.38	0.007	0.20	0.069	0.001	0.900	0.08	0.200	0.23	0.058
Amphibians in FW	0.02	0.234	0.17	0.113	-	-	0.12	0.223	0.16	0.126
All Birds Data	0.33	0.018	0.84	-0.62	0.004	0.254	0.15	0.103	0.67	-0.041
Birds in SW	0.59	-0.076	0.05	0.504	-	-	0.13	0.365	0.54	-0.067
All FW	0.02	0.222	0.15	0.131	-	-	0.09	0.265	0.23	0.086

3.6. Task 6: Determine the Need for Additional Protection of Upland and Wetland Habitat

3.6.1. Habitat Loss from Future Development

The amount of additional development expected in the year 2015 has been calculated and mapped by both Flagler and St. Johns Counties **(their FLUMs are circa 2015)**. The Future Land Use Maps (FLUMs) they updated were then compared to estimates based on population projections from the Bureau of Economic and Business Research (BEBR) and a previously generated population vs. land use relationship developed by the SJRWMD. A comparison between these two estimates shows they differ by only 6.7 percent, and suggest that by the year

2035, a total of 62,000 (approximately) acres of land would be impacted by development. The amount of wetland impact would depend upon the locations where such development takes place. To aid in the location of future development, conceptual development plans were consulted and used to estimate developed areas within developments of regional impact (DRIs). It was estimated that approximately 3,500 acres of development will result from DRIs within the Matanzas River Drainage Basin with the remainder, approximately 13,966 acres (tables 3.5.1.2 & 3.5.1.3), coming from mostly smaller, less regionally noticeable land development activity.

Areas likely to be developed are concentrated along paved transportation corridors such as county, state, or federal highways and adjacent or near areas already targeted for development in the FLUMs and various DRIs.

Based on the map developed to locate areas of expected future development (Figure 3.5.1.1) the acreage of wetlands in those areas was determined. In St. Johns County, it is estimated that approximately 8,026 acres of wetlands are found in those portions of the Matanzas River Basin likely to be developed by the year 2035. In Flagler County, it is estimated that approximately 5,038 acres of wetlands are found in those portions of the Matanzas River Basin likely to be developed by 2035. While various regulatory programs are in place to guide development away from impacting those wetlands, it was assumed that potential net losses of approximately 17% of the total impacted wetland area would be a reasonable expectation. The combined impact from the two counties suggests that approximately 13,000 acres of wetlands are contained within the "footprint" of expected new development by the year 2035. It may be prudent to expect that approximately 2,000 acres (i.e., 0.17 x 13,064 = 2,220 acres) of wetlands would be lost as well.

Based on a comprehensive assessment of the scientific literature on wildlife utilization and buffer widths, it is likely that wider buffer widths do have an enhanced ability to protect wetland-dependent wildlife.

There is an extensive list of species of birds, mammals, reptiles and amphibians expected to occur within the Matanzas River Basin, as shown in Section 3.1. The literature related to buffer widths and wildlife suggests that buffers in excess (or greatly in excess) of 100 feet are commonly given as guidance for the protection of wetland-dependent wildlife. Still, the results from our field reconnaissance efforts in the Matanzas River Basin were not entirely consistent with the literature related to benefits of wider buffer widths.

For example, there was no clear relationship found between buffer widths and the abundance, species richness, or diversity of mammals for either freshwater or saltwater wetlands, but this might be due (at least in part) to the small number of mammals encountered. And while there was evidence of an increased number of birds observed for wetlands with wider buffer widths, most of those birds observed in freshwater wetlands (but not the salt marsh sites) were not wetland-dependent species,. This increased number of birds observed is consistent with much of the research which identifies that while "edge habitat" may have greater species richness, the inhabitants and utilizing species are "generalists" as opposed to the more specialized species seen in wetlands with more protected interior forest (i.e. wider buffers).

However, the field reconnaissance data showed a rather substantial influence of buffer widths on the abundance of amphibians, which require wetlands, by definition, for completing their life cycles. While the abundance of amphibians was positively associated with increased buffer widths, species richness and diversity of amphibians were not correlated with buffer widths; the field data collected in this effort support the contention that more amphibians would be likely found for wetlands with wider buffers (e.g., Whitlock et al. 1994, Semlitsch 1998) but the data collected in this field effort did not provide evidence that more species would likely be encountered in wetlands with wider buffers.

Other factors that influence the abundance and diversity of wetland-dependent species were the width of the wetland itself, and the quality of the wetland habitat. These factors, the quality and extent of the wetland in question, might be useful for determining whether or not some wetlands might be more "deserving" of enhanced protection than other systems (to be discussed below).

By the year 2035, it is probable that the abundance of wetland-dependent animals (especially amphibians) would decrease in response to increasing development of upland habitats adjacent to the remaining wetlands in the Matanzas River basin.

3.6.2. Potential Approaches to Protect Wildlife Utilization

Rather than using a single, default buffer width for protection of wildlife throughout the entire Matanzas River Basin, an optional approach would be for buffer width guidance to vary with the "quality" of the wetland system likely to be impacted by development. For example, Alachua County Florida currently has different setback distances for wetland protection, dependent upon the size and ecological health of individual wetlands. This approach, with tiered buffer width guidance for different types and qualities of wetlands, is consistent with guidance provided for East Central Florida by Brown et al. (1990) as well as guidance provided for wetlands in Washington State by McElfish et al. (2008). In Alachua County, setback distances for wetland protection are determined on a case-by-case basis, depending upon the following issues:

- What type of development is involved, and what is its potential to produce adverse impacts,
- What type of surface water feature or wetland type is involved, and what are its associated hydrologic requirements,
- What are the characteristics of the buffer area itself, including vegetation, soils, and topography,
- What is the expected buffer area function (e.g., water quality protection, wildlife habitat requirements, flood control),
- Are there any listed species of plants and animals in either the wetland or its adjacent buffer, and
- What are the land management requirements of the associated buffer

For those instances where insufficient scientific information is available to answer the above-described questions, the Alachua County ordinance includes default values for buffer widths, as outlined below:

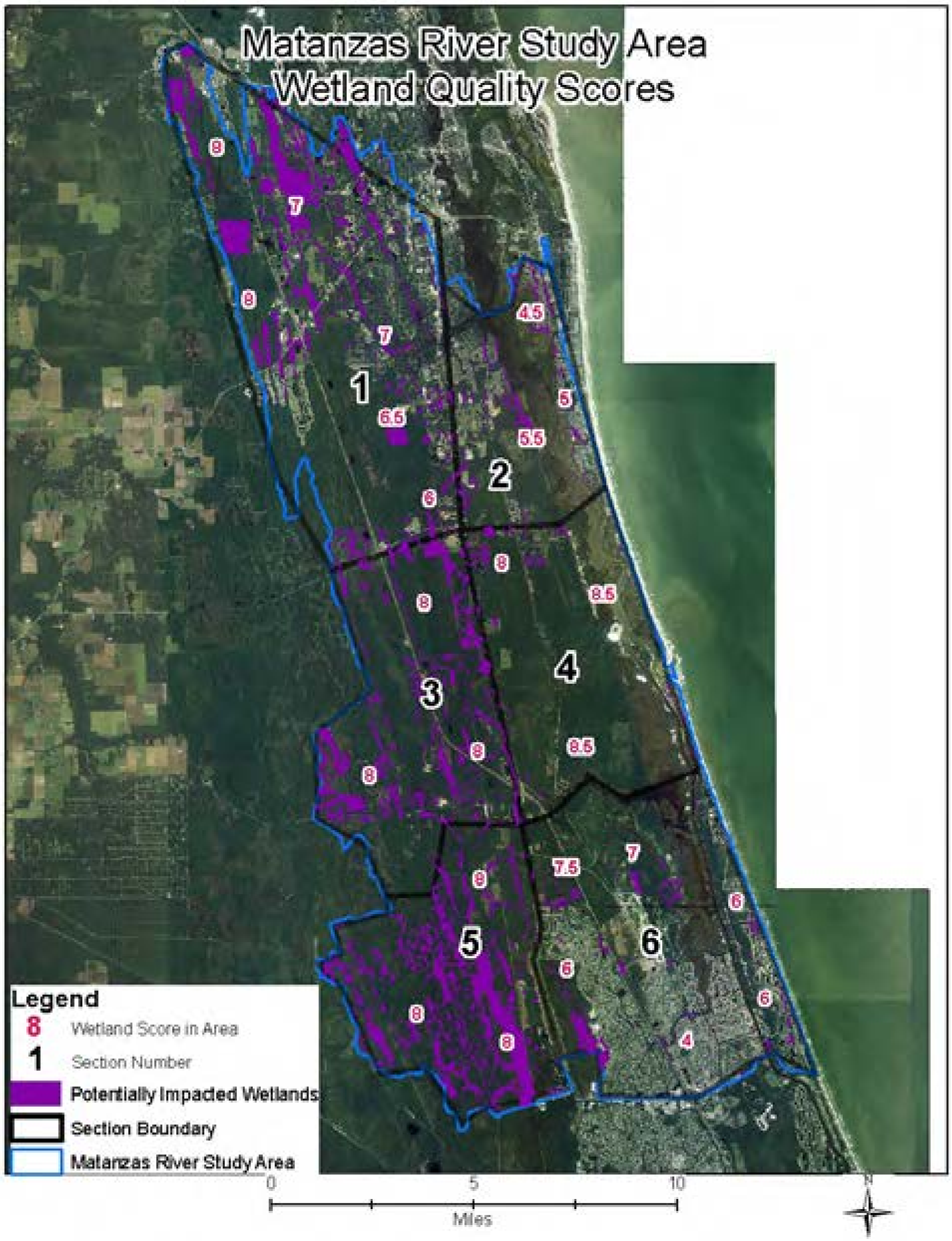
- For wetlands less than or equal to a half acre in size, an average buffer distance of 50 feet and minimum of 35 feet,
- For wetlands greater than half an acre is size, an average buffer distance of 75 feet and a minimum 50 feet,
- For wetlands where listed species are documented to occur, an average buffer distance of 150 feet and a minimum 75 feet,
- And where the County has identified the wetland in question as an outstanding resource waterbody, an average of 150 feet and a minimum 100 feet.

The fact that the guidance used in Alachua County's ordinance is greater than the current guidance used in the Matanzas River Basin is not lost on the authors. And while the data collected in the field sampling efforts is consistent with the broader body of literature that suggests enhanced protection is typically found with wider buffers, these data are restricted to a single wet-season sampling effort at a limited number of locations. Nonetheless, it is likely that wider buffers would be more protective of wetland-dependent wildlife in the Matanzas River Basin, as has been concluded in numerous other locations.

A more holistic approach to wetland protection might be warranted in the Matanzas River Basin. Such an approach might include assessing the quality of the wetland in question, and its degree of interconnectedness to other valuable habitats, both uplands and wetlands, and developing buffer width requirements based on the results of the assessment. This approach might allow the variety of stakeholders in the region to focus their efforts on protecting those wetland features that are more likely to serve as critical wildlife habitat for wetland-dependent species.

As a preliminary attempt to prioritize future conservation efforts, staff from the SJRWMD were interviewed and asked to score the quality of large, regional wetland features that could be impacted by development by the year 2035. The quality of the potentially impacted wetland systems was scored on a scale from 1 to 10 based on criteria such as hydrology, appropriate vegetation, absence of unnatural disturbance, connectivity to more habitat, species richness, presence of listed species, and uniqueness of the habitat. These scores were determined by examining aerial photography and GIS habitat data, and verified via interviews with SJRWMD scientists with local knowledge of the area of concern. To facilitate discussion of these findings, the Matanzas River study area was divided into six sections. These sections and a regionally-derived range of wetland habitat scores are shown in Figure 3.6.1.

Figure 3.6.1
Display of Regional Wetland Quality Scores (see text for description of methodology) for Wetlands Likely to be Impacted by Future Development in the Matanzas River Basin



The large linear wetland features found in the western half of the Matanzas River Basin (Sections 1, 3, and 5) were given the highest habitat quality scores in this analysis. While there were high quality regional wetland features identified in Sections 4 and 6, in the northeastern and southeastern regions of the basin, most wetlands were ranked as being of lower habitat quality. Some of the remaining wetland features in the southernmost (Section 6) and northernmost (Section 2) portions of the basin were ranked as having limited habitat value.

The results of this assessment could be used to prioritize areas within the Matanzas River Basin where different protective criteria, such as buffer widths, could be used to protect wildlife utilization for those wetlands not likely to be protected through mechansims such as land purchase and/or the granting of conservation easements. A flexible approach to wetland protection could allow for a greater consensus to develop among local stakeholders for protecting the wildlife utilization benefits of remaining wetlands in the basin.

In the absence of site-specific or regionally-varying protective guidance, the amount of land that would be requried for buffer widths of 25, 50, 100 and 300 feet was determined for those wetlands that fall within the footprint of expected development by the year 2035 (Table 3.6.1).

Table 3.6.1
Area of Future Development within Various Buffer Distances from Potentially Impacted Wetlands in the year 2035.

Buffer Distance (ft)	"Additional" Buffer Area (acres)	Total Buffer Area (acres)
25	-	2,437
50	2,525	4,962
100	5,141	10,103
300	18,969	29,072

For those wetlands expected to be within the footprint of development in the year 2035, a buffer width of 25 feet would require 2,437 acres of land to be set aside. Should the buffer width be increased to 50 feet, an additional 2,525 acres of land would be needed. For a buffer width of 100 feet, 5,141 additional acres of land would be needed (on top of the 4,962 for a 50 foot buffer). And if a 300 foot buffer was chosen, a total land area of 29,072 acres would be needed to be set aside.

While a single, and perhaps enhanced, buffer width may indeed be selected by the SJRWMD for protecting the wildlife utilization of wetlands in the Matanzas River Basin, a more focused approach would likely reduce the amount of acreage required to protect wildlife utilization of the remaining and at-risk wetlands in the basin.

3.7. References

Brown, M.T. and J.M. Schaefer. 1987. Buffer Zones for Water, Wetland, and Wildlife. A Final Report on the Evaluation of the Applicability of Upland Buffers for the Wetlands of the Wekiva Basin. Prepared for the St. Johns River Water Management District by the Center for Wetlands, University of Florida, Gainesville, Florida 32611. 163 pp.

Brown, Mark; J. Schaefer, and K. Brandt. May 1990. *Buffer Zones for Water, Wetlands and Wildlife in the East Central Florida Region*. Final Report. Center for Wetlands, University of Florida.

Burke, Vincent J. and J. W. Gibbons. 1995. *Terrestrial Buffer Zones and Wetland Conservation: A Case Study of Freshwater Turtles in a Carolina Bay.* Conservation Biology, 9(6):1365-1369.

Castelle, A.J., C. Conolly, M. Emers, E.D. Metz, S. Meyer, M. Witter, S. Mauermann, T. Erickson, S.S. Cooke. 1992. Wetland Buffers: Use and Effectiveness. Adolfson Associates, Inc., Shorelands and Coastal Zone Management Program, Washington Department of Ecology, Olympia, Pub. No. 92-10.

Chase V.P., L.S. Deming and F. Latawiec. 1995. Buffers for Wetlands and Surface Waters: A Guidebook for New Hampshire Municipalities**.** Audubon Society of New Hampshire

Darveau, M., Beauchesne, P., Belanger, L, Huot, J. and P. Larue. 1995. "Riparian forest strips as habitat for breeding birds in boreal forest," *J. Wildl. Management*. 59, 67-78.

Davies and M. Nelson, "Relationships between riparian buffer widths and the effects of logging on stream habitat, invertebrate community composition, and fish abundance," *Australian Journal of Marine and Freshwater Research* 45 (1994).

DeGraaf, Richard M. and M. Yamasaki. 2001. New England Wildlife: habitat, natural history and distribution. University Press of New England, Hanover, NH

deMaynadier, Phillip G. and Malcolm L. Hunter, Jr. 1998. *Effects of Silvicultural Edges on the Distribution and Abundance of Amphibians in Maine.* Conservation Biology 12(2): 340-352.

deMaynadier, Phillip G. and Malcolm L. Hunter, Jr. 1999. *Forest Canopy Closure and Juvenile Emigration By Pool-breeding Amphibians in Maine.* Journal of Wildlife Management 63(2):441-450.

Dodd, Jr. and B.S. Cade, "Movement Patterns and the Conservation of Amphibians Breeding in Small, Temporary Wetlands." *Conservation Biology*, Vol. 12, No. 2 (Apr., 1998), pp. 331-339. 1998

Environmental Law Institute. 2008. Planners Guide to Wetland Buffers for Local Governments.

Fischer, R. A. 2000. "Width of riparian zones for birds." Ecosystem Management and Restoration Research Program Technical Notes Collection, U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi. www.wes.army.mil/el/emrrp.

Fisher et al. 1998. Corridors and Vegetated Buffer Zones: A Preliminary Assessment and Study Design. Technical Report EL-99-3. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Gaines, D. (1974). "Review of the status of the yellow-billed cuckoo in California: Sacramento Valley populations," *Condor* 76, 204-209.

Gibbons. 2003. Terrestrial Habitat: A vital component for Herpetofauna of Isolated Wetlands. *Wetlands*, Vol. 23, No. 3, September 2003, pp. 630–635 (2003), The Society of Wetland Scientists

Hagar, J.C. 1999. "Influence of riparian buffer width on bird assemblages in Western Oregon," *J. Wildl. Management* 63, 484-496.

Hodges, M.F., and D.G. Krementz. 1996. "Neotropical migratory breeding bird communities in riparian forests of different widths along the Altamaha River Georgia," *Wilson Bul*l. 108, 496-506.

Keller, C.M.E., Robbins, C.S. and J.S. Hatfield. 1993. "Avian communities in riparian forests of different widths in Maryland and Delaware," *Wetlands* 13, 137-144.

Kilgo, J.C., Sargent, R.A, Chapman, B.R., and K.V. Miller .1998. "Effect of stand width and adjacent habitat on breeding bird communities in bottomland hardwoods," *Journal of Wildlife Management* 62, 72-83.

McElfish, J.M., Jr. , Kihslinger, R.L. and S. Nichols. 2008. "Setting Buffer Sizes for Wetlands," *National Wetlands Newsletter,* Vol. 30. No. 2.

Mitchell, F. 1996. "Vegetated buffers for wetlands and surface waters: Guidance for New Hampshire municipalities," *Wetlands Journal* 8, 4-8.

Naiman, R. J., H. D.Camps, J. Pastor and C.A. Johnston. 1988. The potential importance of boundaries to fluvial ecosystems. *Journal of the North American Benthological Society* 7(4): 289-306.

Office of Long Island Sound Programs Tidal Wetlands Buffers Guidance Document.

Roman, C.T. and Good, R.E. 1983. Wetlands of the New Jersey Pinelands: Values, Functions and Impacts (Section One). In: Wetlands of the New Jersey Pinelands: Values, Functions, Impacts, and a Proposed Buffer Delineation Model. Division of Pinelands Research, Center for Coastal and Environmental Studies, Rutgers - the State University, New Brunswick, NJ. 123 pp.

Semlitsch.1998. Biological Delineation of Terrestrial Buffer Zones for Pond Breeding Salamanders. Conservation Biology Vol.12 no.5. 1113-1119.

Semlitsch R.D. and J.R. Bodie. 2003. Biological Criteria for Buffer Zones around Wetlands and Riparian Habitats for Amphibians and Reptiles. Conservation Biology 17(5): 1219-1228.

Semlitsch and Jensen. Core Habitat Not Buffer Zone. *National Wetlands Newsletter*. Vol 23, no. 4. 2001

Smith, R. J. and J. M. Schaefer. 1992. Avian characteristics of an urban riparian strip corridor. *Wilson Bulletin* 104(4):732-738.

Spackman, S. C. and J. W. Hughes. 1995. *"Assessment of Minimum Steam Corridor Width for Biological Conservation: Species Richness and Distribution along Mid-Order Streams in Vermont, USA." Biological Conservation* 71: 325-332.

Strommen, B., K. Cappiella, D. Hirschman, and J. Tasillo. 2007. A Local Ordinance to Protect Wetland Functions. Ellicott City, MD: Center for Watershed Protection. *Available at* http://www.cwp.org/wetlands/ articles/WetlandsArticle4.pdf.

Tassone, J. 1981. "Utility of hardwood leave strips for breeding birds in Virginia's central Piedmont," M.S. theses, Virginia Polytechnic Institute and Statue University, Blacksburg.

Triquet, A. M., G. A. McPeek, and W. C. McComb. 1990. Songbird diversity in clearcuts with and without a riparian buffer strip. *Journal of Soil and Water Conservation* July-Aug: 500- 503.

Vander Haegen, M.W. and R.M. DeGraaf 1996. "Predation on artificial nests in forested riparian buffer strips," *J. Wildl. Management* 60, 542-550.

Wenger, Seth. 1999. A Review of the Scientific Literature on Riparian buffer width, extent, and Vegetation. For the Office of Public Service and Outreach at the Institute of Ecology, University of Georgia.

Whitaker, D.M., and W.A. Montevecchi. 1999. "Breeding bird assemblages inhabiting riparian buffer strips in Newfoundland, Canada," *J. Wildl. Management* 63, 167-179.

Whitlock, A.L., N.M. Jarman and J.S. Larson. 1994. *WEThings; Wetland Habitat Indicators for NonGame Species, Wetland-dependent Amphibians, Reptiles and Mammals of New England.*, Publication 94-1, The Environmental Institute, University of Massachusetts, Amherst.

Appendix A

Literature-Based Compilation of Additional Vertebrates Potentially Found in the Matanzas River Study Area

Mammals

The following table is from the American Society of Mammologists website (http://www.mammalsociety.org/statelists/flmammals.html), and lists the mammals that might be found in the Matanzas study area, excluding cetaceans, pinnipeds, and manatee. Ten species are noted as wetland dependent according to Brown *et al.* 1990. See References at the end of section 3.0. Whether a species is wetland dependent (Y) or not (N) is also indicated.

Mammals in the Matanzas River Drainage Basin (Source: American Society of Mammologists)					
Order	**Common Name**	**Scientific Name**	**Wetland Dependent**	**State Listed**	**Federally Listed**
MARSUPIALIA	Virginia opossum	*Didelphis virginia*	-	-	-
INSECTIVORA	Southern short-tailed shrew	*Blairina carolinensis*	-	-	-
	Least shrew	*Cryptotis parva*	-	-	-
	Southeastern shrew	*Sorex longirostris*	Y	-	-
	Eastern mole	*Scalopus aquaticus*	-	-	-
CHIROPTERA	Brazilian free-tailed bat	*Tadarida braziliensis*	-	-	-
	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	-	-	-
	Big brown bat	*Eptesicus fuscus*	-	-	-
	Eastern red bat	*Lasiurus borealis*	-	-	-
	Hoary bat	*Lasiurus cinereus*	-	-	-
	Northern yellow bat	*Lasiurus intermedius*	-	-	-
	Seminole bat	*Lasiurus seminolus*	-	-	-
	Southeastern bat	*Myotis austroriparius*	-	-	-
	Evening bat	*Nycticeius humeralis*	-	-	-
	Eastern pipistrelle	*Pipistrellus subflavus*	Y	-	-
XENARTHRA	Nine-banded armadillo	*Dasypus novemcinctus*	-	-	-
LAGOMORPHA	Cottontail rabbit	*Sylvilagus floridanus*	-	-	-
	Marsh rabbit	*Sylvilagus palustris*	Y	-	-
RODENTIA	Southern flying squirrel	*Glaucomys volans*	-	-	-
	Eastern gray squirrel	*Sciurus carolinensis*	-	-	-
	Fox squirrel	*Sciurus niger*	-	SSC	-
	Southeastern pocket gopher	*Geomys pinetis*	-	-	-
	Nutria	*Myocastor coypus*	Y	-	-
	Marsh rice rat	*Oryzomys palustris*	Y	-	-
	Eastern harvest mouse	*Reithrodontomys humulis*	-	-	-
	Cotton mouse	*Peromyscus gossypinus*	-	-	-
	Beach mouse; Oldfield mouse	*Peromyscus polionouts*	-	E[1]	E[1]
	Florida mouse	*Podomys floridanus*	-	SSC	-

Mammals in the Matanzas River Drainage Basin (Source: American Society of Mammologists)					
Order	**Common Name**	**Scientific Name**	**Wetland Dependent**	**State Listed**	**Federally Listed**
	Golden mouse	*Ochrotomys nuttalli*	Y	-	-
	Hispid cotton rat	*Sigmodon hispidus*	-	-	-
	Eastern woodrat; Key Largo woodrat	*Neotoma floridana*	-	-	-
	Round-tailed muskrat	*Neofiber alleni*	Y	-	-
	House mouse	*Mus musculus*	-	-	-
	Roof or Black rat	*Rattus rattus*	-	-	-
	Norway rat	*Rattus norvegicus*	-	-	-
CARNIVORA	Coyote	*Canis latrans*	-	-	-
	Red fox	*Vulpes vulpes*	-	-	-
	Gray fox	*Urocyon cinereoargenteus*	-	-	-
	Black bear	*Ursus americanus*	Y	T	-
	Raccoon	*Procyon lotor*	Y	-	-
	Long-tailed weasel	*Mustela frenata*	-	-	-
	River otter	*Lutra canadensis*	Y	-	-
	Striped skunk	*Mephitis mephitis*	-	-	-
	Jaguarundi	*Felis yagouaroundi*	-	-	-
	Bobcat	*Lynx rufus*	Y	-	-
ARTIODACTYLA	Feral pig	*Sus scrofa*	-	-	-
	White-tailed deer; Key deer	*Odocoileus virginianus*	-	-	-

SSC = Species of special concern
T = Threatened
E = Endangered
[1] *Peromyscus polionouts phasma,* the Anastasia Island beach mouse
Many mammals travel widely, but for the purposes of this study, the animals on this list are considered endemic.

Birds

The following table is from the St. John's Audubon Society bird checklist (http://www.stjohnsaudubon.org/site/wildlife/countybirdlist.html). Spring occurs from April – May; Summer occurs from June – August; Fall occurs from September – November; Winter occurs from December – February. An asterisk (*) indicates the species probably breeds in St. John's County.

Birds in the Matanzas River Drainage Basin (Source: St. John's Audubon Society)				
Species	Seasonal Occurrence			
	Spring	Summer	Fall	Winter
LOONS & GREBES				
Red-throated Loon				R
Common Loon	R			O
Pied-billed Grebe *	C	R	U	C
Horned Grebe				O
PELICANS & ALLIES				
Northern Gannet	U			C
American White Pelican	O		O	U
Brown Pelican	C	C	C	A
Double-crested Cormorant	C	C	C	A
Anhinga *	U	U	U	U
Magnificent Frigatebird	R	R	R	R
HERONS & EGRETS				
American Bittern	O			O
Least Bittern *	O	U		
Great Blue Heron *	C	C	C	C
Great Egret *	C	C	C	A
Snowy Egret *	C	C	C	C
Little Blue Heron *	C	C	C	C
Tricolored Heron *	C	C	C	C
Reddish Egret	O	O	O	R
Cattle Egret *	A	A	C	A
Green Heron *	O	O	O	O
Black-crowned Night-Heron *	U	U	U	C
Yellow-crowned Night-Heron *	O	O	O	O
IBISES & STORKS				
White Ibis *	C	C	C	A
Glossy Ibis	O	O	O	O
Roseate Spoonbill	U	C	U	
Wood Stork *	C	C	C	C
DUCKS & ALLIES				
Fulvous Whistling-Duck	R		R	R
Snow Goose				R
Canada Goose	O			O
Wood Duck *	O	O	O	O

Birds in the Matanzas River Drainage Basin (Source: St. John's Audubon Society)				
Species	Seasonal Occurrence			
	Spring	Summer	Fall	Winter
Green-winged Teal	O		O	U
American Black Duck	R			R
Mottled Duck *	U		U	U
Mallard	U		U	U
Northern Pintail	O		O	O
Blue-winged Teal	O	R	O	U
Northern Shoveler	O		O	O
Gadwall			O	O
American Wigeon	O		O	U
Canvasback			R	R
Redhead	R		R	O
Ring-necked Duck	R		O	U
Greater Scaup			R	R
Lesser Scaup	O		O	U
Black Scoter			R	R
Surf Scoter			R	R
White-winged Scoter			R	R
Common Goldeneye				R
Bufflehead	O		O	O
Hooded Merganser	U		U	C
Red-breasted Merganser	U		U	C
Ruddy Duck	O		O	U
VULTURES & HAWKS				
Black Vulture *	U	U	U	U
Turkey Vulture *	C	C	C	C
Osprey *	C	C	C	U
Swallow-tailed Kite *	U	U		
Bald Eagle *	U	U	U	U
Northern Harrier	U		U	U
Sharp-shinned Hawk	U		U	U
Cooper's Hawk *	O	O	O	O
Red-shouldered Hawk *	U	U	U	U
Red-tailed Hawk *	U	O	U	U
American Kestrel	C		C	C
Merlin	R		O	R
Peregrine Falcon	R		O	R
QUAILS & TURKEYS				
Wild Turkey *	O	O	O	O
Northern Bobwhite *	O	O	O	O
RAILS, LIMPKINS & CRANES				
Clapper Rail *	C	C	C	C
King Rail *	R	R	R	R
Virgina Rail	U			U
Sora	O		O	O

Birds in the Matanzas River Drainage Basin (Source: St. John's Audubon Society)				
Species	**Seasonal Occurrence**			
	Spring	**Summer**	**Fall**	**Winter**
Purple Gallinule	R	R		
Common Moorhen *	C	C	C	C
American Coot	U		O	C
Limpkin *	O	O	O	O
Sandhill Crane	R			R
SHOREBIRDS				
Black-bellied Plover	C	C	C	A
Wilson's Plover *	U	C	U	U
Semipalmated Plover	C		C	C
Piping Plover	R		R	R
Killdeer *	C	C	C	C
American Oystercatcher *	U	U	U	U
Black-necked Stilt *	O	U	O	
American Avocet			R	
Greater Yellowlegs	U		U	U
Lesser Yellowlegs	U		U	U
Solitary Sandpiper	O		O	R
Willet *	C	C	C	A
Spotted Sandpiper	U		U	U
Whimbrel	U		U	U
Long-billed Curlew			R	R
Marbled Godwit	O		O	O
Ruddy Turnstone	C	U	C	A
Red Knot	U	R	U	U
Sanderling	A	A	A	A
Semipalmated Sandpiper	C	R	C	
Western Sandpiper	C		C	C
Least Sandpiper	U		U	U
Dunlin	C		C	C
Short-billed Dowitcher	A		A	C
Long-billed Dowitcher	R		R	R
Common Snipe	U		U	U
American Woodcock	O		O	O
JEAGERS, GULLS & TERNS				
Pomarine Jaeger				R
Parasitic Jaeger				R
Laughing Gull *	A	A	A	A
Bonaparte's Gull				O
Ring-billed Gull	C	O	C	A
Herring Gull	C	O	C	C
Lesser Black-backed Gull			R	O
Great Black-backed Gull	U	R	U	C
Gull-billed Tern *	O	O	O	
Caspian Tern	U	O	U	U

Birds in the Matanzas River Drainage Basin (Source: St. John's Audubon Society)				
Species	**Seasonal Occurrence**			
	Spring	**Summer**	**Fall**	**Winter**
Royal Tern	C	C	C	C
Sandwich Tern	C	O	C	O
Common Tern	U		U	R
Forster's Tern	U		U	C
Least Tern *	C	A	C	
Black Tern	O		U	
Black Skimmer *	U	U	U	C
DOVES				
Rock Dove *	A	A	A	A
Eurasian Collared-Dove *	C	C	C	C
Mourning Dove *	A	A	A	A
Common Ground-Dove *	U	U	U	U
PARROTS				
Monk Parakeet *	U	U	U	U
Nanday Parakeet (Black-hooded)*	U	U	U	U
Rose-ringed Parakeet	U	U	U	U
Mitred Conure *	U	U	U	U
CUCKOOS				
Yellow-billed Cuckoo *	O	O	O	
OWLS				
Barn Owl *	R	R	R	R
Eastern Screech-Owl *	U	U	U	U
Great Horned Owl *	U	U	U	U
Barred Owl *	U	U	U	U
GOATSUCKERS (NIGHTJARS)				
Common Nighthawk *	U	U	U	
Chuck-will's-widow	C	C	O	
Whip-poor-will	R			
SWIFTS & HUMMINGBIRDS				
Chimney Swift *	C	C	C	
Ruby-throated Hummingbird *	C	C	C	
KINGFISHERS				
Belted Kingfisher *	C	R	C	C
FLYCATCHERS				
Eastern Wood Pewee *	U	R	U	
Least Flycatcher			R	
Eastern Phoebe	U		U	C
Great Crested Flycatcher *	C	U	O	
Western Kingbird				R
Eastern Kingbird *	U	O	U	
Gray Kingbird *	U	U		
SWALLOWS				
Purple Martin *	U	C	U	
Tree Swallow	C		C	C

Birds in the Matanzas River Drainage Basin (Source: St. John's Audubon Society)				
Species	Seasonal Occurrence			
	Spring	Summer	Fall	Winter
Northern Rough-winged Swallow *	R	R	R	
Cliff Swallow *			R	
Barn Swallow	C	U	C	
JAYS & CROWS				
Blue Jay *	A	A	C	C
Florida Scrub-Jay *	R	R	R	R
American Crow *	C	C	C	C
Fish Crow *	A	A	A	A
CHICKADEES, TITMICE & CREEPERS				
Carolina Chickadee *	U	U	U	U
Tufted Titmouse *	C	C	C	C
Brown-headed Nuthatch *	O	O	O	O
Brown Creeper				R
WRENS				
Carolina Wren *	C	C	C	C
House Wren	U		U	U
Sedge Wren	U		U	U
Marsh Wren *	U	U	U	U
KINGLETS & GNATCATCHERS				
Ruby-crowned Kinglet	C		C	C
Blue-gray Gnatcatcher *	U	U	U	U
BLUEBIRDS, THRUSHES & THRASHERS				
Eastern Bluebird *	U	U	U	U
Veery	O		O	
Gray-cheeked Thrush	O		O	
Swainson's Thrush	O		O	
Hermit Thrush	O		O	O
Wood Thrush	O		O	
American Robin	C		U	C
Gray Catbird *	C	R	C	C
Northern Mockingbird *	C	C	C	C
Brown Thrasher *	U	U	U	U
PIPITS & WAXWINGS				
American Pipit				O
Cedar Waxwing	U		O	U
SHRIKES & STARLINGS				
Loggerhead Shrike *	U	U	U	U
European Starling *	A	A	A	A
VIREOS				
White-eyed Vireo *	C	O	C	U
Blue-headed (Solitary) Vireo	U		U	U
Yellow-throated Vireo *	U	O	U	
Red-eyed Vireo *	C	U	C	
WOOD WARBLERS				

Birds in the Matanzas River Drainage Basin (Source: St. John's Audubon Society)				
Species	**Seasonal Occurrence**			
	Spring	**Summer**	**Fall**	**Winter**
Blue-winged Warbler	R		R	
Golden-winged Warbler	R		R	
Tennessee Warbler	U		U	
Orange-crowned Warbler	O		R	U
Nashville Warbler	R		R	
Northern Parula *	C	U	U	R
Yellow Warbler	O	R	O	
Chestnut-sided Warbler	O		O	
Magnolia Warbler	R		U	
Cape May Warbler	R		R	
Black-throated Blue Warbler	U		U	
Yellow-rumped Warbler	A		A	A
Black-throated Green Warbler	O		O	
Blackburnian Warbler	R		R	
Yellow-throated Warbler *	U	U	U	U
Pine Warbler *	U	U	U	U
Prairie Warbler *	U	R	U	O
Palm Warbler	U		U	U
Bay-breasted Warbler	R		R	
Blackpoll Warbler	O		R	
Cerulean Warbler	R		R	
Black-and-White Warbler	U		U	U
American Redstart	C		C	
Prothonotary Warbler *	U	O	U	
Worm-eating Warbler	U		U	
Ovenbird	U		U	R
Northern Waterthrush	U		U	
Louisiana Waterthrush	R		R	
Kentucky Warbler				
Common Yellowthroat *	C	U	C	U
Hooded Warbler	O		O	
Yellow-breasted Chat *	R	R	R	
TANAGERS, BUNTINGS & TOWHEES				
Summer Tanager *	U	U	U	
Scarlet Tanager	R		R	
Northern Cardinal *	C	C	C	C
Rose-breasted Grosbeak	O		O	
Blue Grosbeak *	U	R	U	
Indigo Bunting *	U	R	U	
Painted Bunting *	U	U	U	
Eastern Towhee *	C	C	C	C
SPARROWS & JUNCOS				
Bachman's Sparrow *	O	O	R	R
Chipping Sparrow	U		U	U

Birds in the Matanzas River Drainage Basin (Source: St. John's Audubon Society)				
Species	**Seasonal Occurrence**			
	Spring	**Summer**	**Fall**	**Winter**
Field Sparrow	R		R	U
Vesper Sparrow	R		R	R
Lark Sparrow	R		R	
Savannah Sparrow	C		U	C
Grasshopper Sparrow	R		R	R
Saltmarsh Sharp-tailed Sparrow	O		O	U
Nelson's Sharp-tailed Sparrow	O		O	U
Seaside Sparrow *	U	U	U	U
Fox Sparrow				R
Song Sparrow	U		U	U
Swamp Sparrow	O		O	O
White-throated Sparrow	U		U	U
White-crowned Sparrow	R		R	R
Dark-eyed Junco	O			O
BLACKBIRDS, ORIOLES & FINCHES				
Bobolink	U		U	
Red-winged Blackbird *	A	A	A	A
Eastern Meadowlark *	U	U	U	U
Rusty Blackbird				R
Boat-tailed Grackle *	A	A	A	A
Common Grackle *	C	C	C	C
Brown-headed Cowbird *	O		O	O
Orchard Oriole *	O	O		
Baltimore Oriole	O		O	O
Purple Finch	R			R
Pine Siskin				R
American Goldfinch	U		O	U
OLD WORLD SPARROWS				
House Sparrow *	C	C	C	C

A = Abundant (Easily observed)
C = Common (Observed regularly)
U = Uncommon (Observed in low numbers)
O = Occasional (Observed in low number with special effort)
R = Rare (Not expected; may not be present every year)

Breeding Birds in the Matanzas River Drainage Basin (Source: Florida FWC Breeding Bird Atlas)				
Common Name	**Scientific Name**	**Wetland Dependent?**	**State Listed**	**Federally Listed**
Pied-billed Grebe	*Podilymbus podiceps*	Y	-	-
Double-crested Cormorant	*Phalacrocorax auritus*	Y	-	-
Anhinga	*Anhinga anhinga*	Y	-	-
American Bittern	*Botaurus lentiginosus*	Y	-	-
Least Bittern	*Ixobrychus exilis*	Y	-	-
Great Blue Heron	*Ardea herodias*	Y	-	-
Great Egret	*Ardea alba*	Y	-	-
Snowy Egret	*Egretta thula*	Y	-	-
Tricolored Heron	*Egretta tricolor*	Y	-	-
Cattle Egret	*Bubulcus ibis*	Y	-	-
Green Heron	*Butorides virescens*	Y	-	-
Wood Stork	*Mycteria americana*	Y	E	E
Black Vulture	*Coragyps atratus*	-	-	-
Turkey Vulture	*Cathartes aura*	-	-	-
Muscovy Duck	*Cairina moschata*	Y	-	-
Wood Duck	*Aix sponsa*	Y	-	-
Mallard	*Anas platyrhynchos*	Y	-	-
Mottled Duck	*Anas fulvigula*	Y	-	-
Osprey	*Pandion haliaetus*	Y	SSC	-
Swallow-tailed Kite	*Elanoides forficatus*	Y	-	-
Bald Eagle	*Haliaeetus leucocephalus*	Y	-	-
Sharp-shinned Hawk	*Accipiter striatus*	-	-	-
Cooper's Hawk	*Accipiter cooperii*	-	-	-
Red-shouldered Hawk	*Buteo lineatus*	Y	-	-
Red-tailed Hawk	*Buteo jamaicensis*	-	-	-
American Kestrel	*Falco sparverius*	-	T[1]	-
Wild Turkey	*Meleagris gallopavo*	-	-	-
Northern Bobwhite	*Colinus virginianus*	-	-	-
Clapper Rail	*Rallus longirostris*	Y	-	-
King Rail	*Rallus elegans*	Y	-	-
Purple Gallinule	*Porphyrio martinica*	Y	-	-
Common Moorhen	*Gallinula chloropus*	Y	-	-
Limpkin	*Aramus guarauna*	Y	SSC	-
Sandhill Crane	*Grus canadensis*	Y	SSC	-
Wilson's Plover	*Charadrius wilsonia*	Y	-	-
Killdeer	*Charadrius vociferus*	Y	-	-
American Oystercatcher	*Haematopus palliatus*	Y	SSC	-
Black-necked Stilt	*Himantopus mexicanus*	Y	-	-
Willet	*Catoptrophorus semipalmatus*	Y	-	-
American Woodcock	*Scolopax minor*	Y	-	-
Least Tern	*Sterna antillarum*	Y	T	-
Black Skimmer	*Rynchops niger*	Y	SSC	-
Rock Pigeon	*Columba livia*	-	-	-
Eurasian Collared-Dove	*Streptopelia decaocto*	-	-	-
Mourning Dove	*Zenaida macroura*	-	-	-
Common Ground-Dove	*Columbina passerina*	-	-	-

Breeding Birds in the Matanzas River Drainage Basin (Source: Florida FWC Breeding Bird Atlas)				
Common Name	**Scientific Name**	**Wetland Dependent?**	**State Listed**	**Federally Listed**
Black-hooded Parakeet	*Nandayus nenday*	-	-	-
Monk Parakeet	*Myiopsitta monachus*	-	-	-
Yellow-billed Cuckoo	*Coccyzus americanus*	-	-	-
Barn Owl	*Tyto alba*	-	-	-
Eastern Screech-Owl	*Otus asio*	-	-	-
Great Horned Owl	*Bubo virginianus*	-	-	-
Barred Owl	*Strix varia*	Y	-	-
Common Nighthawk	*Chordeiles minor*	-	-	-
Chuck-will's-widow	*Caprimulgus carolinensis*	-	-	-
Chimney Swift	*Chaetura pelagica*	-	-	-
Ruby-throated Hummingbird	*Archilocus colubris*	-	-	-
Belted Kingfisher	*Ceryle alcyon*	Y	-	-
Red-headed Woodpecker	*Melanerpes erythrocephalus*	-	-	-
Red-bellied Woodpecker	*Melanerpes carolinus*	-	-	-
Downy Woodpecker	*Picoides pubescens*	-	-	-
Hairy Woodpecker	*Picoides villosus*	-	-	-
Northern Flicker	*Colaptes auratus*	-	-	-
Pileated Woodpecker	*Dryocopus pileatus*	-	-	-
Eastern Wood-Pewee	*Contopus virens*	-	-	-
Acadian Flycatcher	*Empidonax virescens*	Y	-	-
Great Crested Flycatcher	*Myiarchus crinitus*	-	-	-
Eastern Kingbird	*Tyrannus tyrannus*	-	-	-
Gray Kingbird	*Tyrannus dominicensis*	-	-	-
Loggerhead Shrike	*Lanius ludovicianus*	-	-	-
White-eyed Vireo	*Vireo griseus*	-	-	-
Yellow-throated Vireo	*Vireo flavifrons*	-	-	-
Red-eyed Vireo	*Vireo olivaceus*	-	-	-
Blue Jay	*Cyanocitta cristata*	-	-	-
Florida Scrub-Jay	*Aphelocoma coerulescens*	-	T	T
American Crow	*Corvus brachyrhynchos*	-	-	-
Fish Crow	*Corvus ossifragus*	-	-	-
Purple Martin	*Progne subis*	-	-	-
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Y	-	-
Barn Swallow	*Hirundo rustica*	-	-	-
Carolina Chickadee	*Poecile carolinensis*	-	-	-
Tufted Titmouse	*Baeolophus bicolor*	-	-	-
Brown-headed Nuthatch	*Sitta pusilla*	-	-	-
Carolina Wren	*Thryothorus ludovicianus*	-	-	-
Blue-gray Gnatcatcher	*Polioptila caerulea*	-	-	-
Eastern Bluebird	*Sialia sialis*	-	-	-
American Robin	*Turdus migratorius*	-	-	-
Gray Catbird	*Dumetella carolinensis*	-	-	-
Northern Mockingbird	*Mimus polyglottos*	-	-	-
Brown Thrasher	*Toxostoma rufum*	-	-	-
European Starling	*Sturnus vulgaris*	-	-	-

Breeding Birds in the Matanzas River Drainage Basin (Source: Florida FWC Breeding Bird Atlas)				
Common Name	**Scientific Name**	**Wetland Dependent?**	**State Listed**	**Federally Listed**
Northern Parula	*Parula americana*	Y	-	-
Yellow-throated Warbler	*Dendroica dominica*	Y	-	-
Pine Warbler	*Dendroica pinus*	-	-	-
Prairie Warbler	*Dendroica discolor*	-	-	-
Prothonotary Warbler	*Protonotaria citrea*	Y	-	-
Common Yellowthroat	*Geothlypis trichas*	Y	-	-
Hooded Warbler	*Wilsonia citrina*	-	-	-
Yellow-breasted Chat	*Icteria virens*	-	-	-
Summer Tanager	*Piranga rubra*	-	-	-
Eastern Towhee	*Pipilo erythrophthalmus*	-	-	-
Bachman's Sparrow	*Aimophila aestivalis*	-	-	-
Northern Cardinal	*Cardinalis cardinalis*	-	-	-
Blue Grosbeak	*Passerina caerulea*	-	-	-
Indigo Bunting	*Passerina cyanea*	-	-	-
Painted Bunting	*Passerina ciris*	-	-	-
Red-winged Blackbird	*Agelaius phoeniceus*	Y	-	-
Eastern Meadowlark	*Sturnella magna*	-	-	-
Common Grackle	*Quiscalus quiscula*	-	-	-
Boat-tailed Grackle	*Quiscalus major*	Y	-	-
Brown-headed Cowbird	*Molothrus ater*	-	-	-
Orchard Oriole	*Icterus spurius*	-	-	-
House Sparrow	*Passer domesticus*	-	-	-

SSC = Species of special concern
T = Threatened
E = Endangered
[1] Florida breeding subspecies: Southeastern American Kestrel
State list species is from the Florida FWC. Federally listed species list is from the USFWS.
This list is based upon the results of the Florida FWC Breeding Bird Atlas (BBA) surveys conducted from 1986 - 1991. Eurasian collared-dove has been added to this list because it has become ubiquitous in Florida since the BBA was completed. Http://myfws.com/bba/
The birds on this list are either confirmed or likely breeders in Flagler and St. John's Counties, and therefore are considered endemic.

Reptiles in the Matanzas River Drainage Basin (Source: Conant and Collins 1998)				
Common Name	**Scientific Name**	**Wetland Dependent**	**State Listed**	**Federally Listed**
Green anole	*Anolis carolinensis*	-	-	-
Brown anole	*Anolis sagrei*	-	-	-
Six-lined racerunner	*Cnemidophorus sexlineatus*	-	-	-
Mole skink	*Eumeces egregius*	-	-	-
Five-lined skink	*Eumeces fasciatus*	-	-	-
Southeastern five-lined skink	*Eumeces inexpectatus*	-	-	-
Broadhead skink	*Eumeces laticeps*	Y	-	-
Indo-Pacific gecko	*Hemidactylus garnotii*	-	-	-
Mediterranean gecko	*Hemidactylus turcicus*	-	-	-
Eastern slender glass lizard	*Ophisaurus attenuatus longicaudus*	-	-	-
Island glass lizard	*Ophisaurus compressus*	-	-	-
Mimic glass lizard	*Ophisaurus mimicus*	-	-	-
Eastern glass lizard	*Ophisaurus ventralis*	-	-	-
Southern fence lizard	*Sceloporus undulatus undulatus*	-	-	-
Ground skink	*Scincella lateralis*	-	-	-
		-	-	-
Florida worm lizard	*Rhineura floridana*	-	-	-
		-	-	-
Florida cottonmouth	*Agkistrodon piscivorus conanti*	Y	-	-
Scarlet snake	*Cemophora coccinea*	Y	-	-
Southern racer	*Coluber constrictor priapus*	Y	-	-
Eastern diamondback rattlesnake	*Crotalus adamanteus*	-	-	-
Timber rattlesnake	*Crotalus horridus atricaudatus*	Y	-	-
Southern ringneck snake	*Diadophis punctatus punctatus*	Y	-	-
Eastern indigo snake	*Drymarchon corais couperi*	Y	T	T
Corn snake	*Elaphe guttata*	-	-	-
Yellow rat snake	*Elaphe obsoleta quadrivittata*	Y	-	-
Eastern mud snake	*Farancia abacura abacura*	Y	-	-
Rainbow snake	*Farancia erytrogramma erytrogamma*	Y	-	-
Eastern hognose snake	*Heterodon platirhinos*	Y	-	-
Southern hognose snake	*Heterodon simus*	-	-	-
Florida kingsnake	*Lampropeltis getula floridana*	-	-	-
Eastern kingsnake	*Lampropeltis getula getula*	Y	-	-
Scarlet kingsnake	*Lampropeltis triangulum elapsoides*	Y	-	-
Eastern coachwhip	*Masticophis flagellum flagellum*	-	-	-
Eastern coral snake	*Micrurus fulvius fulvius*	-	-	-
Atlantic saltmarsh snake	*Nerodia clarkii taeniata*	Y	T	-
Banded watersnake	*Nerodia fasciata*	Y	-	-
Florida green watersnake	*Nerodia floridana*	Y	-	-
Brown watersnake	*Nerodia taxispilota*	Y	-	-
Rough green snake	*Opheodrys aestivus*	Y	-	-
Florida pine snake	*Pituophis melanoleucus mugitus*	-	SSC	-

Reptiles in the Matanzas River Drainage Basin (Source: Conant and Collins 1998)				
Common Name	**Scientific Name**	**Wetland Dependent**	**State Listed**	**Federally Listed**
Striped crayfish snake	*Regina alleni*	Y	-	-
Glossy crayfish snake	*Regina rigida*	Y	-	-
Pine woods snake	*Rhadinaea flavilata*		-	-
North Florida swamp snake	*Seminatrix pygaea pygaea*	Y	-	-
Dusky pygmy rattlesnake	*Sistrurus miliarius barbouri*	Y	-	-
Brown snake	*Storeria dekayi*	Y	-	-
Florida redbelly snake	*Storeria occipitomaculata obscurus*	Y	-	-
Peninsula ribbon snake	*Thamnophis sauritus sackenii*	Y	-	-
Eastern garter snake	*Thamnophis sirtalis sirtalis*	Y	-	-
Rough earth snake	*Virginia striatula*	-	-	-
		-	-	-
American alligator	*Alligator mississippiensis*	Y	SSC	-
		-	-	-
Common snapping turtle	*Chelydra serpentina*	Y	-	-
Stinkpot	*Sternotherus odoratus*	Y	-	-
Loggerhead musk turtle	*Sternotherus minor minor*	Y	-	-
Striped mud turtle	*Kinosternon bauri*	Y	-	-
Mud turtle	*Kinosternon subrubrum*	Y	-	-
Spotted turtle	*Clemmys guttata*	Y	-	-
Florida box turtle	*Terrapene carolina bauri*	Y	-	-
Diamondback terrapin	*Malaclemys terrapin*	Y	-	-
Florida cooter	*Pseudemys floridana*	Y	-	-
Florida redbelly turtle	*Pseudemys nelsoni*	Y	-	-
Chicken turtle	*Deirochelys reticularia*	Y	-	-
Gopher tortoise	*Gopherus polyphemus*	-	T	-
Florida softshell	*Apalone ferox*	Y	-	-

SSC = Species of special concern
T = Threatened
E = Endangered
This list excludes sea turtles.
State list species is from the Florida FWC. Federally listed species list is from the USFWS.

Amphibians in the Matanzas River Drainage Basin (Source: Conant and Collins 1998)		
Common Name	**Scientific Name**	**State Listed**
Two-toed amphiuma	*Amphiuma means*	-
Greater siren	*Siren lacertina*	-
Eastern lesser siren	*Siren intermedia intermedia*	-
Southern Dwarf siren	*Pseudobranchus axanthus*	-
Mole salamander	*Ambystoma talpoideum*	-
Flatwoods salamander	*Ambystoma cingulatum*	SSC
Eastern newt	*Notophthalmus viridescens*	-
Southern dusky salamander	*Desmognathus auriculatus*	-
Slimy salamander	*Plethodon grobmani*	-
Mud salamander	*Pseudotriton montanus*	-
Dwarf salamander	*Eurycea quadridigitata*	-
Eastern spadefoot toad	*Scaphiopus holbrooki holbrooki*	-
Greenhouse frog	*Eleutherodactylus planirostris planirostris*	-
Southern toad	*Bufo terrestris*	-
Oak toad	*Bufo quercicus*	-
Florida cricket frog	*Acris gryllus dorsalis*	-
Green treefrog	*Hyla cinerea*	-
Barking treefrog	*Hyla gratiosa*	-
Pinewoods treefrog	*Hyla femoralis*	-
Squirrel treefrog	*Hyla squirella*	-
Southern spring peeper	*Pseudacris crucifer bartramiana*	-
Southern chorus frog	*Pseudacris nigrita*	-
Ornate chorus frog	*Pseudacris ornata*	-
Little grass frog	*Pseudacris ocularis*	-
Eastern narrowmouth toad	*Gastrophryne carolinensis*	-
Bullfrog	*Rana catesbeiana*	-
Pig frog	*Rana grylio*	-
River frog	*Rana heckscheri*	-
Bronze frog	*Rana clamitans clamitans*	-
Southern leopard frog	*Rana sphenocephala*	-
Florida Gopher frog	*Rana capito aesopus*	SSC

Appendix B

Semi-aquatic and Wetland-dependent Wildlife Species that Occur in East Central Florida Organized by Taxonomic Classes

This appendix is Appendix C from: Brown, Mark T., Joseph Schaefer, and Karla Brandt. 1990. Buffer zones for water, wetlands, and wildlife in east central Florida. Center for Wetlands, University of Florida Publication #89-07. Florida Agricultural Experiments Stations Journal Series No. T-00061

Table C-1. Semi-aquatic and wetland dependent wildlife species of East Central Florida: **AMPHIBIANS**

Species	Scientific Name	References
Toad Family		
A 1. Oak toad	(Bufo quercicus)	Wright, 1949
A 2. Southern toad	(Bufo terrestris)	Wright, 1949
Treefrog Family		
A 3. Southern cricket frog	(Acris gryllus)	Burt, 1938; Wright, 1949; Mecham, 1964
A 4. Green treefrog	(Hyla cineria)	Burt, 1938; Garton and Brandon, 1975
A 5. Spring peeper	(Hyla crucifer)	Delzell, 1958
A 6. Pinewoods treefrog	(Hyla femoralis)	Martof et al., 1980
A 7. Barking treefrog	(Hyla gratiosa)	Martof et al., 1980
A 8. Squirrel treefrog	(Hyla squirella)	Goin and Goin, 1957
A 9. Little grass frog	(Limnaoedus ocularis)	Ashton and Ashton, 1988
A10. Ornate chorus frog	(Pseudacris ornata)	Martof et al., 1980
Narrowmouth Toad Family		
A11. Eastern narrowmouth toad	(Gastrophryne carolinensis)	Ashton and Ashton, 1988
Spadefoot Toad Family		
A12. Eastern spadefoot toad	(Saphiopus holbrookii holbrookii)	Green and Pauley, 1987; Moler, 1988
True Frogs		
A13. Gopher frog+	(Rana areolata)	Wright, 1949
A14. Bullfrog	(Rana catesbeiana)	Bury and Wheland, 1984
A15. Pig frog	(Rana grylio)	Burt, 1938; Martof et al., 1980; Lamb, 1986
A16. River frog	(Rana heckscheri)	Martof et al., 1980
A17. Southern leopard frog	(Rana utricularia)	McCoy, 1978
Lungless Salamander Family		
A18. Southern dusky salamander	(Desmognathus auriculatus)	Mohr, 1935
A19. Dwarf salamander	(Eurycea quadridigitata)	Martof et al., 1980
Newt Family		
A20. Striped newt	(Notophthalmus perstriatus)	Carr and Goin, 1955

+ Endangered, threatened, or special concern species

References for Table C-1: Amphibians

Ashton, R.E., and P.S. Ashton. 1988. The Amphibians. Miami: Windward Publ., Inc. 191 pp.

Burt, C.E. 1938. The Frogs and Toads of the Southeastern United States. Transactions of Kansas Academy of Sciences. Vol. 41.

Bury, R.B., and J.A. Whelan. 1984. Ecology and Management of the Bullfrog. Resource Publication 155. Washington, D.C.: Fish and Wildlife Service.

Carr, A., and C.J. Goin. 1955. Guide to Reptiles, Amphibians, and Freshwater Fishes of Florida. Gainesville: University of Florida Press.

Delzell, D.E. 1958. Spatial Movement and Growth of Hyla Crucifer. Dist. Abst. XIX(6):1478-1479.

Garton, J.S., and R.A. Brandon. 1975. Reproductive Ecology of the Green Treefrog, Hyla cinera, in Southern Illinois. Herpetologica 31:150-161.

Goin, C., and O. Goin. 1957. Remarks on the Behavior of the Squirrel Treefrog (Hyla squirrella).

Green, N. B., and T.K. Pauley. 1987. Amphibians and Reptiles in West Virginia. Pittsburgh: University of Pittsburgh Press.

Hayes, M.P., and P.N. Lahanes. 1988. Supplement May 12-14, 1988. Florida Academy Sci. 51. Coral Gables: University of Miami.

Lamb, T. 1986. The Influence of Sex and Breeding Conditions on Microhabitat Selection and Diet in the Pig Frog (Rana grylio). Aiken, S.C.: Savannah River Ecology Laboratory.

Martof, B.S., W.M. Palmer, J.R. Bailey, and J.R. Harrison III. 1980. Amphibians and Reptiles of the Carolinas and Virginia. Chapel Hill: University of North Carolina Press.

McCoy, C.J., ed. 1978. Amphibians and Reptiles. Pittsburgh: Carnegie Museum of Natural History.

Mecham, J.S. 1964. Ecological and Genetic Relationships of the Two Cricket Frogs, Genus Acris, in Alabama. Herpetologica 20:84-91.

Mohr, C.E. 1935. Salamanders. Journal of the American Museum of Natural History 36(2). 2.

Moler, P. 1988. Personal communication. Florida Game and Fresh Water Fish Commission, Gainesville, FL.

Wright, A.H., and A.A. Wright. 1949. Handbook of Frogs and Toads of the U.S. and Canada. Ithica: Comstock Publishing Associates, Cornell University Press.

Table C-2. Semi-aquatic and wetland dependent wildlife species of East Central Florida: **REPTILES**

Species	Scientific Name	References
Alligator Family		
R 1. American alligator+	(Alligator mississipiensis)	Joanen and McNease, 1970, 1972; Metzen, 1977
Snapping Turtle Family		
R 2. Common snapping turtle	(Chelydra serpentina)	Loncke and Obbard, 1977; Obbard and Brooks, 1980, 1981; Graves and Anderson, 1987
Box and Water Turtle Family		
R 3. Chicken turtle	(Deirochelys reticularia)	Ernst and Barbour, 1972
R 4. Diamondback terrapine	(Malaclemys terrapine)	Ashton and Ashton, 1985
R 5. Florida cooter	(Pseudemys floridana)	Marlof et al., 1980
R 6. Florida redbelly turtle	(Pseudemys nelsoni)	Marlof et al., 1980
R 7. Florida box turtle	(Terrapene carolina bauri)	Ashton and Ashton, 1985
R 8. Slider turtle	(Trachemys scripta)	Cagle, 1950; Moll and Legler, 1971; Morreale and Gibbons, 1986
Mud and Musk Turtle Family		
R 9. Striped mud turtle	(Kinosternon baurii)	Ernst and Barbour, 1972; Ernst et al., 1972
R10. Florida mud turtle	(Kinosternon subrubrum steindachneri)	Ernst and Barbour, 1972
R11. Stinkpot turtle	(Sternotherus ordoratus)	Ernst and Barbour, 1972
Softshell Turtle Family		
R12. Florida softshell turtle	(Apalone ferox)	Ernst and Barbour, 1972
Iguanidae Family		
R13. Green anole	(Anolis carolinensis)	Burt, 1939
Skink Family		
R14. Broadhead skink	(Eumeces laticeps)	Ashton and Ashton, 1985
Colubrid Family		
R15. Florida scarlet snake	(Cemophora coccinea coccinea)	Palmer, 1970
R16. Southern black racer	(Coluber constrictor priapus)	Ashton and Ashton, 1985
R17. Southern ringneck snake	(Diadophis punctatus punctatus)	Ashton and Ashton, 1985
R18. Yellow rat snake	(Elaphe obsoleta quadrivittata)	Ashton and Ashton, 1985
R19. Eastern indigo snake+	(Drymarchon corais couperi)	Allen and Neill, 1952; Lawler, 1976; Moler, 1985
R20. Eastern mud snake	(Farancia abacura abacura)	Mount, 1975; Trutnau, 1979
R21. Rainbow snake	(Farancia erytrogramma)	Mount, 1975; Marlof et al., 1980

Table C-2. Continued.

Species	Scientific Name	References
R22. Eastern hognose snake	(Heterodon platyrhinos)	Platt, 1969; Moler, 1988
R23. Eastern kingsnake	(Lampropeltis getulus getulus)	Ashton and Ashton, 1985
R24. Scarlet kingsnake	(Lampropeltis triangulum elapsoides)	Macartney et al., 1988
R25. Atlantic salt marsh snake+	(Nerodia fasciata taeniata)	Ashton and Ashton, 1985
R26. Green water snake	(Nerodia cyclopion)	Trutnau, 1979; Macartney et al., 1988
R27. Florida banded water snake	(Nerodia fasciata pictiventris)	Trutnau, 1979
R28. Brown water snake	(Nerodia taxispilota)	Trutnau, 1979
R29. Rough green snake	(Opheodrys aestivus)	Macartney et al., 1988
R30. Striped crayfish snake	(Regina alleni)	Godley, 1980
R31. Glossy crayfish snake	(Regina rigida)	Ashton and Ashton, 1985
R32. North Florida swamp snake	(Seminatrix pygaea pygaea)	Dowling, 1950
R33. Florida brown snake+	(Storeria dekayi victa)	Macartney et al., 1988
R34. Redbelly snake	(Storeria occipitomaculata)	Ashton and Ashton, 1985
R35. Peninsula ribbon snake	(Thamnophis sauritus sackenii)	Macartney et al., 1988
R36. Eastern garter snake	(Thamnophis sirtalis sirtalis)	Macartney et al., 1988
Viper Family		
R37. Cottonmouth	(Agkistrodon piscivorus)	Allen and Neill, 1950; Mount, 1975; Macartney et al., 1988
R38. Timber rattlesnake	(Crotalus horridus)	Ashton and Ashton, 1985
R39. Dusky pigmy rattlesnake	(Sistrurus miliarius barbouri)	Ashton and Ashton, 1985

+ Endangered, threatened, or special concern species

References for Table C-2: Reptiles

Allen, R., and W.T. Neill. 1950. Know Your Reptiles; The Cottonmouth Moccasin.

Allen, R., and W.T. Neill. 1952. The Indigo Snake.

Ashton, R.E., and P.S. Ashton. 1981. The Snakes. Miami: Windward Publishing, Inc. 176 pp.

Ashton, R.E., and P.S. Ashton. 1985. Lizards, Turtles & Crocodilians. Miami: Windward Publishing, Inc. 191 pp.

Burt, C. 1939. The Lizards of the Southeastern United States. Trans. Kans. Acad. Sci. 40:349-366.

Cagle, F.R. 1950. The Life History of the Slider Turtle (Pseudemys scripta troosti Holbrook). Ecological Monographs 20:32-54.

Dowling, H.G. 1950. Studies of the Black Swamp Snake (Seminatrix pygaea Cope) with Descriptions of Two New Subspecies. Ann Arbor: University of Michigan Press.

Ernst, C., R.B. Barbour, and J. Butler. 1972. Habitat Preferences of Two Florida Turtles, Genus Kinosternon. Transactions of Kansas Academy of Sciences. Vol. 33.

Ernst, C., and R. Barbour. 1972. Turtles of the United States. Lexington: University Press of Kentucky.

Godley, J.S. 1980. Foraging Ecology of the Striped Swamp Snake (Regina alleni) in Southern Florida. Ecological Monographs 50:411-436.

Graves, B.M., and S.H. Anderson. 1987. Habitat Suitability Index Models: Snapping Turtle. U.S. Fish and Wildlife Service Biological Report 82(10.141).

Joanen, T., and L. McNease. 1970. A Telemetric Study of Nesting Female Alligators on Rockefeller Refuge, LA. 24th Annual Conference of the Southeastern Association of Game and Fish Commissioners.

Joanen, T., and L. McNease. 1972. A Telemetric Study of Adult Male Alligators on Rockefeller Refuge, LA. 26th Annual Conference of the Southeastern Association of Game and Fish Commissioners.

Lawler, H.E. 1976. Why Protect the Indigo Snake?

Loncke, D.J., and M.E. Obbard. 1977. Tag Successes, Dimensions, Clutch Size, and Nesting Site Fidelity for the Snapping Turtle (Chelydra serpentina) (Reptila, Testudines, Chelydridae) in Algonquin Park, Ontario, Canada. Herpetologica. 11(2):243-244.

Macartney, J.M., P.T. Gregory, and K.W. Larsen. 1988. A Tabular Survey of Data on Movements and Home Ranges of Snakes. J. Herpet. 22:61-73.

Martof, B.S., W.M. Palmer, J.R. Bailey, and J.R. Harrison III. 1980. Amphibians and Reptiles of the Carolinas and Virginia. Chapel Hill: University of North Carolina Press.

References for Table C-2: Reptiles Continued.

Metzen, W.D. 1977. Nesting Ecology of Alligators on the Okefenokee Wildlife Refuge. 31st Annual Conference of the Southwestern Association of Fish and Wildlife Agencies.

Michot, T.C. 1981. Thermal and Spatial Ecology of Three Species of Water Snakes (Nerodia) in a Louisiana Swamp. Dist. Abst. Int. B. 42:4292.

Moler, P. 1985. Indigo Snake Habitat Determination. Study No. E-1-06. Gainesville: Game and Fish Commission.

Moler, P. 1988. Personal communication. Florida Game and Fresh Water Fish Commission, Gainesville, FL.

Moll, E.O., and J.M. Legler. 1971. The Life History of a Neotropical Slider Turtle (Pseudemys scripta, Schoepff), in Panama. Bulletin Los Angeles County Museum of Nat. Hist. Sci. 11:1-102.

Morreale, S.J., and J.W. Gibbons. 1986. Habitat Suitability Index Models: Slider Turtle. U.S. Fish and Wildlife Service Biological Report 82(10.125).

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Auburn: Auburn Printing Company.

Obbard, M.E., and R.J. Brooks. 1980. Nesting Migrations of the Snapping Turtle (Chelydra serpentina). Herpetologica 36:158-162.

Obbard, M.E., and R.J. Brooks. 1981. A Radio-Telemetry and Mark-Capture study of Activity in the Common Snapping Turtle, Chelydra serpentina. Copeia 1981:630-637.

Palmer, W.M. 1970. Notes on the Natural History of the Scarlet Snake, Cemophora coccinea copei Jan, in North Carolina. Herpetologica 26:300-302.

Platt, D. 1969. Natural History of the Hognose Snakes Heterodon platyrhinos and Heterodon nasicus. Univ. Kansas Publ. Mus. Nat. Hist. 18:235-420.

Trutnau, L. 1979. Nonvenomous Snakes. Woodbury: Barron's Educational Series, Inc.

Wharton, C.H. 1969. The Cottonmouth Moccasin on Sea Horse Key, FL. Bulletin of the Florida State Museum, Biological Sciences 14(3).

Table C-3. Semi-aquatic and wetland dependent wildlife species of East Central Florida: BIRDS

Species	Scientific Name	References
Grebe Family		
B 1. Pied-billed grebe*	(Podilymbus podiceps)	Pough, 1951
Pelican Family		
B 2. Brown pelican*+	(Pelecanus occidentalis)	Harrison, 1975
Cormorant Family		
B 3. Double-crested cormorant	(Phalacrocorax auritus)	Siegel-Causey and Hunt, Jr., 1986
Anhinga Family		
B 4. Anhinga*	(Anhinga anhinga)	Allen, 1961; Hamel et al., 1982
Waterfowl Family		
B 5. Wood duck*	(Aix sponsa)	Johnsgard, 1975
B 6. American widgeon	(Anas americana)	Girard, 1941; Keith, 1961; Johnsgard, 1975; Potter et al., 1980
B 7. Northern shoveler	(Anas clypeata)	Palmer, 1976
B 8. Green-winged teal	(Anas carolinensis)	Palmer, 1976
B 9. Blue-winged teal*	(Anas discors)	Bennett, 1938
B10. Mottled duck*	(Anas fulvigula)	Johnsgard, 1975
B11. Mallard*	(Anas platyrhynchos)	Mulhern et al., 1985
B12. Ring-necked duck	(Anthya collaris)	Mendall, 1958
B13. Hooded merganser*	(Lophodytes cucullatus)	Hamel et al., 1982
Kite, Hawk and Eagle Family		
B14. Short-tailed hawk*	(Buteo brachyurus)	Hamel et al., 1982
B15. Red-shouldered hawk*	(Buteo lineatus)	Portnoy and Dodge, 1979; Hamel et al., 1982
B16. Northern harrier*	(Circus cyaneus)	Hamel et al., 1982
B17. Swallow-tailed kite*	(Elanoides forficatus)	Hamel et al., 1982
B18. Bald eagle*+	(Haliaeetus leucocephalus)	U.S. Fish and Wildlife Service, 1984; Jaffee, 1980; Anthony and Isaacs, 1981; Peterson, 1986
B19. Snail kite*+	(Rostrhamus sociabilis)	Hamel et al., 1982
Osprey Family		
B20. Osprey*	(Pandion haliaetus)	Austin-Smith and Rhodenize, 1983

Table C-3. Continued.

Species	Scientific Name	References
Falcon Family		
B21. Peregrine falcon+	(Falco peregrinus)	Bent, 1961; Kale, 1978
Turkey Family		
B22. Wild turkey*	(Meleagris gallopavo)	Hamel et al., 1982
Heron and Bittern Family		
B23. Great blue heron*	(Ardea herodias)	Hancock and Kushlan, 1984
B24. American bittern*	(Botaurus lentiginosus)	Hamel et al., 1982
B25. Cattle egret*	(Bubulcus ibis)	Maxwell and Kale, 1977
B26. Green-backed heron*	(Butorides striatus)	Hancock and Kushlan, 1984
B27. Great egret*	(Casmerodius albus)	Graber et al., 1978; AOU Checklist, 1983
B28. Little blue heron*+	(Egretta caerulea)	Hancock and Kushlan, 1984
B29. Snowy egret*+	(Egretta thula)	Maxwell and Kale, 1977, Hancock and Kushlan, 1984
B30. Tricolored heron*+	(Egretta tricolor)	Maxwell and Kale, 1977; Hancock and Kushlan, 1984
B31. Least bittern*	(Ixobrychus exilis)	Hamel et al., 1982
B32. Black-crowned night heron*	(Nycticorax nycticorax)	Beaver, 1980
B33. Yellow-crowned night heron*	(Nycticorax violacea)	Palmer, 1976
Wood Ibis Family		
B34. Wood stork*+	(Mycteria americana)	Kale, 1978
Ibis and Spoonbill Family		
B35. White ibis*	(Eudocimus albus)	Kushlan, 1976; Hamel et al., 1982
Crane Family		
B36. Sandhill crane*+	(Grus canadensis)	Ambruster, 1987
Limpkin Family		
B37. Limpkin*+	(Aramus guarauna)	Hamel et al., 1982

Table C-3. Continued.

Species	Scientific Name	References
Rail, Gallinule, and Coot Family		
B38. American coot*	(Fulica americana)	Hamel et al., 1982
B39. Common moorhen*	(Gallinula chloropus)	Hamel et al., 1982
B40. Black rail*	(Laterallus jamaicensis)	Hamel et al., 1982
B41. Purple gallinule*	(Porphyrula martinica)	Meanley, 1963
B42. Clapper rail*	(Rallus longirostris)	Lewis and Garrison, 1983
B43. King rail*	(Rallus elegans)	Meanley and Wetherbee, 1962
Oystercatcher Family		
B44. American oystercatcher*+	(Haematopus palliatus)	Levings et al., 1986
Stilt Family		
B45. Black-necked stilt*	(Himantopus mexicanus)	Potter et al., 1980
Plover Family		
B46. Killdeer*	(Charadrius vociferus)	Harrison, 1975
B47. Wilson's plover*	(Charadrius wilsonia)	Harrison, 1975
Sandpiper Family		
B48. Spotted sandpiper	(Actitis macularia)	Potter et al., 1980
B49. Sanderling	(Calidris alba)	Hall, 1960; Parmelee, 1970
B50. Western sandpiper	(Calidris mauri)	Potter et al., 1980
B51. Least sandpiper	(Calidris minutilla)	Potter et al., 1980
B52. Willet*	(Catoptrophorus semipalmatus)	Ryan and Renken, 1987
B53. Dunlin	(Erolia alpina)	Potter et al., 1980
B54. Short-billed dowitcher	(Limnodromus griseus)	Hall, 1960
B55. Long-billed dowitcher	(Limnodromus scolopaceus)	Potter et al., 1980
B56. Lesser yellowlegs	(Tringa flavipes)	Hall, 1960; McElroy, 1974
B57. Greater yellowlegs	(Tringa melanoleuca)	Hall, 1960; McElroy, 1974
Woodcock and Snipe Family		
B58. Common snipe	(Gallinago gallinago)	Potter et al., 1980
B59. American woodcock	(Scolopax minor)	Sheldon, 1967
Gull and Tern Family		
B60. Laughing gull*	(Larus atricilla)	Burger and Shisler, 1980
B61. Ring-billed gull	(Larus delawarensis)	Collins, 1959
B62. Least tern*+	(Sterna antillarum)	McElroy, 1974
B63. Fosters tern	(Sterna forsteri)	Collins, 1959
B64. Gull-billed tern	(Sterna nilotica)	Collins, 1959; Potter et al., 1980
B65. Royal tern*	(Thalasseus maximus)	Buckley and Buckley, 1977

Table C-3. Continued.

Species	Scientific Name	References
Skimmer Family		
B66. Black skimmer*	(Rynchops niger)	McElroy, 1974
Cuckoo Family		
B67. Yellow-billed cuckoo*	(Coccyzus americanus)	Smith unpub.
Owl Family		
B68. Barred owl*	(Strix varia)	Smith unpub.
Hummingbird Family		
B69. Ruby-throated hummingbird*	(Archilochus colubris)	Harrison, 1975
Kingfisher Family		
B70. Belted kingfisher*	(Ceryle alcyon)	Cornwell, 1963; Potter et al., 1980
Woodpecker Family		
B71. Ivory-billed woodpecker+	(Campephilus principalis)	Tanner, 1942; Potter et al., 1980
B72. Pileated woodpecker*	(Dryocopus pileatus)	Hamel et al., 1982
B73. Downy woodpecker*	(Picoides pubescens)	Schroeder, 1982a
Flycatcher Family		
B74. Eastern wood pewee*	(Contopus virens)	Harrison, 1975
B75. Acadian flycatcher*	(Empidonax virescens)	Smith unpub.
Swallow Family		
B76. Tree swallow	(Tachycineta bicolor)	McElroy, 1974
Crow Family		
B77. Fish crow*	(Corvus ossifragus)	Hamel et al., 1982
Wren Family		
B78. Marsh wren*	(Cistothorus palustris)	Bent, 1948; Gutzwiller and Anderson, 1987
B79. Sedge wren	(Cistothorus platensis)	Hamel et al., 1982
Thrush Family		
B80. Wood thrush	(Hylocichla mustelina)	Brackbill, 1943; Hamel et al., 1982

Table C-3. Continued.

Species	Scientific Name	References
Pipit Family		
B81. Water pipit	(Anthus spinoletta)	Hamel et al., 1982
Wood Warbler Family		
B82. Yellow-throated warbler*	(Dendroica dominica)	Hamel et al., 1982
B83. Pine warbler*	(Dendroica pinus)	Robbins, 1979; Schroeder, 1982b
B84. Common yellow throat*	(Geothlypis trichas)	Stewart, 1953
B85. Swainson's warbler	(Limnothlypis swainsonii)	Hamel et al., 1982
B86. Northern parula*	(Parula americana)	Tassone, 1981
B87. Prothonotary warbler*	(Protonotaria citrea)	Smith unpub
B88. Louisiana waterthrush	(Sciurus motacilla)	Tassone, 1981
B89. Northern waterthrush	(Sciurus noveboracensis)	Hamel et al., 1982
B90. Hooded warbler*	(Wilsonia citrina)	Smith unpub.
Blackbird Family		
B91. Red-winged blackbird*	(Agelaius phoeniceus)	Case and Hewitt, 1963; Orians, 1973, 1980
B92. Rusty blackbird	(Euphagus carolinus)	Orians 1980
Sparrow Family		
B93. LeConte's sparrow	(Ammodramus leconteii)	Potter et al., 1980
B94. Seaside sparrow*	(Ammospiza maritima)	Post, 1974; Harrison, 1975
B95. Swamp sparrow	(Melospiza georgiana)	Hamel et al., 1982

* Breeds in East Central Florida
+ Endangered, threatened, or special concern species

Reference for Table C-3: Birds

Allen, T.T. 1961. Notes on the Breeding Behavior of the Anhinga. Wilson Bull. 73:115-125.

Armbruster, M.J. 1987. Habitat Suitability Index Models: Greater Sandhill Crane. U.S. Fish and Wildl. Serv. Biol. Rep. 82(10.140). 26 pp.

American Ornithologists Union. 1983. The AOU Checklist of North American Birds. 6th edition. Lawrence, Kansas: Allen Press, Inc.

Anthony, R.G., and F.B. Isaacs. 1981. Characteristics of Bald Eagle Nest Sites in Oregon. Report to Crown Zellerbach Corp. and U.S. Fish and Wildl. Service, Contract No. 14-16-001-77028. 28 pp.

Austin-Smith, P.J., and G. Rhodenze. 1983. Ospreys (Pandion haliatus) Relocate Nests from Power Poles to Substitute Sites. Can. Field Nat. 97:315-319.

Beaver, D.L. 1980. Nest Site and Colony Characteristics of Wading Birds in Selected Atlantic Coast Colonies. Wilson Bull. 92:200-220.

Bennett, L.J. 1938. The Blue-winged Teal, Its Ecology and Management. Ames: Collegiate Press.

Bent, A.C. 1942. Life Histories of North American Flycatchers, Larks, Swallows, and Their Allies. Bulletin No. 179. U.S. Government Printing Office, Washington, D.C.)

Bent, A.C. 1948. Life Histories of North American Nuthatches, Wrens, Thrashers, and Their Allies. Bulletin No. 195. U.S. National Museum, Washington, D.C.

Bent, A.C. 1961. Life Histories of North American Birds of Prey. Bulletin No. 170. U.S. National Museum, Washington, D.C.

Brackbill, H. 1943. A Nesting Study of the Wood Thrush. Wilson Bull. 55:73-87.

Buckley, P.A., and F.G. Buckley. 1977. Hexagonal Packing of Royal Tern Nests. Auk 94:36-43.

Burger,J., and J. Shisler. 1980. Colony and Nest Site Selection in Laughing Gulls in Response to Tidal Flooding. Condor 82:251-258.

Case, N.A., and O.H. Hewitt. 1963. Nesting and productivity of the Red-Winged Blackbird in Relation to Habitat. The Living Bird. 2nd annual conference of the Cornell Laboratory of Ornithology. pp. 7-20.

Collins, H.H. 1959. Harper and Row's Complete Guide to North American Wildlife. New York: Harper and Row.

Cornwell, G.W. 1963. Observations of the Breeding Biology and Behavior of a Nesting Population of Belted Kingfishers. Condor 65:426-431.

Girard, G.L. 1941. The Mallard, its Management in Western Montana. Journal of Wildlife Management.

Graber, J.W., R.R. Graber, and E.L. Kirk. 1978. Illinois Birds: Ciconiiformes. Illinois Nat. Hist. Survey Biol. Notes No. 109.

Reference for Table C-3: Birds Continued.

Gutzwiller, K.J., and S.H. Anderson. 1987. Habitat Suitability Index Models: Marsh Wren. U.S. Fish and Wildlife Service Biological Report 82(10.139).

Hall, H.M. 1960. A Gathering of Shore Birds. New York: Bramhall House.

Hamel, P.B., H.E. LeGrand, Jr., M.R. Lennartz, and S.A. Gauthreaux. 1982. Bird Habitat Relationships on Southeastern Forest Lands. USDA Southeastern Forest Experiment Station General Technical Report SE-22. Asheville: Forest Service, USDA.

Hancock, J., and J. Kushlan. 1984. The Herons Handbook. New York: Harper and Row, Publishers.

Harrison, H.H. 1975. Bird Nests. Boston: Houghton Mifflin Company. 257 pp.

Jaffee, N.B. 1980. Nest Site Selection and Foraging Behavior of the Bald Eagle in Virginia. MS Thesis, William and Mary College, Williamsburg, VA. 113 pp.

Johnsgard, P.A. 1975. Waterfowl of North America. Bloomington: Indiana University Press.

Kale, H.W. 1978. Rare and Endangered Biota of Florida: Birds. Gainesville, University Presses of Florida. 121 pp.

Keith, L.B. 1961. A Study of Waterfowl Ecology on Small Impoundments in Southeastern Alberta. Wildlife Monographs 6:1-188.

Kushlan, J.A. 1976. Site Selection for Nesting Colonies by the American White Ibis (Eudocimus alba) in Florida. Ibis 118:590-593.

Levings, S.C., S.D. Garrity, and L.R. Ashkenas. 1986. Feeding Rates and Prey Selection of Oystercatchers in the Pearl Islands of Panama. Biotropica 18:62-71.

Lewis, J.C., and R.L. Garrison. 1983. Habitat Suitability Index Models: Clapper Rail. U.S. Dept. Int. Fish and Wildl. Serv. FWS/OBS-82/10.51. 15 pp.

Maxwell, G.R., and H.W. Kale, Jr. 1977. Breeding Biology of Five Species of Herons in Coastal Florida. Auk 94:689-700.

McElroy, T.P., Jr. 1974. The Habitat Guide to Birding. New York: Alfred A. Knopf, Inc.

Meanley, B. 1963. Pre-nesting Activity of the Purple Gallinule Near Savannah, Georgia. Auk 80:545-547.

Meanley, B., and D. K. Wetherbee. 1962. Ecological Notes on Mixed Populations of King Rails and Clapper Rails in Delaware Bay Marshes. Auk 79:453-457.

Mendall, H.L. 1958. The Ring-Necked Duck in the Northeast. Orono, Maine: University Press.

Mulhern, J.H., T.D. Nudds, and B.R. Neal. 1985. Wetland Selection by Mallards and Blue-winged Teal. Wilson Bull. 97:473-485.

Reference for Table C-3: Birds Continued.

Orians, G.H. 1973. The Red-Winged Blackbird in Tropical Marshes. Condor 75:28-42.

Orians, G.H. 1980. Some Adaptations of Marsh-Nesting Blackbirds. Princeton: Princeton University Press.

Palmer, R.S., ed. 1976. Handbook of North American Birds. Vol 2, New Haven: Yale Univ. Press.

Parmelee, D.P. 1970. Breeding Behavior of the Sanderling in the Canadian High Arctic. The Living Bird. 9th annual New York: Cornell Laboratory of Ornithology.

Peterson, A. 1986. Habitat Suitability Index Models: Bald Eagle (Breeding Season). U.S. Fish and Wildlife Service Biological Report 82(10.126).

Potter, E.F., and J.F. Parnell, and R.P. Teulings. 1980. Birds of the Carolinas. Chapel Hill: University of NC Press.

Portnoy, J.W., and W.E. Dodge. 1979. Red-shouldered Hawk Nesting Ecology and Behavior. Wilson Bull. 91:104-117.

Post, W. 1974. Functional Analysis of Space-related Behavior in the Seaside Sparrow. Ecology 55:564-575.

Pough, R.H. 1951. Audubon Water Bird Guide. Garden City: Doubleday & Co., Inc.,.

Robbins, C.S. 1979. Effects of Forest Fragmentation on Bird Populations. Pages 75-83 in R.M. DeGraaf, tech. coord. Proceedings of the Workshop: Management of northcentral and northeastern forests for nongame birds. U.S. Dept. of Agriculture, Forestry Service General Tech. Rep. NC-51.

Ryan, M.R., and R.B. Renken. 1987. Habitat Use by Breeding Willets in the Northern Great Plains. Wilson Bull. 99:175-189.

Schroeder, R.L. 1982a. Habitat Suitability Index Models: Downy Woodpecker. U.S. Dept. of the Interior, Fish and Wildlife Service FWS/OBS-82/10.38.

Schroeder, R.L. 1982b. Habitat Suitability Index Models: Pine Warbler. U.S. Dept. of the Interior, Fish and Wildlife Service, FWS/OBS-82/10.28.

Sheldon, W.G. 1967. The Book of the American Woodcock. University of Mass. Press.

Siegel-Causey, D, and G.L. Hunt, Jr. 1986. Breeding Site Selection and Colony Formation in Double-crested and Pelagic Cormorants. Auk 103:230-234.

Stewart, R.E. 1953. A Life History Study of the Yellow-throat. Wilson Bull. 65:99-115.

Tanner, J.T. 1942. The Ivory Billed Woodpecker. Research Report No. 1. New York: National Audubon Society.

Tassone, J.F. 1981. Utility of Hardwood Leave Strips for Breeding Birds in Virginia's Central Piedmont. MS Thesis. Blacksburg, VA: Virginia Polytechnic Institute and State College. 83 pp.

U.S. Fish and Wildlife Service. 1984. Management Guidelines for the Bald Eagle in the Southeast Region.

Table C-4. Semi-aquatic and wetland dependent wildlife species of East Central Florida: **MAMMALS**

Species	Scientific Name	References
Shrew Family		
M 1. Southeastern shrew	(Sorex longirostris)	Layne, 1978
Twilight Bat Family		
M 2. Eastern pipistrele	(Myotis subflavus)	Southall, 1988
Rabbit Family		
M 3. Marsh rabbit	(Sylviagus palustris)	Collins, 1959
Squirrel Family		
M 4. Gray squirrel	(Sciurus carolinensis)	Flyger, 1960; Doebel, 1967; Cordes and Barkalow, 1972; Allen, 1987
New World Mice, Rats, and Voles		
M 5. Round-tailed muskrat	(Neofiber alleni)	Layne, 1978
M 6. Marsh rice rat	(Oryzomys palustris)	Southall, 1988
Bear Family		
M 7. Black bear	(Ursus americanus)	Taylor, 1971; U.S. Forest Service, 1975; Garshelis, 1978; Landers et al., 1978; Smith, 1985; Rogers and Allen, 1987
Raccoon Family		
M 8. Raccoon	(Procyon lotor)	Johnson, 1970
Weasels and Skunks		
M 9. River otter	(Lutra canadensis)	Melquist and Hornocker, 1983; Chandler, 1988
M10. Mink	(Mustela vison)	Mitchell, 1961; Gorell, 1974; Melquist et al., 1981; Allen, 1986
Cat Family		
M11. Bobcat	(Felis rufus)	Hall and Newsom, 1976; Miller and Speake, 1979; Miller, 1980; Buie, 1980; Boyle and Fendley, 1987

+ Endangered, threatened or special concern species

References for Table C-4: Mammals

Allen, A.W. 1986. Habitat Suitability Index Models: Mink, revised. U.S. Fish and Wildlife Service Biological Report 82(10.127).

Allen, A.W. 1987. Habitat Suitability Index Models: Gray Squirrel, revised. U.S. Fish and Wildlife Service Biological Report 82(10.135).

Boyle, K.A., and T.T. Fendley. 1987. Habitat Suitability Index Models: Bobcat. U.S. Fish and Wildlife Service Biological Report 82(10.147)

Buie, D.E. 1980. Seasonal Home Range and Movement Patterns of the Bobcat on the Savannah River Plant. MS Thesis. Clemson University, Clemson, SC.

Chandler, W.J., ed. 1988. Audubon Wildlife Report 1988/1989. New York: Academic Press, Inc.

Collins, H.H. 1959. Harper and Row's Complete Guide to North American Wildlife. New York: Harper and Row.

Cordes, C.L., and F.S. Barkalow. 1972. Home Range and Dispersal in a North Carolina Gray Squirrel Population. Proceedings from the Annual Conference of the Association of Game and Fish Commission, 26:124-135.

Doebel, J.H. 1967. Home Range and Activity of the Gray Squirrel in a Southwest Virginia Woodlot. MS Thesis. Virginia Polytechnic Institute, Blacksburg.

Flyger, V. 1960. Movements and Home Range of the Gray Squirrel (Sciurus carolinensis), in Two Maryland Woodlots. Ecology 4:365-369.

Garshelis, D.L. 1978. Movement Ecology and Activity Behavior of Black Bears in the Great Smoky Mountains National Park. MS Thesis. University of Tennessee, Knoxville. 117 pp.

Gerell, R. 1970. Home Ranges and Movements of the Mink (Mustela vison Schreber) in Southern Sweden. Oikos 21(2):160-173.

Hall, H.T, and J.D. Newsom. 1976. Summer Home Ranges and Movements of Bobcats in Bottomland Hardwoods of Southern Louisiana. Proceedings of the Southeastern Association of Fish and Wildlife Agencies 30:427-436.

Interview with Peter Southall, Biologist, Game and Fish Commission, Lake City, FL, December, 1988.

Johnson, A.S. 1970. Biology of the Raccoon in Alabama. Bulletin 402, Agricultural Experiment Station Auburn University.

Landers, J.L., R.J. Hamilton, A.S. Johnson, and R.L. Marchington. 1979. Food and Habitat of Black Bears in Southeastern North Carolina. Journal of Wildlife Management 43(1):143-153.

Melquist, W.E., J.S. Whitman, and M.G. Hornocker. 1981. Resource Partitioning and Coexistence of Sympatric Mink and River Otter Populations. Pages 187-220 in J.A. Chapman and D. Pursley, eds., Worldwide Furbearer Conference Proceedings, Vol 1. Frostberg, MD.

References for Table C-4: <u>Mammals Continued.</u>

Melquist, W.E., and M.G. Hornocker. 1983. Ecology of River Otters in West Central Idaho. Wildlife Monographs 83:1-60.

Miller, S.D. 1980. The Ecology of the Bobcat in Southern Alabama. PhD Dissertation, Auburn University, Auburn. 156 pp.

Miller, S.D., and D.W. Speake. 1979. Progress report: Demography and Home Range of the Bobcat in South Alabama. Proceedings of the Bobcat Research Conference, Nat. Wildl. Fed. Sci. Tech. Ser. 6:123-124.

Mitchell, J.L. 1961. Mink Movements and Populations on a Montana River. Journal of Wildlife Management 25(1):48-54.

Rogers, L.L., and A.W. Allen. 1987. Habitat Suitability Index Model: Black Bear, Upper Great Lakes Region. U.S. Fish and Wildlife Service, Biological Report 82(10.144).

Smith, T.R. 1985. Ecology of Black Bears in a Bottomland Hardwood Forest in Arkansas. PhD Dissertation, University of Tennessee, Knoxville. 209 pp.

Taylor, D.F. 1971. A Radio-Telemetry Study of the Black Bear (<u>Ursus americanus</u>) with Notes on its History and Present Status in Louisiana. MS Thesis, Louisiana State University, Baton Rouge.

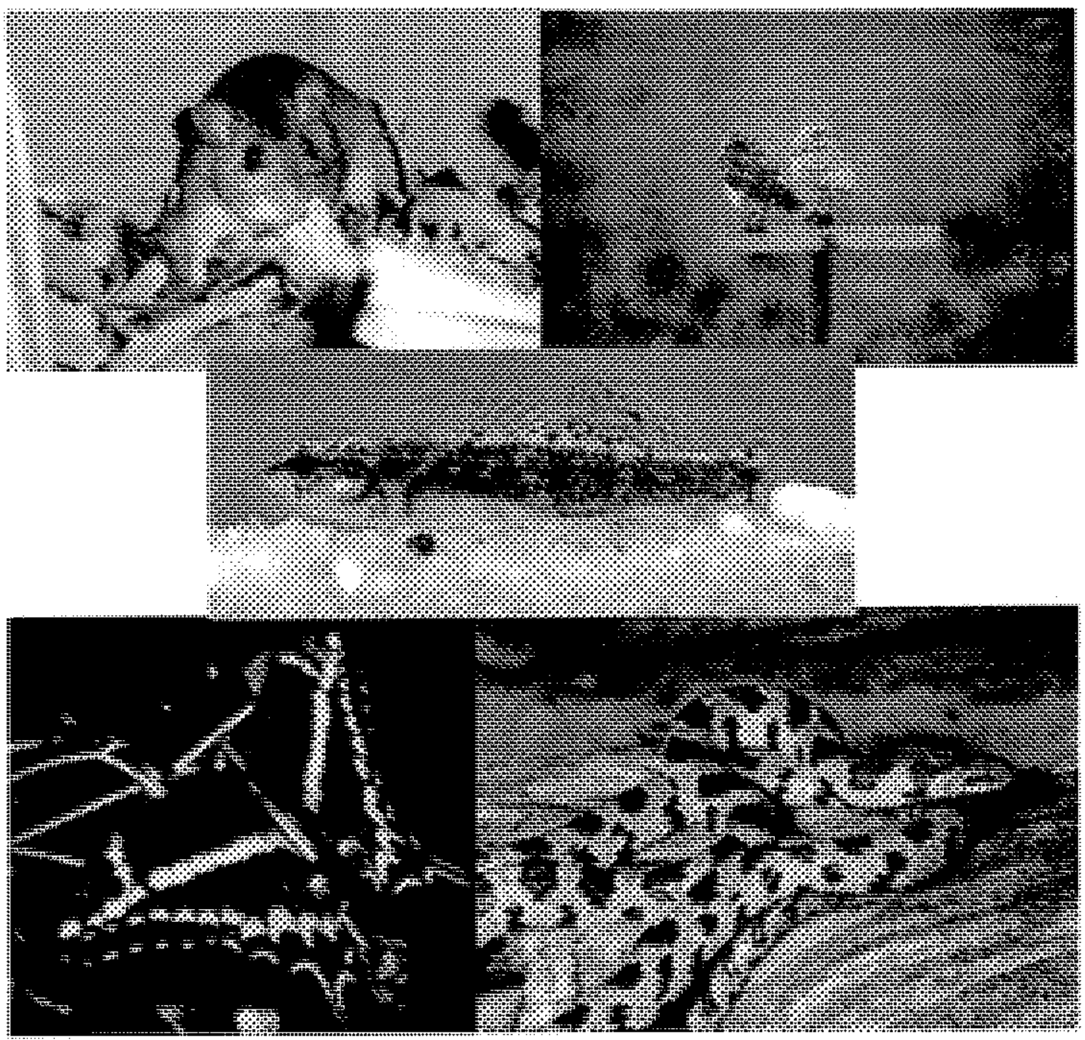
USDA Forest Service. 1975. Endangered, Threatened, and Unique Mammals of the Southern National Forests.

Appendix C

Florida's Endangered Species, Threatened Species and Species of Special Concern

May 2008

FLORIDA'S ENDANGERED SPECIES, THREATENED SPECIES, AND SPECIES OF SPECIAL CONCERN



May 2008

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

CONTENTS

PREFACE

This document consolidates the official state of Florida list of endangered species, threatened species, and species of special concern. The Florida Fish and Wildlife Conservation Commission (FWC) maintains the state list of animals designated as endangered, threatened, or species of special concern, in accordance with Rules 68A-27.003, 68A-27.004, and 68A-27.005, respectively, Florida Administrative Code (F.A.C.), https://www.flrules.org/Default.asp. The state lists of plants, which are designated endangered, threatened, and commercially exploited, are administered and maintained by the Florida Department of Agriculture and Consumer Services (DOACS) via Chapter 5B-40, F.A.C. This list of plants can be obtained at http://www.fl-dof.com/forest_management/plant_conserve_list.html. The federal agencies that share the authority to list species as Endangered and Threatened are the National Oceanic and Atmospheric Administration-National Marine Fisheries Service (NOAA-NMFS) and U. S. Fish and Wildlife Service (USFWS). The NOAA-NMFS is responsible for listing most marine species. The federal list of animals and plants is administered by the USFWS, and this list is published in 50 CFR 17 (animals) and 50 CFR 23 (plants). Additional information regarding federal listings can be located at the following websites:
NOAA-NMFS - http://www.nmfs.noaa.gov and
USFWS - http://endangered.fws.gov/wildlife.html#Species.

Please note that while the FWC has published a consolidated list of state and federally listed species in the past, we now only publish a list of species listed within the state of Florida. This list will be maintained and available at our agency website: http://www.myfwc.com. Lists of federally listed species can still be viewed at the USFWS and NOAA-NMFS websites mentioned above. It is our intent by providing the list in this manner that we will be able to maintain a current list that is more readily available to the public.

- **Common and scientific names listed first are as they appear in the Florida Administrative Code, Title 68A. Common and/or scientific names following this and located within parentheses ( ) contain names as used by USFWS, or other commonly used names.**

Bradley J. Gruver, Ph.D
Listed Species Coordinator
Species Conservation Planning Section
Division of Habitat and Species Conservation
Florida Fish and Wildlife Conservation Commission

Cover Photos by FWC Staff: Key Largo Woodrat, Burrowing Owls, Okaloosa Darter, Schaus' Swallowtail butterfly, Short-tailed Snake.

NUMERICAL SUMMARY OF SPECIES LISTED BY THE STATE OF FLORIDA AS ENDANGERED, THREATENED, OR SPECIES OF SPECIAL CONCERN

STATUS DESIGNATION	FISH	AMPHIBIANS	REPTILES	BIRDS	MAMMALS	INVERTEBRATES	TOTAL
E	3	0	6	8	20	4	**41**
T	2	0	11	9	4	0	**26**
SSC	10	5	7	18	6	4	**50**
TOTAL	**15**	**5**	**24**	**35**	**30**	**8**	**117**

OFFICIAL LISTS

Common Name	Scientific Name	Status
FISH		
Atlantic sturgeon (Gulf sturgeon)	*Acipenser oxyrinchus* (*Acipenser oxyrinchus desotoi*)	SSC (1)
shortnose sturgeon	*Acipenser brevirostrum*	E
shoal bass	*Micropterus cataractae*	SSC (1,2)
Suwannee bass	*Micropterus notius*	SSC (1)
rivulus (mangrove rivulus)	*Rivulus marmoratus*	SSC (1)
Lake Eustis pupfish	*Cyprinodon variegatus hubbsi*	SSC (1)
blackmouth shiner	*Notropis melanostomus*	E
bluenose shiner	*Pteronotropis welaka*	SSC (1,2)
saltmarsh topminnow	*Fundulus jenkinsi*	SSC (1)
key silverside	*Menidia conchorum*	T
crystal darter	*Crystallaria asprella*	T
harlequin darter	*Etheostoma histrio*	SSC (1)
okaloosa darter	*Etheostoma okalossae*	E
Southern tessellated darter (tessellated johnny darter)	*Etheostoma olmstedi maculaticeps*	SSC (1)
key blenny	*Starksia starcki*	SSC (1)
AMPHIBIANS		
flatwoods salamander	*Ambystoma cingulatum*	SSC
Georgia blind salamander	*Haideotriton wallacei*	SSC (1,2)
pine barrens treefrog	*Hyla andersonii*	SSC (1)
Florida bog frog	*Rana okaloosae*	SSC (2)
gopher frog	*Rana capito*	SSC (1,2)
REPTILES		
American alligator	*Alligator mississippiensis*	SSC (1,3)
American crocodile	*Crocodylus acutus*	E
key ringneck snake	*Diadophis punctatus acricus*	T
Eastern indigo snake	*Drymarchon corais couperi*	T
red rat snake	*Elaphe guttata*	SSC (1)
Atlantic salt marsh water snake (Atlantic salt marsh snake)	*Nerodia clarkii taeniata*	T

Common Name	Scientific Name	Status
Florida pine snake	*Pituophis melanoleucus mugitus*	SSC (2)
short-tailed snake	*Stilosoma extenuatum*	T
Florida brown snake	*Storeria dekayi victa*	T[1]
rim rock crowned snake	*Tantilla oolitica*	T
Florida ribbon snake	*Thamnophis sauritus sackeni*	T[1]
bluetail mole skink	*Eumeces egregius lividus*	T
Florida Key mole skink	*Eumeces egregius egregius*	SSC (1)
sand skink	*Neoseps reynoldsi*	T
gopher tortoise	*Gopherus polyphemus*	T
Barbour's map turtle	*Graptemys barbouri*	SSC (1,2)
alligator snapping turtle	*Macroclemys temminckii*	SSC (1)
striped mud turtle	*Kinosternon baurii*	E[1]
Suwannee cooter	*Pseudemys concinna suwanniensis*	SSC (1,2)
loggerhead seaturtle (loggerhead sea turtle)	*Caretta caretta*	T
green seaturtle (green sea turtle)	*Chelonia mydas*	E
leatherback seaturtle (leatherback sea turtle)	*Dermochelys coriacea*	E
hawksbill seaturtle (hawksbill sea turtle)	*Eretmochelys imbricata*	E
Kemp's ridley seaturtle (Kemp's ridley sea turtle)	*Lepidochelys kempii*	E
BIRDS		
piping plover	*Charadrius melodus*	T
snowy plover (Cuban snowy plover)	*Charadrius alexandrinus*	T
American oystercatcher	*Haematopus palliatus*	SSC (1,2)
brown pelican	*Pelecanus occidentalis*	SSC (1)
black skimmer	*Rynchops niger*	SSC (1)
least tern	*Sterna antillarum*	T
roseate tern	*Sterna dougalli* (*Sterna dougallii dougallii*)	T
limpkin	*Aramus guarauna*	SSC (1)
reddish egret	*Egretta rufescens*	SSC (1,4)
snowy egret	*Egretta thula*	SSC (1)
little blue heron	*Egretta caerulea*	SSC (1,4)
tricolored heron	*Egretta tricolor*	SSC (1,4)

Common Name	Scientific Name	Status
white ibis	*Eudocimus albus*	SSC (2)
Florida sandhill crane	*Grus canadensis pratensis*	T
whooping crane	*Grus americana*	SSC (5)
wood stork	*Mycteria americana*	E
roseate spoonbill	*Platalea ajaja*	SSC (1,4)
burrowing owl (Florida burrowing owl)	*Athene cunicularia* (*Athene cunicularia floridana*)	SSC (1)
crested caracara (Audubon's crested caracara)	*Caracara cheriway* (*Polyborus plancus audubonii*)	T
peregrine falcon	*Falco peregrinus*	E
Southeastern American kestrel	*Falco sparverius paulus*	T
osprey	*Pandion haliaetus*	SSC[2] (1,2)
snail kite (Everglades snail kite)	*Rostrhamus sociabilis plumbeus*	E
Florida scrub jay	*Aphelocoma coerulescens*	T
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E
Florida grasshopper sparrow	*Ammodramus savannarum floridanus*	E
Scott's seaside sparrow	*Ammodramus maritimus peninsulae*	SSC (1)
Wakulla seaside sparrow	*Ammodramus maritimus juncicolus*	SSC (1)
white-crowned pigeon	*Columba leucocephala*	T
Kirtland's warbler	*Dendroica kirtlandii*	E
Bachman's warbler	*Vermivora bachmanii*	E
ivory-billed woodpecker	*Campephilus principalis*	E
red-cockaded woodpecker	*Picoides borealis*	SSC
Marian's marsh wren	*Cistothorus palustris marianae*	SSC (1)
Worthington's marsh wren	*Cistothorus palustris griseus*	SSC (1)
MAMMALS		
Florida panther	*Puma concolor coryi* (*Puma* [=*Felis*] *concolor coryi*)	E
Florida black bear	*Ursus americanus floridanus*	T[3]
Everglades mink	*Mustela vison evergladensis*	T
key deer	*Odocoileus virginianus clavium*	E

Common Name	Scientific Name	Status
Lower Keys marsh rabbit	*Sylvilagus palustris hefneri*	E
Big Cypress fox squirrel	*Sciurus niger avicennia*	T
Sherman's fox squirrel	*Sciurus niger shermani*	SSC (1,2)
Eastern chipmunk	*Tamias striatus*	SSC (1)
Sanibel Island rice rat	*Oryzomys palustris sanibeli*	SSC (1,2)
silver rice rat (rice rat, lower FL Keys)	*Oryzomys argentatus* (*Oryzomys palustris natator*)	E
Key Largo woodrat	*Neotoma floridana smalli*	E
Key Largo Cotton Mouse	*Peromyscus gossypinus allapaticola*	E
Choctawhatchee beach mouse	*Peromyscus polionotus allophrys*	E
Southeastern beach mouse	*Peromyscus polionotus niveiventris*	T
Anastasia Island beach mouse	*Peromyscus polionotus phasma*	E
St. Andrews beach mouse	*Peromyscus polionotus peninsularis*	E
Perdido Key beach mouse	*Peromyscus polionotus trissyllepsis*	E
Florida mouse	*Podomys floridanus*	SSC (1)
Florida mastiff bat	*Eumops glaucinus floridanus*	E
gray bat	*Myotis grisescens*	E
Indiana bat	*Myotis sodalis*	E
Florida saltmarsh vole (Florida salt marsh vole)	*Microtus pennsylvanicus dukecampbelli*	E
Sherman's short-tailed shrew	*Blarina carolinensis* [= *brevicauda*] *shermani*	SSC (2)
Homosassa shrew	*Sorex longirostris eionis*	SSC (2)
sei whale	*Balaenoptera borealis*	E
fin whale (finback whale)	*Balaenoptera physalus*	E
North Atlantic right whale (right whale)	*Eubalaena glacialis* (*Balaena glacialis* [*incl. australis*])	E
humpback whale	*Megaptera novaeangliae*	E
sperm whale	*Physeter macrocephalus*	E
Florida manatee (West Indian manatee)	*Trichechus manatus latirostris* (*Trichechus manatus*)	E

Common Name	Scientific Name	Status
INVERTEBRATES		
CORALS		
pillar coral	*Dendrogyra cylindrus*	E
CRUSTACEANS		
Panama City crayfish (econfina crayfish)	*Procambarus econfinae*	SSC (1)
sims sink crayfish (Santa Fe cave crayfish)	*Procambarus erythrops*	SSC (1)
black creek crayfish	*Procambarus pictus*	SSC (1)
INSECTS		
Miami blue butterfly	*Cyclargus [=Hemiargus] thomasi bethunebakeri*	E
Schaus' swallowtail butterfly	*Heraclides aristodemus ponceanus*	E
MOLLUSKS		
Florida tree snail	*Liguus fasciatus*	SSC (1)
Stock Island tree snail	*Orthalicus reses* *Orthalicus reses [not incl. nesodryas]*	E

KEY TO ABBREVIATIONS AND NOTATIONS

List Abbreviations

FWC =	Florida Fish and Wildlife Conservation Commission
E =	Endangered
T =	Threatened
SSC =	Species of Special Concern

Reasons for SSC listings prior to January 1, 2001 are indicated by the number in parenthesis under the following criteria:

(1) has a significant vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation which, in the foreseeable future, may result in its becoming a threatened species unless appropriate protective or management techniques are initiated or maintained;
(2) may already meet certain criteria for designation as a threatened species but for which conclusive data are limited or lacking;
(3) may occupy such an unusually vital or essential ecological niche that should it decline significantly in numbers or distribution other species would be adversely affected to a significant degree;
(4) has not sufficiently recovered from past population depletion, and
(5) occurs as a population either intentionally introduced or being experimentally managed to attain specific objectives, and the species of special concern prohibitions in Rule 68A-27.002, F.A.C., shall not apply to species so designated, provided that the intentional killing, attempting to kill, possession or sale of such species is prohibited.

List Notations

[1] Lower keys population only.

[2] Monroe County population only.

[3] Other than those found in Baker and Columbia Counties or in Apalachicola National Forest.

U.S. Fish & Wildlife Service

North Florida Field Office

St. Johns County Federally Listed Species

This information is provided as a guide to project planning, and is not a substitute for site-specific surveys. Such surveys may be needed to assess species' presence or absence, as well as the extent of project effects on listed species and/or designated critical habitat.

The following table lists those federally-listed species known to be present in the county.
Code Key: E = Endangered, T = Threatened, P = Proposed, C = Candidate, CH = Critical Habitat

Category	Species Common Name	Species Scientific Name	Code
Mammals	West Indian (Florida) Manatee	*Trichechus manatus latirostris*	E/CH
	Anastasia Island Beach Mouse	*Peromyscus polionotus phasma*	E
Birds	Piping Plover	*Charadrius melodus*	T
	Florida Scrub-jay	*Aphelocoma coerulescens*	T
	Wood Stork	*Mycteria americana*	E
Fish	None		
Reptiles	Eastern Indigo Snake	*Dymarchon corais couperi*	T
	Green Sea Turtle	*Chelonia mydas*	E
	Hawksbill Sea Turtle	*Eremochelys imbricata*	E
	Leatherback Sea Turtle	*Dermochelys coriacea*	E
	Kemp's ridley Sea Turtle	*Lepidochelys kempii*	E
	Loggerhead Sea Turtle	*Caretta caretta*	T
Amphibians	None		
Mollusks	None		
Crustaceans	None		
Plants	None		

▶ Home ▶ Species: North Florida County ▶ Species: South Florida County ▶ Species: Panhandle County

For details on State listed species, please go to http: myfwc.com imperiledspecies

Send comments on our web site or general questions to North Florida office
If you need special assistance please contact the Public Affairs Officer

U.S. Fish & Wildlife Service

North Florida Field Office

Flagler County Federally Listed Species

This information is provided as a guide to project planning, and is not a substitute for site-specific surveys. Such surveys may be needed to assess species' presence or absence, as well as the extent of project effects on listed species and/or designated critical habitat.

The following table lists those federally-listed species known to be present in the county.
Code Key: E = Endangered, T = Threatened, P = Proposed, C = Candidate, CH = Critical Habitat

Category	Species Common Name	Species Scientific Name	Code
Mammals	West Indian (Florida) Manatee	*Trichechus manatus latirostris*	E/CH
Birds	Florida Scrub-jay	*Aphelocoma coerulescens*	T
	Wood Stork	*Mycteria americana*	E
	Red-cockaded Woodpecker	*Picoides borealis*	E
Fish	Gulf Sturgeon	*Acipenser oxyrhynchus desotoi*	T
Reptiles	Eastern Indigo Snake	*Drymarchon corais couperi*	T
	Green Sea Turtle	*Chelonia mydas*	E
	Hawksbill Sea Turtle	*Eremochelys imbricata*	E
	Leatherback Sea Turtle	*Dermochelys coriacea*	E
	Kemp's ridley Sea Turtle	*Lepidochelys kempii*	E
	Loggerhead Sea Turtle	*Caretta caretta*	T
Amphibians	None		
Mollusks	None		
Crustaceans	None		
Plants	None		

▶ Home ▶ Species: North Florida County ▶ Species: South Florida County ▶ Species: Panhandle County

For details on State listed species, please go to http: myfwc.com imperiledspecies.

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Last modified June 28, 2007

Appendix D
Animals Photographed by the Camera Traps

Wetland A4 – Unidentified rat

Wetland B3 - Raccoon

Wetland C1 - Raccoon

Wetland 8 - Raccoon

Wetland B4 – Raccoons and Virginia Opossum

Wetland C - Raccoon

Wetland 21 – White-tailed Deer

Wetland 22 – Virginia Opossums

Wetland C2 - Raccoon

Wetland 2 – Virginia Opossum

Wetland 13 – Domestic Cat

Appendix E

The Integrated Wildlife Habitat Ranking System

2008

THE INTEGRATED WILDLIFE HABITAT RANKING SYSTEM 2008

Mark Endries[1], Terry Gilbert[2], and Randy Kautz[3]

[1]**Florida Fish and Wildlife Conservation Commission**
620 South Meridian St.
Tallahassee, FL 32399-1600

[2]**URS Corporation**
1625 Summit Lake Drive
Tallahassee, FL 32327

[3]**Breedlove, Dennis and Associates, Inc.**
2625 Neuchatel Drive
Tallahassee, FL 32303-2249

ABSTRACT

The Florida Fish and Wildlife Conservation Commission (FWC) is responsible for the protection of the state's fish, wildlife and habitat resources. FWC biologists perform environmental reviews of major land development projects in Florida that potentially impact upland, wetland, and aquatic habitat systems that support commercially and recreationally important fish and wildlife resources, including listed species. In an effort to improve the efficiency and accuracy of these reviews, and to improve coordination among agencies, the FWC developed a Geographic Information Systems (GIS)-based assessment tool that incorporates a wide variety of land cover and wildlife species data. The Integrated Wildlife Habitat Ranking System (IWHRS) ranks the Florida landscape based upon the habitat needs of wildlife as a way to identify ecologically significant lands in the state, and to assess the potential impacts of land development projects. The IWHRS is provided as part of the FWC's continuing technical assistance to various local, regional, state, and federal agencies, and entities interested in wildlife needs and conservation in order to: (1) determine ways to avoid or minimize project impacts by evaluating alternative placements, alignments, and transportation corridors during early planning stages, (2) assess direct, secondary, and cumulative impacts to habitat and wildlife resources, and (3) identify appropriate parcels for public land acquisition for wetland and upland habitat mitigation purposes.

The IWHRS was originally created in 2001 and underwent a major revision in 2007 using updated datasets. In 2008 changes were made to five of the data layers (Listed Species Locations, Species Richness, Managed Lands, Distance to Managed Lands, and Florida Forever Board of Trustees/Save Our Rivers Lands) using data not available in 2007 and the Landscape Diversity layer was replaced with a much improved Spatial Heterogeneity layer. This document describes the IWHRS 2008.

INTRODUCTION

FWC Biologists perform reviews of major land developments such as highways, residential and commercial developments, dredging for navigation channels and marinas, natural gas pipelines, phosphate and limestone mining, and other projects that impact fish and wildlife resources and their habitats. These land use changes can adversely impact species listed by the FWC as threatened, endangered, or species of special concern; recreationally and commercially important fish and wildlife resources; rare and sensitive wildlife habitats; and public lands. FWC biologists evaluate project design to estimate the total area that will be impacted, assess the type and level of impacts, and then make recommendations to the applicant or permitting agencies on potential ways to avoid, minimize, or mitigate those impacts.

Providing input during the early planning stage of major land developments, followed by in-depth coordination and cooperation between designers, planners, and resource agencies, is the key to successfully influencing land use decisions on land development projects. Accurate, detailed information on habitat quality and the spatial distribution of fish and wildlife resources within the project area must be readily available to resource biologists and land developers. Additionally, major resource issues must be quickly and clearly defined and potential solutions fully investigated before final project design and implementation in order to avoid future problems with state and federal permits and second party court challenges.

To improve the efficiency and accuracy of environmental assessments, a tool was needed to allow for rapid assessment of fish and wildlife resource and habitat features in the state of Florida. This tool would permit landscape-scale evaluation of a proposed project to assess its impact on lands important to fish and wildlife species.

Geographic Information Systems (GIS) provide an ideal tool for regional and statewide assessments of landscapes, development and application of habitat models, and modeling of the potential distribution of species and habitats (Conner and Leopold 1998, Stoms *et al.* 1992). GIS have also emerged as a tool to assist in the resolution of land use conflict and the management of natural resources (Brown *et al.* 1994). Given appropriate digital habitat and wildlife data, these data can be used to identify environmentally sensitive lands, to allow GIS users to view their project in a landscape prospective, and to allow habitat quality and wildlife needs to be simulated as a function of proposed management (Conner and Leopold 1998).

The FWC used the tools of GIS to strengthen and enhance environmental assessments and to help bridge the information gap between wildlife agencies, land developers, and land use planners by creating the Integrated Wildlife Habitat Ranking System (IWHRS). The IWHRS is a GIS-based habitat model that incorporates a wide variety of land cover and wildlife species data to identify ecologically significant lands within the state of Florida and rank the Florida landscape based on the needs of wildlife.

The IWHRS was originally constructed in 2001. Since 2001, many of the principal datasets utilized have been updated, new datasets have become available, and information on wildlife locations has continued to be gathered. Furthermore, the landscape of Florida has changed. While additional lands have been acquired for wildlife conservation, large areas of habitat have been lost to development. As a result, in 2007 we recalculated the IWHRS was utilizing new and updated datasets (IWHRS 2007). We recalculated the IWHRS in 2008 (IWHRS

2008) by replacing the Landscape Diversity layer with a much more refined Spatial Heterogeneity layer and updating the other layers when new and updated datasets were available. The updated layers in the IWHRS 2008 include Listed Species Locations, Species Richness, Managed Lands, Distance to Managed Lands, and Florida Forever Board of Trustees/Save Our Rivers Lands. These updates maintain the IWHRS 2008 as a relevant natural resource tool given the rapid pace of land use change occurring across the Florida landscape. This document describes the IWHRS 2008.

METHODS

All GIS work was conducted in raster format using the Spatial Analyst extension of the ArcMap software package (ESRI, Version 9.2, 2003). The pixel size used for the analysis was 30 x 30 m, and the extent was the political boundary of the State of Florida.

Table 1. The 10 data layers used to calculate the IWHRS 2008.

Data Layers
1. Spatial Heterogeneity
2. Roadless Habitat Patch Size
3. Strategic Habitat Conservation Areas (SHCA)
4. Listed Species Locations
5. Species Richness
6. Florida Natural Areas Inventory (FNAI) Habitat Conservation Priorities
7. Managed Lands
8. Distance to Managed Lands
9. Landscape Connectivity
10. Florida Forever Board of Trustees/Save Our Rivers (FFBOT/SOR) Lands

The IWHRS 2008 is composed of 10 data layers that represent important ecological aspects for wildlife species in Florida (Table 1). The data layers used in the IWHRS 2008 were constructed by utilizing various preexisting GIS datasets (Table 2). The datasets were selected by their ability to accurately represent the natural vegetation of the study area, represent areas currently protected for wildlife, model wildlife habitats, and identify lands critical to wildlife. To construct the data layers of the IWHRS 2008, the preexisting datasets were manipulated to extract those features needed.

Table 2. Datasets used to construct the data layers of the IWHRS 2008.

Dataset	Description
Statewide Landcover	The land cover image created by the FWC using Landsat Enhanced Thematic Mapper satellite imagery collected in 2003. The classified image includes 43 land cover classes, including 26 natural and semi-

	natural vegetation types, 16 types of disturbed lands (e.g. agriculture, urban, mining), and 1 water class. For a complete description of classification methods and land cover classes please see Kautz et al. (2007) and Stys et al. (2004).
Wildlife Species Potential Habitat Maps	These FWC maps are based on known locations of species of wildlife, information on the land cover and vegetation types used by each species, and published or well documented information on the life-history requirements of the species. The potential habitat maps identify those areas statewide that could serve as potential habitat for an individual wildlife species.
Strategic Habitat Conservation Areas (SHCA)	SHCA are important habitat areas in Florida with no formal conservation protection that are needed to achieve population stability for listed, rare, and imperiled wildlife (Cox *et al.* 1994, Endries *et al.* In Preparation). Through population viability analyses, the lands identified as SHCA for a species, in conjunction with habitat occurring on existing conservation lands, are needed to provide the species with a minimum base of habitat for long-term persistence. We used the SHCA identified in The FWC Wildlife Habitat Conservation Needs in Florida report (Endries et al. In Preparation).
FNAI Conservation Needs Assessment Habitat Conservation Priorities.	The Conservation Needs Assessment is a geographic analysis of the distribution of certain natural resources and resource based land uses that have been identified by the Florida Forever Council and Florida Legislature as needing increased conservation attention (Florida Natural Areas Inventory 2007*b*). The Habitat Conservation Priorities layer prioritizes areas on the landscape that would protect both the greatest number of rare species and those species with the greatest conservation need. We utilized version 2.1 completed in July 2006.
Florida Ecological Greenways Network Critical Linkages	The Florida Ecological Greenways Network identifies the opportunities to protect large, intact landscapes important for conserving Florida's biodiversity and ecosystem services (Hoctor et al. 2000). The Florida Greenways project is an analysis of potential ecological connectivity using land-use data to identify areas with conservation significance and potential

	landscape linkages. This dataset contains the Florida ecological greenways network and critical linkages prioritization results approved by the Florida Greenways and Trails Council in November 2005 (Florida Geographic Data Library 2007).
Managed Land Boundaries	The FNAI Florida Managed Areas (FLMA) database includes public and some private lands that the FNAI has identified as having natural resource value and that are being managed at least partially for conservation purposes (Florida Natural Areas Inventory 2007*c*). The Inventory database includes boundaries and statistics for more than 1,600 federal, state, local, and private managed areas, all provided directly by the managing agencies. National parks, state forests, wildlife management areas, local and private preserves are examples of the managed areas included. We utilized the FLMA database from March 2008.
Florida Forever Board of Trustees (FFBOT) Projects	Florida Forever is the nation's largest conservation land buying program. Collectively, the State of Florida has protected over 535,643 acres of land with $1.8 billion in Florida Forever funds through December 2006. Florida Forever lands are proposed for acquisition because of outstanding natural resources, opportunity for natural resource-based recreation, or historical and archaeological resources. However, these areas may not be currently managed for their resource value. This dataset contains boundaries of all FFBOT projects approved by the State's Acquisition and Restoration Council as of 8 December 2006 (Florida Natural Areas Inventory 2007*a*).
Save Our Rivers (SOR) Lands Boundaries	Using monies from the Water Management Lands Trust Fund and Florida Forever, the SOR program enables the five Florida water management districts to acquire lands necessary for water management, water supply, and the conservation and protection of water resources including wildlife. Due to lack of more current information, we utilized the existing Save our Rivers database from the original IWHRS but removed any areas that are publicly owned.

Model Layers

Spatial Heterogeneity

This layer measures the spatial complexity and variability of habitat patches in the state of Florida. It is important when identifying areas of ecological significance to consider heterogeneity of the landscape, which may have significant effects on various ecosystem processes including predator-prey relationships (Pierce et al. 2000), population and metapopulation dynamics (Dempster and Pollard 1986, Dunning et al. 1992, Henein et al. 1998, Kie et al. 2002), community structure and biotic diversity (Holt 1984, Pianka 1992, Holt 1997), conservation biology (With 1997), and others. A landscape composed of a mosaic of habitats will provide suitable conditions for a variety of species (Huston 1996). For example, bird diversity has been shown to be positively correlated with structural complexity or species diversity of trees, and in aquatic environments, diversity associated with structural species such as corals or sponges is strongly associated with diversity of fish and invertebrates (Huston 1996).

The spatial heterogeneity analysis only includes natural land cover types from the FWC 2003 landcover image. Any open water, disturbed communities, agriculture, exotic plants, urban, and mining landcover categories were excluded. Due to computer processing limitations landcover classes were grouped to seven general categories (Table 3). We used the definition of spatial heterogeneity in categorical maps proposed by Li and Reynolds (1994). They define spatial heterogeneity as complexity in five components: (1) number of patch types, (2) proportion of each type, (3) spatial arrangement of patches, (4) patch shape, and (5) contrast between neighboring patches. To model these components in a GIS, we created an intermediate GIS data layer for each component of spatial heterogeneity.

Table 3. Classification of the FWC 2003 land cover image for the spatial heterogeneity analysis.

Classes	Description
1 – 2	Coastal Habitat
4, 5, 9	Pineland
3, 8, 10, 11	Hardwood Forest
7	Mixed Hardwood-Pine Forests
6	Dry Prairie
12, 13, 14, 23, 26	Herbaceous Wetland
15, 16, 17, 18, 19, 20, 21, 22, 24, 25	Woody Wetland

To represent the number of patch types we ran a Variety moving window analysis in ArcGIS using a 570 m (19 pixels) window. 570 m as a radius gets as close to a 100 ha circle as possible given 30 m pixel intervals in the landcover image. We then ran a Maximum Zonal Statistic in ArcGIS to obtain the maximum variety value for each patch. The resultant layer attributes each patch with the highest number of different patches within 570 m. To represent proportion of each type we used Fragstats and performed Simpson's Evenness Index (SIEI) landscape analysis. Then using zonal statistics in ArcGIS, we obtained the mean SIEI value for each patch. To represent the spatial arrangement of patches we used Fragstats and performed a patch analysis using the Mean Proximity Index. To represent patch shape we used Fragstats and performed a patch analysis using the Fractal Dimension analysis. To represent the contrast between neighboring patches we used Fragstats and performed a patch analysis using the Edge Contrast Index.

To obtain our final spatial heterogeneity layer we first transformed any of the intermediate data layers that were non-normally distributed. Next, we standardized the data ranges between the intermediate layers so that all were on a 0-1 scale and then added all layers together to obtain our measure of spatial heterogeneity. The range of values was divided into 10 discrete categories using a quantile methodology, the higher the value in the spatial heterogeneity layer the more heterogeneous the patch.

Roadless Habitat Patch Size

The influence of roads on wildlife is well documented. In a review, Trombulak and Frissell (2000) identified 7 general impacts that roads have on wildlife: (1) mortality from road construction, (2) mortality from collision with vehicles, (3) modification of animal behavior, (4) alteration of the physical environment, (5) alteration of the chemical environment, (6) spread of exotics, and (7) increased use of areas by humans. Furthermore, roads create a barrier to wildlife movement, can alter animal communities, reduce biological diversity, and increase the threat of extinction (Alexander and Waters 2000). We represented the effects of roads on wildlife in the IWHRS 2008 by identifying continuous habitat patches in the state of Florida bounded by roads and ranking them based on size.

To construct the data layer for roadless habitat patch size, the FWC 2003 land cover image was reclassified so that only categories representing natural land cover habitat (values 1-26) were identified and grouped into single-value continuous patches. To ensure that all major roads were accurately represented as sectioning the landscape, the October 2006 version of the Florida Department of Transportation Roads Characteristics Inventory (RCI) dataset (Florida Department of Transportation 2007) was converted into a 30 m grid where all road networks were given a value of NoData and all other areas were given a value of 0. Next, an addition calculation was performed with the reclassed land cover image and RCI grid. The resulting grid represents native vegetation patches as a single value and all non-native vegetation and road areas as no data. We calculated the total area of each continuous patch by performing a region group analysis, which clusters each patch and identifies the total number (count) of pixels per patch.

Due to the size and scale of analysis, a minimum habitat patch size of 0.15 km^2 was used. Mykytka and Pelton (1989) found that habitat patches >0.152 km^2 (37 acres) were important components of black bear habitat in the Osceola National Forest. The Florida black bear is a species integral to the IWHRS 2008, and its history of roadkills is well documented (Gilbert *et al.* 2001, Wooding and Brady 1987). If a habitat patch was smaller than 0.15 km^2, it was not included in the analysis and scored 0.

Habitat patches were ranked using a 10 class quantile classification scheme due to the large size range of the parcels (from 0.15 km^2 to 3490 km^2). The quantile classification method identifies class cut-off values so that the total area of land in each class is approximately the same. Scoring was as follows:

0. < 0.15 km^2
1. 0.15 km^2 – 2.49 km^2
2. 2.50 km^2 – 10.15 km^2
3. 10.16 km^2 – 22.67 km^2
4. 22.68 km^2 – 44.60 km^2
5. 44.61 km^2 – 82.00 km^2
6. 82.01 km^2 – 138.50 km^2
7. 138.51 km^2 – 235.50 km^2
8. 235.51 km^2 – 516.50 km^2
9. 516.51 km^2 – 912.50 km^2
10. > 912.51 km^2

Strategic Habitat Conservation Areas (SHCA)

SHCA identify important habitat areas for species of wildlife with a deficiency in the amount of appropriate habitat protected by the current system of lands managed for conservation in Florida. All SHCA identified in the Wildlife Habitat Conservation Needs in Florida report (Endries et al. In Preparation) were given a value of 10.

Listed Species Locations

The US Endangered Species Act of 1973 was the most comprehensive and powerful piece of environmental legislation enacted by the United States (Orians 1993). Congress passed this legislation to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved". With that in mind, we included a layer that reflects the locations and diversity of the state-listed terrestrial vertebrate wildlife species in the state of Florida. The FWC officially lists imperiled wildlife species in the state of Florida and recognizes 3 categories: endangered, threatened, and species of special concern. The state imperiled species list serves as a means for the state to protect wildlife and to set conservation priorities specific to the state of Florida.

Using wildlife potential habitat maps for listed species created by the FWC, the data layer was classified based on the presence, number, and level of imperiled status for listed species present. The ranking scheme of the coverage is given below:

0. No listed species present
1. 1 species of special concern
2. ≥ 2 Species of Special Concern
3. 1 Threatened species and ≤ 1 Species of Special Concern
4. 1 Threatened Species and ≥ 2 Species of Special Concern
5. 2 Threatened Species and ≤ 1 Species of Special Concern
6. 2 Threatened Species and ≥ 2 Species of Special Concern
7. ≥ 3 Threatened Species and ≥ 0 Species of Special Concern
8. 1 Endangered Species and ≥ 0 Threatened Species and ≥ 0 Species of Special Concern
9. 2 Endangered Species and ≥ 0 Threatened Species and ≥ 0 Species of Special Concern
10. ≥3 Endangered Species and ≥ 0 Threatened Species and ≥ 0 Species of Special Concern

Species Richness

The protection of biodiversity is important for a variety of reasons such as for its ecological, economical, medical, aesthetical, and recreational value. Biodiversity is the foundation of any healthy ecosystem and helps an ecosystem persist. Numerous studies have reinforced the link between species richness and community function (Naeem et al. 1994, Tilman 1996, Hooper and Vitousek 1997, Wilsey and Potvin 2000).

To model biodiversity for the species richness data layer, we utilized the potential habitat maps of 95 wildlife species that were created by the FWC and merged each species map into a single layer. A pixel's value represents a classification of the number of species identified as having potential habitat at that site. The range of values was 0 (representing no species) to 21 species overlapping in a single pixel. We used a 10 class quantile classification scheme. The classification values are given below:

0. No species present
1. 1 species
2. 2 species
3. 3 species
4. 4 species
5. 5 species
6. 6 species
7. 7 species
8. 8 species
9. 9 - 10 species
10. ≥11 species

FNAI Habitat Conservation Priorities

The FNAI conservation needs assessment layer contains six priority classes. The classes prioritize habitats throughout Florida based on number of rare species and those species with the greatest conservation need. We reclassified the six FNAI conservation needs assessment priority classes on a 0 – 10 scale as follows:

0. No priority
2. Priority 6 habitats
3. Priority 5 habitats
5. Priority 4 habitats
7. Priority 3 habitats
8. Priority 2 habitats
10. Priority 1 habitats

Managed Lands

Lands managed for the benefit of fish and wildlife resources provide the most essential protection of fish and wildlife species and are the one of the most important ways to ensure that those lands that are needed for fish and wildlife will remain in perpetuity. To construct the public lands data layer, all public lands identified in the FNAI FLMA database were given a value of 10; all other areas were classed 0.

Distance to Managed Lands

If one applies the theory of island biogeography (MacArthur and Wilson 1967) to managed lands by treating each block of managed land as an "island", then the predictions of island biogeography theory can be applied to land management in the following way:

1. Managed land tracts of larger area will host more species than those of smaller area because those of larger area are likely to provide a greater variety of habitat types.
2. Small, isolated managed land tracts will suffer higher rates of extinction than larger managed land tracts. Small "islands" generally support fewer individuals of each species present; therefore, each species is at greater risk of its numbers declining to zero.
3. Managed land tracts of small area close to very large managed land tracts will be more diverse and have lower extinction rates than those distant from very large managed land tracts. In general, the recolonization potential that large managed land tracts provide increases as the distance to the smaller managed land decreases.

These predictions suggest that the size of new managed lands and their proximity to existing managed areas can be critical to the maintenance of their species diversity and persistence. For example, protecting areas surrounding existing managed lands serves to enhance the conservation value of the entire area (Sayer 1991). Additionally, protecting areas surrounding existing managed lands protects the park or protected area from outside disturbance (Martino 2001, Reid and Miller 1989). For wide ranging species, building upon existing managed lands helps to protect areas large enough to sustain stable populations of the species.

The distance to managed lands data layer was constructed by performing a find distance query in ArcGIS on the FNAI FLMA database. From the results, the range of values was divided into 10 discrete categories using natural breaks. Values assigned to pixels were inversely proportional to the distance to managed lands, (e.g. a pixel with a value of 10 falls in the closest interval to managed land, 9 is the next interval outward from managed land land, and so forth until the outermost interval). The ranking system of the coverage is given below:

1. > 20.0 km from managed land
2. 15.51 km – 20.0 km from managed land
3. 12.21 km – 15.5 km from managed land
4. 9.51 km – 12.2 km from managed land
5. 7.21 km – 9.5 km from managed land
6. 5.11 km – 7.2 km from managed land
7. 3.31 km – 5.1 km from managed land
8. 1.51 km – 3.3 km from managed land
9. 0.01 km – 1.5 km from managed land
10. 0 km from managed land

Landscape connectivity

There is general consensus among conservation biologists that landscape-level connectivity has the potential to enhance population viability for many species, and that most of our current species have evolved in well-connected landscapes (Gilpin and Soule 1986; Noss 1987). Maintaining and restoring habitat connectivity can result in healthy ecosystem function, increased habitat, increased species richness and persistence, larger populations, optimal genetic interchange, reduced predation, and reduced human-caused death (Hilty *et al.* 2006). For example, vegetated riparian corridors are important contributors to improved water quality in streams (Karr and Schlosser 1978; Schlosser and Karr 1981), and hedgerows and shelterbelts have been shown to inhibit soil erosion (Forman and Baudry 1984). Habitat connectivity also has human benefits in the form of areas open to public access.

To include landscape connectivity in the IWHRS 2008, we utilized the results of the Florida ecological greenways network and critical linkages prioritization results (Florida Geographic Data Library 2007). We reclassified the six prioritization classes on a 0 – 10 scale as follows:

0. No linkage
2. Low priority linkage
3. Moderate-low priority linkage
5. Moderate priority linkage
7. High priority linkage
8. Very high priority linkage
10. Critical priority linkage

FFBOT/SOR Lands

Florida Forever Board of Trustees lands serve to conserve and protect unique natural areas, endangered species, unusual geologic features, wetlands, and archaeological and historical sites. Save Our Rivers lands conserves lands for water management, water supply, and the conservation and protection of water resources, and wildlife.

We included these lands because they were identified as ecologically important and are actively being pursued for public acquisition and protection. For the FFBOT/SOR data layer, lands identified on either of these lists were given a value of 10 where all other areas were given a value of 0. Overlaps with existing managed areas were eliminated from the analysis.

IWHRS 2008 Construction

The final image was constructed by adding all 10 data layers together. Since the model only assesses upland and wetland terrestrial habitats, we used the FWC 2003 landcover image and reclassified all open water areas to have a value of zero. The final calculation was then classified using a 10 class scheme. The resulting value assigned to each pixel indicates its importance to wildlife (e.g. the higher the value of a pixel the more important it is to wildlife) (Table 4).

Table 4. Classification of the IWHRS calculation result.

IWHRS Class	Calculation Value Range
1	1 – 10
2	10 – 17
3	17 – 24
4	24 – 31
5	31 – 38
6	38 – 45
7	45 – 52
8	52 – 59
9	59 – 67
10	67 – 88

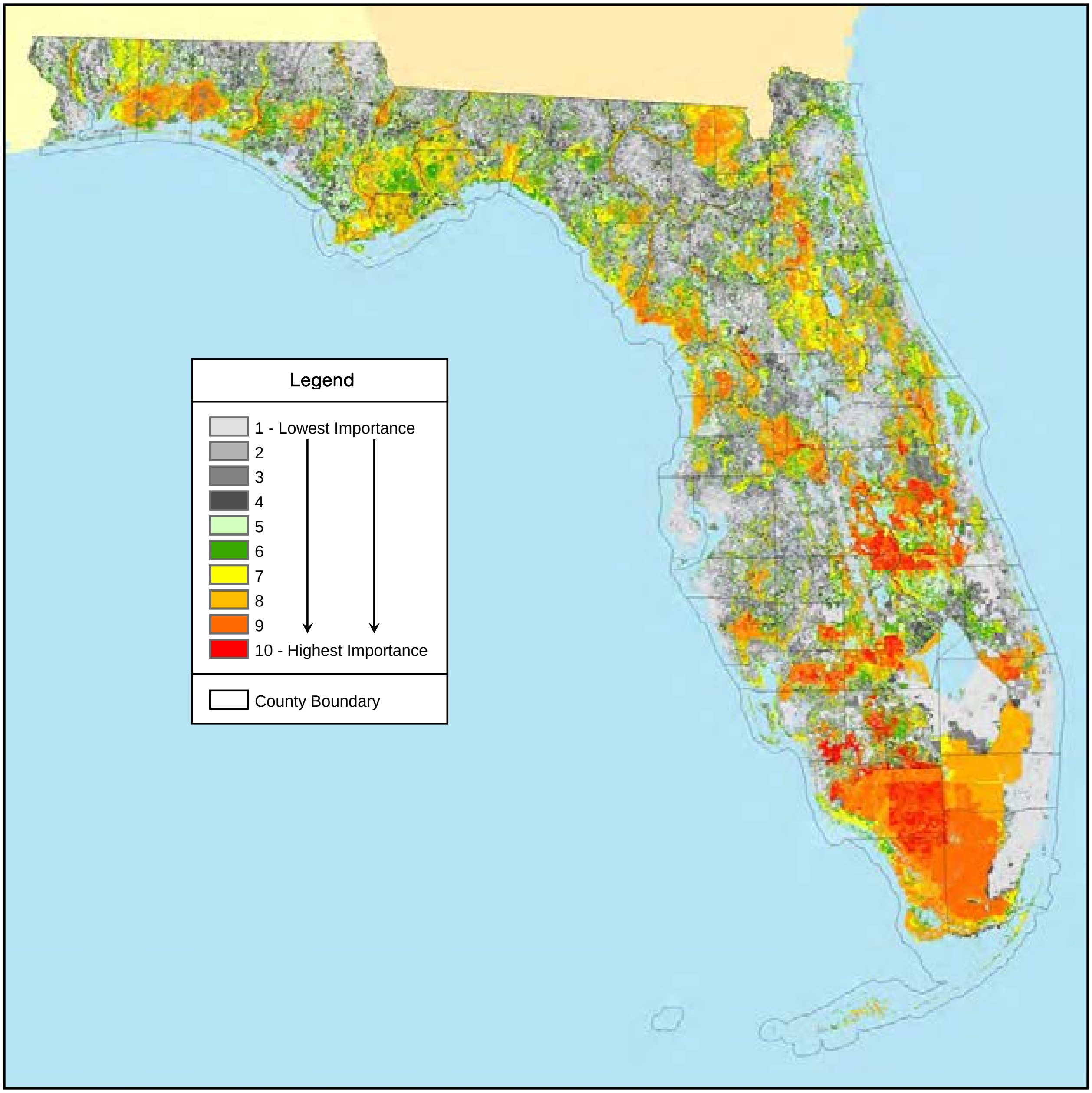

Figure 1. The final model calculation of the IWHRS 2008.

RESULTS

Figure 1 shows the result of the IWHRS 2008. Florida is fortunate that many areas of important native ecological communities remain statewide. Assuming that lands identified in the IWHRS 2008 with a value of 6 or greater constitute at least intermediate quality habitat for wildlife, 5.92 million hectares of a statewide total of 14.5 million hectares are identified. This reveals that over 1/3 of the total land mass of Florida continues to provide some level of ecological significance to wildlife.

The IWHRS 2008 identifies the importance of many lands currently managed for conservation in Florida, and it indicates the relative ecological values of many unprotected areas. Of the 5.92 million hectares of lands with a value of 6 or greater, 2.45 million of these hectares are not managed under any type of formal conservation protection.

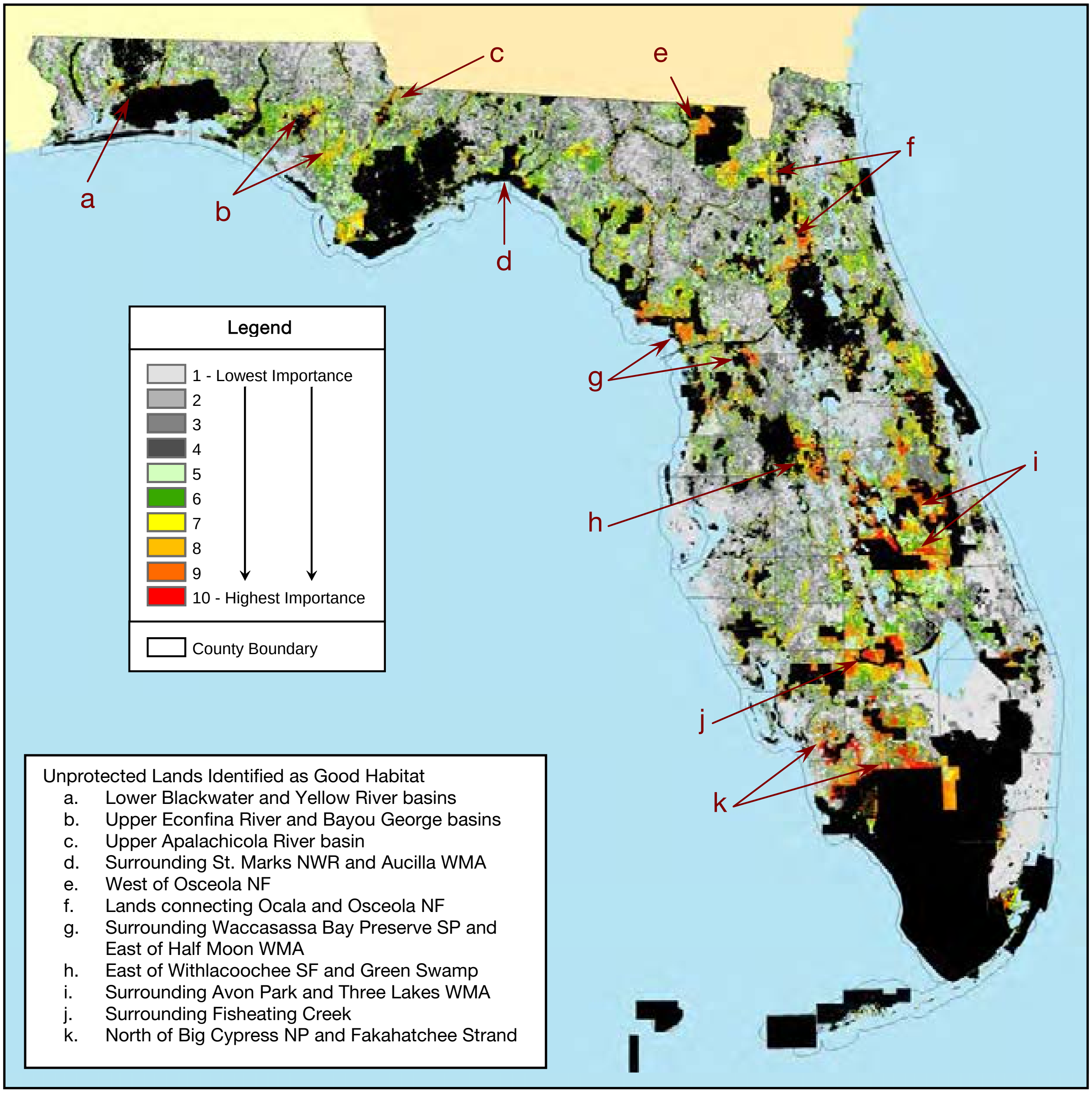

Figure 2. Final model calculation of the IWHRS 2008 with managed lands in black.

Overlaying the FLMA database on the IWHRS 2008 allows one to visually identify many good quality lands not under any type of conservation protection (Figure 2). Some of these areas include (a) the lower Blackwater and Yellow River systems and associated uplands that would connect Blackwater State Forest with Eglin Air Force Base, (b) lands within the Upper Econfina and Bayou George basins, (c) lands along the upper Apalachicola River, (d) lands surrounding St. Marks National Wildlife Refuge and Aucilla and Big Bend Wildlife Management Areas, (e) lands along the western border of Osceola National Forest, (f) lands that would connect Ocala and Osceola National Forests through Camp Blanding, (g) lands surrounding Waccasassa Bay Preserve State Park and east of Half Moon Wildlife Management Area, (h) lands East of Withlacoochee State Forest and Green Swamp, (i) lands surrounding Avon Park and Three Lakes Wildlife Management Area , (j) lands surrounding Fisheating Creek, and (k) lands north of Big Cypress National Preserve and Fakahatchee Strand.

DISCUSSION

Florida currently has an estimated population of 18.1 million people (U.S. Census Bureau 2007) and hosts roughly 80 million tourists each year (VISIT FLORIDA Research 2007). From 2000 to 2006 Florida experienced an average population growth rate of 13.2%, adding over 2.1 million people to the state (U.S. Census Bureau 2007). Population growth projections have the Florida population surpassing New York making Florida the third largest state with over the 20 million people by 2015.

With population growth and tourism comes loss of natural habitat by conversion to urban and agriculture uses. Land use change measured over a 14-18 year period ending in 2003 calculated a 13.34% loss of natural and semi-natural land cover to urban (6.21%) and agricultural uses (7.14%)(Kautz et al. 2007). The large population growth is a major factor in rural land development. It is estimated that until the year 2020, roughly 130,000 acres per year will be converted to urban from rural uses (Reynolds 1999). The projected population growth and accompanying land development jeopardizes the natural landscape of Florida. It is imperative that those lands critical to preserving Florida's wildlife are not dramatically impacted by development pressures.

IWHRS Uses

The IWHRS provides a measure of habitat quality over the entire land surface of Florida and is designed to serve as a rapid assessment tool to help manage impact assessment on development projects. The IWHRS serves a role in helping users identify habitat areas important to wildlife that should be conserved and assess impacts that land development projects could have on the surrounding area. With this information one can evaluate the habitat quality of potential development project site locations and surrounding areas to make informed decisions and identify those projects requiring the most attention and coordination with the FWC. Furthermore, the IWHRS can be used to identify appropriate parcels of land for mitigation through public land acquisition.

Specific Examples of IWHRS Use

Since its inception in 2001 the IWHRS has become an integral tool used to assess proposed development projects and their impacts on the status of wildlife and biodiversity conservation statewide. It has proven valuable for assessing the impacts of proposed road construction projects, helping to compare and select alignments with the least impact to wildlife habitat, and identifying mitigation lands. It is hoped that the IWHRS 2008 will be utilized the same as the original and 2007 version of the IWHRS and supply users with current data on wildlife needs in Florida.

The FWC is using the IWHRS for coordination with many agencies including the Florida Department of Transportation (FDOT), the Florida Department of Community Affairs, County governments, and other state and local groups to assist in determining ways to avoid or minimize negative impacts of land development projects. The IWHRS assists with reviews of development projects including new highway construction or expansions and dredge and fill associated with bridge construction. The FWC uses the IWHRS to evaluate and compare multiple alignments, and assess direct, secondary, and cumulative impacts to important habitat systems and wildlife resources. The IWHRS is especially useful in performing larger, landscape level assessments of linear projects such as highways. FWC initial project reviews center on identifying the array of issues which should be addressed by FDOT in the project development and environmental study (PD&E) phase such as impacts to listed species, public lands, and habitat connectivity. The natural resource information forms the basis for a FWC letter to regulatory agencies on recommendations on ways to avoid, minimize, or mitigate impacts.

The IWHRS is being used as one of the guiding data layers for selecting and mapping spatially explicit conservation lands for the myregion.org program. Myregion.org is a regional growth management visioning program consisting of citizens and leaders from public, private, and institutional sectors to prepare the Central Florida Region to compete more effectively in the 21st century while enhancing the quality of life of its citizenry (myregion.org 2007). The conservation plan for myregion.org is being used as the environmental infrastructure that will guide growth modeling for placement of growth centers, transportation corridors, and local land use planning.

The Orlando Orange County Expressway Authority's Environmental Advisory Committee is using the IWHRS as one of the major environmental data layers and as a primary biodiversity data layer used in feasibility studies.

The IWHRS has been used by the St. John's River Water Management District and FDOT to identify habitat areas for the public acquisition of $8.17 million of mitigation lands as part of the of the I-4 expansion project in Volusia county. The lands purchased enlarge the public land habitat system in the area of Tiger Bay State Forest in Volusia County, and enhance the connection of the Tiger Bay State Forest with the Ocala National Forest.

The IWHRS is one of the FWC datasets incorporated into the FDOT Environmental Screening Tool used to analyze impacts of all FDOT proposed road projects reviewed by various private, state, and federal agencies for all 7 FDOT districts and the Turnpike Enterprise. In 2006 the IWHRS was used in approximately 130 project reviews and for 2007 will total about 140 project reviews. The IWHRS will also be used by the FDOT for an upcoming pilot project to assess the indirect and cumulative impacts that highway projects have on wildlife and biodiversity. The IWHRS is especially suited for this application since the evaluation parameters are diverse and wide-reaching. The IWHRS provides a convenient and consistent way to measure habitat quality at the various scales and provides a means to assess the indirect and cumulative impacts (often occurring far from the actual project area) that a road development project can facilitate in the surrounding area.

Data Distribution

We provide the results of the IWHRS, the data layers that contributed to the IWHRS, and an ArcGIS (ESRI, Redlands, CA) project on digital media. By providing the data in this format, users have the full capabilities of GIS to perform further analysis or inquiries with the IWHRS data. Using the identify tool in ArcGIS, users can identify individual pixel values of the IWHRS results, and any data layer used to calculate the IWHRS at specific locations or regions in Florida. This allows users to get a clear understanding of the importance of each data layer at specific locations. Users can also use their own data or the additional data included on the CD in conjunction with the IWHRS.

Users can customize and recalculate the IWHRS by adding or removing data layers to better fit the task at hand. This improves the utility of the IWHRS by giving it the flexibility to suit the needs of specific projects or queries. Additionally, as new or better data becomes available, users can replace old data layers and update the IWHRS. This will keep the IWHRS as current and accurate as the data available.

Limitations

A GIS model is only as accurate as the data it contains. The information provided on the IWHRS CD is based on data from numerous sources. As with most GIS data, deficiencies exist and users must be aware of these deficiencies when utilizing the data.

Five of the data layers (spatial heterogeneity, roadless habitat patch size, SHCA, listed species, and species richness) use the FWC 2003 land cover image as the base map to represent the habitat classes and wildlife habitat that exist statewide. Misclassifications in the FWC 2003 landcover image are possible because the landcover image was not assessed for accuracy. During map construction the map was visually inspected and reviewed by local managers, and cursory site inspections of many areas was conducted by the map creators, but the accuracy of the landcover image statewide was not formally assessed. Thus, the effects of misclassification errors on species habitat delineations are unknown. Also, the FWC land cover image was created from 2003 Landsat Thematic Mapper imagery. The Florida landscape is rapidly changing and any changes since 2003 are not reflected in the data layers constructed from the land cover imagery.

The remaining data layers were constructed using datasets not created by the FWC. The errors associated with these datasets can be referenced by reviewing the documentation and metadata associated with each specific dataset.

The IWHRS is intended to be used as a guide. Land development and ownership in Florida is ever-changing and priority areas identified in the IWHRS might already have been significantly altered due to development or acquired into public ownership. Onsite surveys, literature reviews, and coordination with FWC biologists remain essential steps in documenting the presence or absence of imperiled species within the project area. Be sure to check the status of all lands prior to making any decisions based upon the information contained in the IWHRS.

REFERENCES CITED

Alexander, S. M. and N. M. Waters. 2000. The Effects of Highway Transportation Corridors on Wildlife: a Case Study of Banff National Park. Transportation Research Part C 8 (2000): 307-320.

Brown, S., H. Schreier, W. A. Thompson, and I. Vertinsky. 1994. Linking Multiple Accounts with GIS as Decision Support System to Resolve Forestry/Wildlife Conflicts. Journal of Environmental Management 42: 349-364.

Conner, L. M., and B. D. Leopold. 1998. A Multivariate Habitat Model for Female Bobcats: A GIS Approach. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 52: 232-243.

Dempster, J. P., and E. Pollard. 1986. Spatial Heterogeneity, Stochasticity and the Detection of Density Dependence in Animal Populations. Oikos 46: 413-416.

Dunning, J. B., B. J. Danielson, and H. R. Pulliam. 1992. Ecological processes that affect populations in complex landscapes. Oikos 65: 169-175.

Endries, M. J., B. E. Stys, R. J. Kawula, G. M. Mohr, G. Kratimenos, S. Langley, K. V. Root, and R. S. Kautz. In Preparation. Wildlife Habitat Conservation Needs in Florida: Updated Recommendations for Strategic Habitat Conservation Areas. Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida, USA.

ESRI. 2003. ArcGIS, version 9.2. ESRI, Redlands, California, USA.

Florida Department of Transportation. 2007. Roads Characteristics Inventory Dataset. http://www.dot.state.fl.us/planning/statistics/gis/default.htm#roads. Accessed 10 Janurary 2007.

Florida Fish and Wildlife Conservation Commission. 2005. Florida's Wildlife Legacy Initiative. Florida's Comprehensive Wildlife Conservation Strategy. Tallahassee, Florida, USA.

Florida Geographic Data Library. 2007. Florida Ecological Greenways Network Critical Linkages and Priorities Results. http://www.fgdl.org/metadata/fgdc_html/gweco_prio_2005.fgdc.htm. Accessed 1 February 2007.

Florida Natural Areas Inventory. 2007*a*. Florida Forever / Board of Trustees Environmental Land Acquisition Projects. http://www.fnai.org/gisdata.cfm. Accessed 8 February 2007.

Florida Natural Areas Inventory. 2007*b*. Florida Forever Conservation Needs Assessment Habitat Conservation Priorities. http://www.fnai.org/gisdata.cfm. Accessed 8 February 2007.

Florida Natural Areas Inventory. 2007*c*. Florida Managed Areas (FLMA). http://www.fnai.org/gisdata.cfm. Accessed 8 February 2007.

Forman, R. T. T. and J. Baudry. 1984. Hedgerows and Hedgerow Networks in Landscape Ecology. Environmental Management 8: 495-510.

Gilbert, T., R. Kautz, T. Eason, R. Kawula, and C. Morea. 2001. Prioritization of Statewide Black Bear Roadkill Problem Areas in Florida. Pp. 574-579 *in* 2001 Proceedings of the International Conference on Ecology and Transportation. Center for Transportation and the Environment, North Carolina State University, Raleigh, North Carolina, USA.

Gilpin, M. E. and M. E. Soule. 1986. Conservation Biology: The Science of Scarcity and Diversity. Sinsuer Associates, Inc, Sunderland, Massachusetts, USA.

Henein, K., J. Wegner, and G. Merriam. 1998. Population Effects of Landscape Model Manipulation on Two Behaviourally Different Woodland Small Mammals. Oikos 81: 168-186.

Hilty, J. A., W. Z. Lidicker Jr., and A. M. Merenlender. 2006. Corridor Ecology: The Science and Practice of Linking Landscapes for Biodiversity Conservation. Island Press, Washington DC, USA.

Hoctor, T. S., M. H. Carr, and P. D. Zwick. 2000. Identifying a Linked Reserve System Using a Regional Landscape Approach: the Florida Ecological Network. Conservation Biology 14(4): 984-1000.

Holt, R. D. 1984. Spatial Heterogeneity, Indierect Interactions, and the Coexistence of Prey Species. American Naturalist 124: 377-406.

Holt, R. D. 1997. From Metapopulation Dynamics to Community Structure: Some Consequences of Spatial Heterogeneity. Pages 149-164 *in* I. Hanski and M. E. Gilpin, editors. Metapopulation Biology: Ecology, Genetics , and Evolution. Academic Press, San Diego, California, USA.

Hooper D. U. and P. M. Vitousek. 1997. The Effects of Plant Composition and Diversity on Ecosystem Processes. Science 277: 1302-1305.

Huston, M. A. 1996. Biological Diversity: The Coexistence of Species on Changing Landscapes. Cambridge University Press, New York, New York, USA.

Karr, J. R. and I. J. Schlosser. 1978. Water Resources and the Land-water Interface. Science 201:229-234.

Kautz, R., B. Stys, R. Kawula. 2007. Florida Vegetation 2003 and Land Use Change Between 1985-89 and 2003. Florida Scientist 1: 12-23.

Kie, J. G., R. T., Bowyer, M. C. Nicholson, B. B. Boroski, and E. R. Loft. 2002. Landscape Heterogeneity at Differing Scales: Effects on Spatial Distribution of Mule Deer. Ecology 83: 530-544.

Lambeck, R. J. 1997. Focal species: a multi-species umbrella for nature conservation. Conservation Biology 11: 849-856.

MacArthur, R. H., and E. O. Wilson. 1967. The Theory of Island Biogeography. Princeton University Press, Princeton, New Jersey, USA.

Martino, D. 2001. Buffer Zones Around Protected Areas: A Brief Literature Review. Electronic Green Journal 15: 1-15.

McGarigal, K. S. A., S. A. Cushman, M. C. Neel, and E. Ene. 2002. FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps. www.umass.edu/landeco/research/fragstats/fragstats.html Accessed 14 May 2008

Mykytka, J. M. and M. R. Pelton. 1989. Management Strategies for Florida Black Bears Based on Home Range Habitat Composition. International Conference of Bear Research and Management 8: 161-167.

Myregion.org. 2007. About myregion.org. http://www.myregion.org Accessed 17 March 2007.

Naeem, S., L. J. Tompson, S. P. Lawler, J. H. Lawton, and R. M. Woodfin. 1994. Declining Biodiversity can Alter the Performance of Ecosystems. Nature 368: 734-37.

Noss, R. F. 1987. Corridors in Real Landscapes: A Reply to Simberloff and Cox. Conservation Biology 1(2): 159-164.

Orians, G. H. 1993. Endangered at What Level? Ecological Applications 3(2): 206-208.

Pianka, E. 1992. Fire Ecology. Disturbance, Spatial Heterogeneity, and Biotic Diversity: Fire Succession in Arid Australia. National Geographic Research and Exploration 8: 352-371.

Pierce, B. M., V. C. Bleich, and R. T. Boyer. 2000. Social Organization of Mountain Lions: Does a Land-tenure System Regulate Population Size? Ecology 81: 1533-1543.

Reid, W. and K. Miller. 1989. Keeping Options Alive: The Scientific Basis for Conserving Biodiversity. World Resources Institute, Washington, DC.

Reynolds, J. E. 1999. Urban Land Conversion and Competition for Rural Land Use. Staff Paper Series SP 99-15, University of Florida Institute of Food and Agricultural Sciences, Gainesville, Florida, USA.

Sayer, J. 1991. Rainforest Buffer Zones: Guidelines for Protected Area Managers. IUCN – The World Conservation Union, Forest Conservation Programme. Gland, Switzerland.

Schlosser, I. J. and J. R. Karr. 1981. Water Quality in Agricultural Watersheds: Impact of Riparian Vegetation during Base Flow. Water Research Bulletin 17: 233-240.

Stoms, D. M., F. W. Davis, and C. B. Cogan. 1992. Sensitivity of Wildlife Habitat Models to Uncertainties in GIS Data. Photogrammetric Engineering and Remote Sensing 6(58): 843-850.

Stys, B, R. Kautz, D. Reed, M. Kertis, R. Kawula, C. Keller, and A. Davis. 2004. Florida vegetation and land cover data derived from 2003 Landsat ETM+ imagery. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida, USA.

Tilman, D. 1996. Biodiversity: Population Versus Ecosystem Stability. Ecology 77: 350-363.

Trombulak, S. C., and C. A. Frissell. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology 14(1): 18-30.

U.S. Census Bureau. 2007. Population Finder, Florida. http://www.census.gov. Accessed 15 March 2007.

VISIT FLORIDA Research. 2007. Visit Florida's Online Portal to Florida Tourism Information and Resources. http://www.visitflorida.org. Accessed 20 March 2007.

Wilsey, B. J., and C. Potvin. 2000. Bodiversity and Ecosystem Functioning: Importance of Species Evenness in an Old Field. Ecology 81: 887-892.

With, K. A. 1997. The Application of Neutral Landscape Models in Conservation Biology. Conservation Biology 11: 1069-1080.

Wooding, J. B., and J. R. Brady. 1987. Black Bear Roadkills in Florida. Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies 41:438-44.

Appendix F
Photographs along Transects in the Matanzas Basin Study Area

A2 Wetland

A2 Buffer

A4 Wetland

20 Wetland

20 Buffer

B3 Wetland

C1 Wetland

C1 Buffer

C4 Wetland

C4 Buffer

19 Wetland

19 Buffer

D4 Wetland

D4 Buffer

B2 Wetland

B2 Buffer

I1 Wetland

I1Buffer

I2 Wetland

I2 Buffer

8 Wetland

B4 Wetland

C Wetland

C Buffer

21 Wetland

21 Buffer

22 Wetland

22 Buffer

C2 Wetland

C2 Buffer

D1 Wetland

D1 Buffer

D2 Wetland

D2 Buffer

2 Wetland

2 Buffer

13 Wetland

13 Buffer

18 Wetland

18 Buffer

30 Wetland

30 Buffer

32 Wetland

32 Buffer

E-Xd Wetland

E-Xd Buffer

FD Wetland

FD Buffer

Appendix G
Additional Photographs

Transect B3 – Florida Cricket Frog

Near Transect D4 – Rough Green Snake

Transect I1 – Pinewoods Treefrog

Transect I2 – Marsh Rice Rat

Transect 22 – Cotton Mouse

Transect 13 – Southern Flying Squirrel

Transect 18 – Florida Green Watersnake

Appendix H
References for the Wildlife Information Prepared for Task 2

Amphibian Reference Information

***Acris gryllus* - Southern Cricket Frog**

AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: http://amphibiaweb.org/. (Accessed: Jul 17, 2009).

Babbitt, K.J. and G. W. Tanner Effective Management for Frogs and Toads on Florida's Ranches @ http://wfrec.ufl.edu/range/frogs/default.htm

Conant, R. and J. T. Collins. 1991. ―Peterson Field Guide – Reptiles and Amphibians Eastern / Central North America". Houghton Mifflin Company, Boston.

Knapp, W. 2002. "The Frogs and Toads of Georgia" (On-line). Accessed March 20, 2003 at http://wwknapp.home.mindspring.com/docs/southern.cricket.frog.html

University of Florida, 2002. "Frogs and Toads of Florida" (On-line). Accessed March 20, 2003 at http://www.wec.ufl.edu/extension/wildlife_info/frogstoads/acris_gryllus_dorsalis.php

***Ambystoma cingulatum* - Flatwoods Salamander**

Anderson, J.D. and G.K. Williamson. 1976. Terrestrial mode of reproduction in *Ambystoma cingulatum*. Herpetologica 32:214–221.

AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: http://amphibiaweb.org/. (Accessed: Jul 17, 2009).

Ashton, R.E., Jr. 1992. Flatwoods salamander. Pp. 39–43. *In* Moler, P.E. (Ed.), Rare and Endangered Biota of Florida. Volume III. Amphibians and Reptiles. University Press of Florida, Gainesville, Florida.

Conant, R. and J.T. Collins. 1991. A Field Guide to Reptiles and Amphibians: Eastern and Central North America. Third edition. Houghton Mifflin Company, Boston, Massachusetts.

Florida Natural Areas Inventory. 2001. Field Guide to the Rare Animal of Florida. http://www.fnai.org/FieldGuide/pdf/Ambystoma_cingulatum.PDF Date accessed: July 16, 2009.

Martof, B.S. 1968. *Ambystoma cingulatum*. Pp. 57.1–57.2. Catalogue of American Amphibians and Reptiles. Society for the Study of Amphibians and Reptiles, St. Louis, Missouri.

Means, D.B., J.G. Palis and M. Baggett. 1996. Effects of slash pine silviculture on a Florida population of flatwoods salamander. Conservation Biology 10:426–437.

Palis, J.G. 1995b. Larval growth, development, and metamorphosis of *Ambystoma cingulatum* on the Gulf Coastal Plain of Florida. Florida Scientist 58:352–358.

Palis, J.G. 1997b. Distribution, habitat, and status of the flatwoods salamander (*Ambystoma cingulatum*) in Florida, USA. Herpetological Natural History 5:53–65.

Palis, J.G. 1997a. Breeding migration of *Ambystoma cingulatum* in Florida. Journal of Herpetology 31:71–78.

U.S. Fish and Wildlife Service. 1997c. Endangered and threatened wildlife and plants; proposed rule to list the flatwoods salamander as threatened. Federal Register 62(241):65787–65794.

***Ambystoma talpoideum* - Mole Salamander**

AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: http://amphibiaweb.org/. (Accessed: Jul 17, 2009).

Anderson, J.D. and G.K. Williamson. 1974. Nocturnal stratification in larvae of the mole salamander, *Ambystoma talpoideum*. Herpetologica 30:28–29.

Gibbons, J.W. and R.D. Semlitsch. 1991. Guide to the Reptiles and Amphibians of the Savannah River Site. University of Georgia Press, Athens, Georgia.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C.

Semlitsch, R.D. 1988. Allotopic distribution of two salamanders: effects of fish predation and competitive interactions. Copeia 1988:290–298.

Taylor, B.E., R.A. Estes, J.H.K. Pechmann and R.D. Semlitsch. 1988. Trophic relations in a temporary pond: larval salamanders and their microinvertebrate prey. Canadian Journal of Zoology 66:2191–2198.

***Amphiuma means* - Two-toed Amphiuma**

Bishop, S.C. 1943. A Handbook of Salamanders. The Salamanders of the United States, of Canada, and of Lower California. Comstock Publishing Company, Ithaca, New York.

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Dundee, H.A. and D.A. Rossman 1989. The Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge, Louisiana.

Funderburg, J.B., Jr. 1955. The amphibians of New Hanover County, North Carolina. Journal of the Elisha Mitchell Scientific Society 71:19–28.

Gunzburger, M.S. 2003. Evaluation of the hatching trigger and larval ecology of the salamander *Amphiuma means*. Herpetologica 59:459–468.

Johnson, S.A., and R. B. Owen, Florida Department of Environmental Protection, Guana River State Park, contributing authors to *Amphibian Declines: The Conservation Status of United States Species*, edited by Michael Lannoo (©2005 by the Regents of the University of California) modified for Amphibiaweb: http://amphibiaweb.org/ (obtained 7/7/09).

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (accessed: 7/7/09).

Rose, F.L. 1967. Seasonal changes in lipid levels of the salamanders *Amphiuma means*. Copeia 1967:662–666.

***Bufo quercicus* - Oak Toad**

Dalrymple, G.H. 1990. Habitat suitability index model for the oak toad, *Bufo quercicus*. Pp. 26–68. *In* Richter, W. and E. Myers (Eds.), Habitat suitability index models used for the Bird Drive Everglades Basin Special Area Management Plan. Department of Environmental Research Management, Technical Report Number 90–1, Miami, Florida.

Dodd, C.K. 1994. The effects of drought on population structure, activity, and orientation of toads (*Bufo quercicus* and *B. terrestris*) at a temporary pond. Ethology, Ecology and Evolution 6:331–349.

Duellman, W.E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bulletin of the Florida State Museum 3:181–324.

Hamilton, W.J. 1955. Notes on the ecology of the oak toad in Florida. Herpetologica 11:205–210.

Pechmann, J.H.K., D.E. Scott, J.W. Gibbons and R.D. Semlitsch. 1989. Influence of wetland hydroperiod on diversity and abundance of metamorphosing juvenile amphibians. Wetlands Ecology and Management 1:3–11.

AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: http://amphibiaweb.org/. (Accessed: Jul 17, 2009).

Punzo, F. 1995. An analysis of feeding in the oak toad, *Bufo quercicus* (Holbrook) (Anura: Bufonidae). Florida Scientist 58:16–20.

Bufo terrestris **- Southern Toad**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Ashton, R.E., Jr. and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida: Part Three: The Amphibians. Windward Publishing, Miami, Florida.

Bartlett, R.D. and P.P. Bartlett. 1999a. A Field Guide to Florida Reptiles and Amphibians. Gulf Publishing Company, Houston, Texas.

Blem, C.R. 1979. *Bufo terrestris*. Pp. 223.1–223.4. Catalogue of American Amphibians and Reptiles. Society for the Study of Amphibians and Reptiles, St. Louis, Missouri.

Duellman, W.E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bulletin of the Florida State Museum 3:181–324.

Dundee, H.A. and D.A. Rossman 1989. The Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge, Louisiana.

Gibbons, J.W. and R.D. Semlitsch. 1991. Guide to the Reptiles and Amphibians of the Savannah River Site. University of Georgia Press, Athens, Georgia.

Krakauer, T. 1968. The ecology of the neotropical toad, *Bufo marinus*, in south Florida. Herpetologica 24:214–221.

Martof, B.S., W.M. Palmer, J.R. Bailey and J.R. Harrison III. 1980. Amphibians and Reptiles of the Carolinas and Virginia. University of North Carolina Press, Chapel Hill, North Carolina.

Wilson, L.A. 1995. Land manager's guide to the amphibians and reptiles of the South. Nature Conservancy, Southeastern Region, Chapel Hill, North Carolina.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

Desmognathus auriculatus **- Southern Dusky Salamander**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Folkerts, G.W. 1968. The genus *Desmognathus* Baird (Amphibia: Plethodontidae) in Alabama. Ph.D. dissertation. Auburn University, Auburn, Alabama.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 7, 2009).

***Eurycea quadridigitata* - Dwarf Salamander**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Goin, C.J. 1951. Notes on the eggs and early larvae of three more Florida salamanders. Annals of the Carnegie Museum 32:253–263.

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Agricultural Experimental Station, Auburn University Press, Auburn, Alabama.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 7, 2009).

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C.

Taylor, B.E., R.A. Estes, J.H.K. Pechmann and R.D. Semlitsch. 1988. Trophic relations in a temporary pond: larval salamanders and their microinvertebrate prey. Canadian Journal of Zoology 66:2191–2198.

***Gastrophryne carolinensis* - Eastern Narrowmouth Toad**

Allen, M.J. 1932. A survey of the amphibians and reptiles of Harrison County, Mississippi. American Museum Novitates, Number 542, American Museum of Natural History, New York.

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Anderson, P.K. 1954. Studies in the ecology of the narrow-mouthed toad, *Microhyla carolinensis carolinensis.* Tulane Studies in Zoology 2:15–46.

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Blanchard, F.N. 1922. The amphibians and reptiles of western Tennessee. Occasional Papers of the Museum of Zoology, Number 117, University of Michigan, Ann Arbor, Michigan.

Blair, W.F. 1950. The biotic provinces of Texas. Texas Journal of Science 2:93–117.

Brandt, B.B. 1936a. The frogs and toads of eastern North Carolina. Copeia 1936:215–223.

Buhlmann, K.A., J.C. Mitchell and C.A. Pague. 1994. Amphibian and small mammal abundance and diversity in saturated forested wetlands and adjacent uplands of southeastern Virginia. Pp. 1–7. *In* Eckles, S.D., A. Jennings, A. Spingarn and C. Wienhold (Eds.), Proceedings of a Workshop on Saturated Forested Wetlands in the Mid-Atlantic Region: The State of the Science. U.S. Fish and Wildlife Service, Annapolis, Maryland.

Dodd, C.K., Jr. 1992. Biological diversity of a temporary pond herpetofauna in north Florida sandhills. Biodiversity and Conservation 1:125–142.

Duellman, W.E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bulletin of the Florida State Museum 3:181–324.

Gibbons, J.W. and R.D. Semlitsch. 1991. Guide to the Reptiles and Amphibians of the Savannah River Site. University of Georgia Press, Athens, Georgia.

Gosner, K.L. and I.H. Black. 1956. Notes on amphibians from the upper Coastal Plain of North Carolina. Journal of the Elisha Mitchell Scientific Society 72:40–47.

Holbrook, J.E. 1842. North American Herpetology, Volume 5. J. Dobson and Son, Philadelphia, Pennsylvania.

Learm, J., T.C. Carter, M.A. Menzel, T.S. McCay, J.L. Boone, W.M. Ford, L.T. Lepardo, D.M. Krishon, G. Balkcom, N.L. Vad der Maath and M.L. Harris. 1999. Amphibians, reptiles, and mammals of Sapelo Island, Georgia. Journal of the Elisha Mitchell Scientific Society 115:104–126.

Martof, B.S. 1955. Observations on the life history and ecology of the amphibians of the Athens area, Georgia. Copeia 1955:166–170.

Tinkle, D.W. 1959. Observations of reptiles and amphibians in a Louisiana swamp. American Midland Naturalist 62:189–205.

Werler, J.C. and J. McCallion. 1951. Notes on a collection of reptiles and amphibians from Princess Anne County, Virginia. American Midland Naturalist 45:245–252.

Wood, J.T. 1948. *Microhyla c. carolinensis* in an ant nest. Herpetologica 4:226.

Wright, A.H. 1932. Life Histories of the Frogs of the Okefinokee Swamp, Georgia. North American Salientia (Anura) Number 2. Macmillan Press, New York.

***Hyla* spp. - Tree Frogs**

Allen, M.J. 1932. A survey of the amphibians and reptiles of Harrison County, Mississippi. American Museum Novitates, Number 542, American Museum of Natural History, New York.

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Ashton, R.E., Jr. and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida: Part Three: The Amphibians. Windward Publishing, Miami, Florida.

Brown, R.L. 1974. Diets and habitat preferences of selected anurans in southeast Arkansas. American Midland Naturalist 91:468–473.

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida

Conant, R. and J. T. Collins. 1991. A field guide to reptiles and amphibians: eastern and central North America. Third edition. Houghton Mifflin Co., Boston, Massachusetts. 450 pp. @ http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Hyla%20chrysoscelis

Delzell, D.E. 1979. A provisional checklist of amphibians and reptiles in the Dismal Swamp area, with comments on their range of distribution. Pp. 244–260 *In* Kirk, P.W., Jr. (Ed.), The Great Dismal Swamp. University Press of Virginia, Charlottesville, Virginia.

Diener, R.A. 1965. The occurrence of the tadpoles of the green treefrog *Hyla cinerea cinerea*, in Trinity Bay, Texas. British Journal of Herpetology 3:198–199.

Dodd, C.K. 1994. The effects of drought on population structure, activity, and orientation of toads (Bufo quercicus and B. terrestris) at a temporary pond. Ethology, Ecology and Evolution 6:331–349.

Duellman, W.E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bulletin of the Florida State Museum 3:181–324.

Dunn, E.R. 1937. The status of *Hyla evittata* Miller. Proceedings of the Biological Society of Washington 50:9–10.

Freed, A.N. 1982a. A treefrog menu: a selection for an evening's meal. Oecologia 53:20–26.

Frost, D. R. 1985. Amphibian species of the world. A taxonomic and geographical reference. Allen Press, Inc., and The Association of Systematics Collections, Lawrence, Kansas. v + 732 pp.

Garrett, J.M. and D.A. Barker. 1987. Field Guide to Reptiles and Amphibians of Texas. Texas Monthly Fieldguide Series, Gulf Publishing Company, Houston, Texas.

Garton, J.S. and R.A. Brandon. 1975. Reproductive ecology of the green treefrog, *Hyla cinerea*, in southern Illinois (Anura: Hylidae). Herpetologica 31:150–161.

Gibbons, J.W. and R.D. Semlitsch. 1991. Guide to the Reptiles and Amphibians of the Savannah River Site. University of Georgia Press, Athens, Georgia.

Goin, C.J. 1947a. Studies on the life history of Eleutherodacytlus ricordii planirostris (Cope) in Florida with special reference to the local distribution of an allelomorphic color pattern. University of Florida Studies, Biological Science Series 4, Gainesville, Florida

Goin, C.J. and O. Goin. 1957. Remarks on the behavior of the squirrel treefrog, *Hyla squirella*. Annals of the Carnegie Museum 35:27–36.

Haber, V.R. 1926. The food of the Carolina tree frog, *Hyla cinerea* Schneider. Journal of Comparative Psychology 6:214–216.

Hamilton, W.J. 1955. Notes on the ecology of the oak toad in Florida. Herpetologica 11:205–210.

Harper, F. 1932. A voice from the pines. Natural History Magazine 32:280–288.

Lazell, J.D., Jr. 1989. Wildlife of the Florida Keys: A Natural History. Island Press, Washington, D.C.

Kilby, J.D. 1945. A biological analysis of the food and feeding habits of two frogs, *Hyla cinerea cinerea* and *Rana pipiens sphenocephala*. Quarterly Journal of the Florida Academy of Science 8:71–104.

Livezey, R.L. and A.H. Wright. 1947. A synoptic key to the salientian eggs of the United States. American Midland Naturalist 37:179–222.

Lee, D.S. 1968b. Herpetofauna associated with central Florida mammals. Herpetologica 24:83–84.

Martof, B.S. 1963. Some observations on the herpetofauna of Sapelo Island, Georgia. Herpetologica 19:70–72.

Mitchell, J.C. and J.M. Anderson. 1994. Amphibians and reptiles of Assateague and Chincoteague Islands. Virginia Museum of Natural History, Special Publication, Number 2, Martinsville, Virginia.

Moore, R.H. 1976. Reproductive habits and growth of *Bufo speciosus* on Mustang Island, Texas, with notes on the ecology and reproduction of other anurans. Texas Journal of Science 17:173–178.

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Agricultural Experimental Station, Auburn University Press, Auburn, Alabama.

Mueller, A.J. 1985. Vertebrate use of nontidal wetlands on Galveston Island, Texas. Texas Journal of Science 37:215–225.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 2, 2009).

Neill, W.T. 1952. Burrowing habits of *Hyla gratiosa*. Copeia 1952:196.

Neill, W.T. 1958a. The occurrence of amphibians and reptiles in saltwater areas, and a bibliography. Bulletin of Marine Science of the Gulf and Caribbean 8:1–97.

Neill, W.T. 1958b. The varied calls of the barking treefrog, *Hyla gratiosa* LeConte. Copeia 1958:44–46.

Oliver, J.A. 1955a. The Natural History of North American Amphibians and Reptiles. D. Van Nostrand Company, Princeton, New Jersey.

Pechmann, J.H.K., D.E. Scott, J.W. Gibbons and R.D. Semlitsch. 1989. Influence of wetland hydroperiod on diversity and abundance of metamorphosing juvenile amphibians. Wetlands Ecology and Management 1:3–11.

Punzo, F. 1995. An analysis of feeding in the oak toad, *Bufo quercicus* (Holbrook) (Anura: Bufonidae). Florida Scientist 58:16–20.

Redmer, M., L.E. Brown and R.A. Brandon. 1999a. Natural history of the bird-voiced treefrog (*Hyla avivoca*) and green treefrog (*Hyla cinerea*) in southern Illinois. Bulletin of the Illinois Natural History Survey 36:37–66.

Ritchie, S.A. 1982. The green treefrog (*Hyla cinerea*) as a predator of mosquitoes in Florida. Mosquito News 42:619.

Smith, L.L., R. Franz and C.K. Dodd Jr. 1993. Additions to the herpetofauna of Edgemont Key, Hillsborough County, Florida. Florida Scientist 56:231–234.

Turnipseed, G. and R. Altig. 1975. Population density and age structure of three species of hylid tadpoles. Journal of Herpetology 9:287–291.

VanNorman, D.E. and A.F. Scott. 1987. The distribution and breeding habitat of the barking treefrog, *Hyla gratiosa* LeConte, in south-central Kentucky and north-central Tennessee. Journal of the Tennessee Academy of Science 62:7–11.

Wright, A.H. 1932. Life Histories of the Frogs of the Okefinokee Swamp, Georgia. North American Salientia (Anura) Number 2. Macmillan Press, New York.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

Notopthalmus perstriatus - Striped Newt

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Christman, S.P. and D.B. Means, contributing authors to Rare and Endangered Biota of Florida, Vol. 3, Amphibians and Reptiles, 1978

Notopthalmus viridescens - Eastern Newt

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Bellis, E.D. 1968. Summer movement of red-spotted newts in a small pond. Journal of Herpetology 1:68–91.

Bishop, S.C. 1941b. The Salamanders of New York. New York State Museum Bulletin, Number 324, Albany, New York.

Bishop, S.C. 1943. A Handbook of Salamanders. The Salamanders of the United States, of Canada, and of Lower California. Comstock Publishing Company, Ithaca, New York.

Evans, H.E. 1947. Herpetology of Crystal Lake, Sullivan County, N.Y. Herpetologica 4:19–21.

Gates, J.E. and E.L. Thompson. 1982. Small pool habitat selection by red-spotted newts in western Maryland. Journal of Herpetology 16:7–15.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 2, 2009).

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C.

Schwartz, A. and W.E. Duellman. 1952. The taxonomic status of the newts, *Diemictylus viridescens*, of peninsular Florida. Bulletin of the Chicago Academy of Sciences 9:219–227.

Williams, E.C. 1947. The terrestrial form of the newt, *Triturus viridescens*, in the Chicago region. Natural History Miscellanea, Number 5, Chicago Academy of Sciences, Chicago, Illinois.

***Plethodon grobmani* - Southeastern Slimy Salamander**

Allen, E.R. and W.T. Neill. 1949. A new subspecies of salamander (genus *Plethodon*) from Florida and Georgia. Herpetologica 5:112–114.

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Brandon, R.A. 1965b. Morphological variation and ecology of the salamander *Phaeognathus hubrichti*. Copeia 1965:67–71.

Enge, K.M. 1998. Herpetofaunal drift-fence survey of steephead ravines in the Apalachicola and Ochlockonee river drainages. Florida Game and Freshwater Fish Commission, Tallahassee, Florida.

Highton, R. 1956. The life history of the slimy salamander, *Plethodon glutinosus*, in Florida. Copeia 1956:75–93.

Highton, R. 1989. Geographic protein variation. Pp. 1–78. *In* Highton, R., G.C. Maha and L.R. Maxson (Eds.), Biochemical Evolution in the Slimy Salamanders of the *Plethodon glutinosus* Complex in the Eastern United States. Illinois Biological Monographs, Number 57, University of Illinois Press, Urbana, Illinois.

Lazell, J. 1994. Recognition characters and juxtaposition of Florida and Mississippi slimy salamanders (Plethodon glutinosus complex). Florida Scientist 57:129–140

***Pseudacris crucifer bartramiana* - Southern Spring Peeper**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Blanchard, F.N. 1928b. Amphibians and reptiles of the Douglas Lake region in northern Michigan. Copeia 166:42–51.

Conant, R. and J.T. Collins. 1991. A Field Guide to Reptiles and Amphibians: Eastern and Central North America. Third edition. Houghton Mifflin Company, Boston, Massachusetts.

McAlister, W.H. 1963. A post-breeding concentration of the spring peeper. Herpetologica 19:293.

Minton, S.A., Jr. 2001. Amphibians and Reptiles of Indiana. Second edition. Indiana Academy of Science, Indianapolis, Indiana.

Olson, R.E. 1956. The amphibians and reptiles of Winnebago County, Illinois. Copeia 1956:188–191.

Oplinger, C.S. 1967. Food habits and feeding activity of recently transformed and adult *Hyla crucifer crucifer* Weid. Herpetologica 23:209–217.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

***Pseudacris nigrita* - Southern Chorus Frog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Caldwell, J.P. 1987. Demography and life history of two species of chorus frogs (Anura: Hylidae) in South Carolina. Copeia 1987:114–127.

Carr, A. and C.J. Goin. 1959. Guide to the Reptiles, Amphibians and Fresh-water Fishes of Florida. University of Florida Press, Gainesville, Florida.

Duellman, W.E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bulletin of the Florida State Museum 3:181–324.

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Agricultural Experimental Station, Auburn University Press, Auburn, Alabama.

Martof, B.S., W.M. Palmer, J.R. Bailey and J.R. Harrison III. 1980. Amphibians and Reptiles of the Carolinas and Virginia. University of North Carolina Press, Chapel Hill, North Carolina.

Schwartz, A. 1957a. Chorus frogs (*Pseudacris nigrita* LeConte) in South Carolina. American Museum Novitates, Number 1838, American Museum of Natural History, New York.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

***Pseudacris ocularis* - Little Grass Frog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Gibbons, J.W. and R.D. Semlitsch. 1991. Guide to the Reptiles and Amphibians of the Savannah River Site. University of Georgia Press, Athens, Georgia.

Harper, F. 1939. Distribution, taxonomy, nomenclature, and habits of the little treefrog (*Hyla ocularis*). American Midland Naturalist 22:134–149.

Marshall, J.L. and C.D. Camp. 1995. Aspects of the feeding ecology of the little grass frog, *Pseudacris ocularis* (Anura: Hylidae). Brimleyana 22:1–7.

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Agricultural Experimental Station, Auburn University Press, Auburn, Alabama.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

***Pseudacris ornata* - Ornate Chorus Frog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Ashton, R.E., Jr. and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida: Part Three: The Amphibians. Windward Publishing, Miami, Florida.

Brown, L.E. and D.B. Means. 1984. Fossorial behavior and ecology of the chorus frog *Pseudacris ornata*. Amphibia-Reptilia 5:261–273.

Caldwell, J.P. 1987. Demography and life history of two species of chorus frogs (Anura: Hylidae) in South Carolina. Copeia 1987:114–127.

Carr, A.F., Jr. 1940b. Dates of frog choruses in Florida. Copeia 1940:55.

Gerhardt, H.C. 1973. Reproductive interactions between *Hyla crucifer* and *Pseudacris ornata* (Anura: Hylidae). American Midland Naturalist 89:81–88.

Harper, F. 1937. A season with Holbrook's chorus frog (*Pseudacris ornata*). American Midland Naturalist 18:260–272.

Martof, B.S., W.M. Palmer, J.R. Bailey and J.R. Harrison III. 1980. Amphibians and Reptiles of the Carolinas and Virginia. University of North Carolina Press, Chapel Hill, North Carolina.

Means, D.B. and R.C. Means. in press (2000). Effects of sand pine silviculture on pond-breeding amphibians in the Woodville Karst Plain of north Florida. Pp. xxx–xxx. *In*

Meshaka, W.E. and K.J. Babbitt (Eds.), Status and Conservation of Florida Amphibians and Reptiles. Krieger Publishing, Malabar, Florida.

Neill, W.T. 1957c. Notes on metamorphic and breeding aggregations of the eastern spadefoot, *Scaphiopus holbrookii* (Harlan). Herpetologica 13:185–187.

Wilson, L.A. 1995. Land manager's guide to the amphibians and reptiles of the South. Nature Conservancy, Southeastern Region, Chapel Hill, North Carolina.

Wigley, T.B., S.W. Sweeney and J.M. Sweeney. 1999. Final Report: Southeastern Coastal Plain amphibian survey. National Council for Air and Stream Improvement, Clemson, South Carolina.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

***Pseudobranchus axanthus* - Southern Dwarf Siren**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Duellman, W.E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bulletin of the Florida State Museum 3:181–324.

Harper, F. 1935. Records of amphibians in the southeastern states. American Midland Naturalist 16:275–310.

Freeman, J.R. 1967. Feeding behavior of the narrow-striped dwarf siren *Pseudobranchus striatus axanthus*. Herpetologica 23:313–314.

***Pseudotriton montanus* - Mud Salamander**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Brimley, C.S. 1939. Amphibians and reptiles of North Carolina. Carolina Tips, Number 2, Elon College, North Carolina

Bruce, R.C. 1975. Reproductive biology of the mud salamander, *Pseudotriton montanus*, in western South Carolina. Copeia 1975:129–137.

Dunn, E.R. 1926. Salamanders of the Family Plethodontidae. Smith College 50th Anniversary Publication. Northhampton, Massachusetts.

Fowler, J.A. 1946. The eggs of *Pseudotriton montanus montanus*. Copeia 1946:105.

Goin, C.J. 1947c. Notes on the eggs and early larvae of three Florida salamanders. Natural History Miscellanea, Number 10, Chicago Academy of Sciences, Chicago, Illinois.

***Rana capito* - Gopher Frog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Bailey, M.A. 1991. The dusky gopher frog in Alabama. Journal of the Alabama Academy of Science 62:28–34.

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Deckert, R.F. 1920. Note on the Florida gopher frog, *Rana aesopus*. Copeia 80:26.

Dickerson, M.C. 1906. The Frog Book. Doubleday, Doran, and Company, Garden City, New Jersey.

Franz, R. 1986. The Florida gopher frog and Florida pine snake as burrow associates of the gopher tortoise in northern Florida. Pp. 16–20. *In* Jackson, D.R. and R.J. Bryant (Eds.), The Gopher Tortoise and its Community. Proceedings of the Fifth Annual Meeting of the Gopher Tortoise Council, Florida State Museum, Gainesville, Florida.

Gentry, J.B. and M.H. Smith. 1968. Food habits and burrow associates of *Peromyscus polionotus*. Journal of Mammalogy 49:562–565. George Washington and Jefferson National Forests, U.S. Fish and Wildlife Service, and Blue Ridge Parkway. 1997. Habitat conservation assessment for the Peaks of Otter salamander (*Plethodon hubrichti*). George Washington and Jefferson National Forests, Unpublished planning document, Roanoke, Virginia.

Godley, J.S. 1992. Gopher frog. Pp. 15–19. *In* Moler, P.E. (Ed.), Rare and Endangered Biota of Florida, Volume 3, Amphibians and Reptiles. Second edition. University Press of Florida, Gainesville, Florida.

Jackson, D.R. and E.G. Milstrey. 1989. The fauna of gopher tortoise burrows. Pp. 86–98. *In* Diemer, J.E., D.R. Jackson, J.L. Landers, J.N. Layne and D.A. Wood (Eds.), Gopher Tortoise Relocation Symposium Proceedings. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program, Technical Report, Number 5, Tallahassee, Florida.

John B. Jensen, Nongame-Endangered Wildlife Program, Georgia Department of Natural Resources, personal observations.

Jensen, J.B. and L.V. LaClaire. 1995. Geographic distribution: *Rana capito*. Herpetological Review 26:106.

Lee, D.S. 1968b. Herpetofauna associated with central Florida mammals. Herpetologica 24:83–84.

Means, D.B. 1986b. Threatened dusky gopher frog. Pp. 30–31. *In* Mount, R.H. (Ed.), Vertebrate Animals of Alabama in Need of Special Attention. Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama.

Moler, P.E. and R. Franz. 1987. Wildlife values of small, isolated wetlands in the southeastern coastal plain. Pp. 234–241. *In* Odum, R.R., K.A. Riddleberger and J.C. Ozier (Eds.), Proceedings of the Third Annual Nongame and Endangered Wildlife Symposium, Georgia Department of Natural Resources, Atlanta, Georgia.

Nickerson, M.A. and S.F. Celino. 2003. Natural history notes: *Rana capito* (gopher frog). Drought shelter. Herpetological Review 34:137–138.

Palis, J.G. 1995a. Species stewardship summary for *Rana capito*. Pp. 77–89. *In* Jordan, R.S., K.S. Wheaton and W.M. Wheiler (Eds.), Integrated Endangered Species Management Recommendations for Army Installations in the Southeastern United States: Assessment of Army-wide Guidelines for the Red-cockaded Woodpecker on Associated Endangered, Threatened, and Candidate Species. Nature Conservancy, Southeast Regional Office, Chapel Hill, North Carolina.

Phillips, K.M. 1995. *Rana capito capito*, the Carolina gopher frog, in southeast Georgia: reproduction, early growth, adult movement patterns, and tadpole fright response. Master's thesis. Georgia Southern University, Statesboro, Georgia.

Smith, S.D. and A.L. Braswell. 1994. Preliminary investigation of acidity in ephemeral wetlands and the relationship to amphibian usage in North Carolina. Report to the Nongame and Endangered Wildlife Program, North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

Stevenson, D.J. and A.E. Davis Jr. 1995. A summary of rare herpetofaunal species surveys at Fort Stewart, Georgia. Nature Conservancy, Fort Stewart Inventory, Unpublished report, Savannah, Georgia.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

***Rana catesbeiana* - Bullfrog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Bury, R.B. and J.A. Whelan. 1984. Ecology and management of the bullfrog. U.S. Fish and Wildlife Service, Resource Publication Number 155, Washington, D.C.

George, I.D. 1940. A study of the bullfrog, *Rana catesbeiana* Shaw, at Baton Rouge, Louisiana. Ph.D. dissertation. University of Michigan, Ann Arbor, Michigan.

Holbrook, J.E. 1842. North American Herpetology, Volume 5. J. Dobson and Son, Philadelphia, Pennsylvania.

Pope, C.H. 1964a. Amphibians and Reptiles of the Chicago Area. Chicago Natural History Museum Press, Chicago, Illinois.

Schwalbe, C.R. and P.C. Rosen. 1999. Bullfrogs–the dinner guests we're sorry we invited. Sonorensis 19:8–10.

Storer, T.I. 1922. The eastern bullfrog in California. California Fish and Game 8:219–224.

Treanor, R.R. and S.J. Nichola. 1972. A preliminary report of the commercial and sporting utilization of the bullfrog, *Rana catesbeiana* Shaw in California. California Department of Fish and Game, Inland Fish Administrative Report 72-4, Sacramento, California.

***Rana clamitans* - Bronze Frog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Bohnsack, K.K. 1951. Temperature data on the terrestrial hibernation of the green frog, *Rana clamitans*. Copeia 1951:236–239.

Collins, J.T. 1993. Amphibians and reptiles in Kansas. Third edition, revised. Natural History Museum, University of Kansas, Lawrence, Kansas

Dickerson, M.C. 1906. The Frog Book. Doubleday, Doran, and Company, Garden City, New Jersey.

Forstner, J.M., M.R.J. Forstner and J.R. Dixon 1998. Ontogenetic effects on prey selection and food habits of two sympatric east Texas ranids: the southern leopard frog, *Rana sphenocephala*, and the bronze frog, *Rana clamitans clamitans*. Herpetological Review 29:208–211.

Hamilton, R. 1948. The egg-laying process in the tiger salamander. Copeia 1948:212–213.

Harding, J.H. and J.A. Holman. 1992. Michigan Frogs, Toads, and Salamanders. A Field Guide and Pocket Reference. Michigan State University Museum Press, East Lansing, Michigan

Jenssen, T.A. 1967. Food habits of the green frog, *Rana clamitans*, before and during metamorphosis. Copeia 1967:214–218.

Pope, C.H. 1947. Amphibians and Reptiles of the Chicago Area. Chicago Natural History Museum Press, Chicago, Illinois.

Stewart, M.M. and P. Sandison. 1972. Comparative food habits of sympatric mink frogs, bullfrogs, and green frogs. Journal of Herpetology 6:241–244.

Walker, C.F. 1946. The amphibians of Ohio. Part I. Frogs and toads. Ohio State Museum of Science Bulletin, Volume 1, Number 3, Columbus, Ohio.

Warkentin, K.M. 1992a. Effects of temperature and illumination on feeding rates of green frog tadpoles (*Rana clamitans*). Copeia 1992:725–730.

Warkentin, K.M. 1992b. Microhabitat use and feeding rate variation in green frog tadpoles (*Rana clamitans*). Copeia 1992:731–740.

Werner, E.E. and M.A. McPeek. 1994. Direct and indirect effects of predators on two anuran species along an environmental gradient. Ecology 75:1368–1382.

Whitaker, J.O., Jr. 1961. Habitat and food of mousetrapped young *Rana pipiens* and *Rana clamitans*. Herpetologica 17:173–179.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

***Rana grylio* - Pig Frog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Ashton, R.E., Jr. and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida: Part Three: The Amphibians. Windward Publishing, Miami, Florida.

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Delis, P.R., H.R. Mushinsky and E.D. McCoy. 1996. Decline of some west-central Florida anuran populations in response to habitat degradation. Biodiversity and Conservation 5:1579–1595.

Duellman, W.E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bulletin of the Florida State Museum 3:181–324.

Dundee, H.A. and D.A. Rossman 1989. The Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge, Louisiana.

Lamb, T. 1984. The influence of sex and breeding conditions on microhabitat selection and diet in the pig frog, *Rana grylio*. American Midland Naturalist 111:311–318.

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Agricultural Experimental Station, Auburn University Press, Auburn, Alabama.

Smith, P.W. and J.C. List. 1955. Notes on Mississippi amphibians and reptiles. American Midland Naturalist 53:115–125.

Wright, A.H. 1932. Life Histories of the Frogs of the Okefinokee Swamp, Georgia. North American Salientia (Anura) Number 2. Macmillan Press, New York.

***Rana heckscheri* - River Frog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Bartlett, R.D. and P.P. Bartlett. 1999a. A Field Guide to Florida Reptiles and Amphibians. Gulf Publishing Company, Houston, Texas.

Hill, J. 2000. *Rana hecksheri*. Animal Diversity Web, University of Michigan Museum of Zoology website at: http://animaldiversity.ummz.umich.edu/accounts/rana/r._heckscheri$narrative.html.

Martof, B.S., W.M. Palmer, J.R. Bailey and J.R. Harrison III. 1980. Amphibians and Reptiles of the Carolinas and Virginia. University of North Carolina Press, Chapel Hill, North Carolina.

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Agricultural Experimental Station, Auburn University Press, Auburn, Alabama.

Wright, A.H. 1932. Life Histories of the Frogs of the Okefinokee Swamp, Georgia. North American Salientia (Anura) Number 2. Macmillan Press, New York.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

***Rana sphenocephala* - Florida Leopard Frog**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Bartlett, R.D. and P.P. Bartlett. 1999a. A Field Guide to Florida Reptiles and Amphibians. Gulf Publishing Company, Houston, Texas.

Behler, J.L. and F.W. King. 1998. The Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, New York.

Brandt, B.B. 1936a. The frogs and toads of eastern North Carolina. Copeia 1936:215–223.

Conant, R. and J.T. Collins. 1998. A Field Guide to Amphibians and Reptiles: Eastern and Central North America. Third edition, expanded. Houghton Mifflin Company, Boston, Massachusetts.

Cope, E.D. 1886. Synonymic list of the North American species of *Bufo* and *Rana*, with description of some species of Batrachia, from specimens in the National Museum. Proceedings of the American Philosophical Society 23:514–526.

Crother, B.I., J. Boundy, J.A. Campbell, K. de Queiroz, R.F. Frost, R. Highton, J.B. Iverson, P.A. Meylan, T.W. Reeder, M.E. Seidel, J.W. Sites Jr. and T.W. Taggart. 2000. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. Herpetological Circular, Number 29, Society for the Study of Amphibians and Reptiles, St. Louis, Missouri.

Force, E.R. 1925. Notes on reptiles and amphibians of Okmulgee County, Oklahoma. Copeia 141:25–27.

Garrett, J.M. and D.A. Barker. 1987. Field Guide to Reptiles and Amphibians of Texas. Texas Monthly Fieldguide Series, Gulf Publishing Company, Houston, Texas.

Hillis, D.M. 1982. Morphological differentiation and adaptation of the larvae of *Rana berlandieri* and *Rana sphenocephala* (*Rana pipiens* complex) in sympatry. Copeia 1982:168–174.

Hoffman, R.L. 1990. *Rana utricularia* (southern leopard frog): VA: Pittsylvania Co. VA. Hy 880, ca.0.4 km S of int. with VA 863 at Berry Hill. Catesbeiana 10:44–45.

Johnson, T.R. 1992. The Amphibians and Reptiles of Missouri. Missouri Department of Conservation, Jefferson City, Missouri.

Wright, A.H. 1932. Life Histories of the Frogs of the Okefinokee Swamp, Georgia. North American Salientia (Anura) Number 2. Macmillan Press, New York.

Wright, A.H. and A.A. Wright. 1949. Handbook of Frogs and Toads of the United States and Canada. Third edition. Comstock Publishing Associates, Ithaca, New York.

***Scaphiopus holbrookii* - Spadefoot Toad**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Ashton, R.E., Jr. and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida: Part Three: The Amphibians. Windward Publishing, Miami, Florida.

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Driver, E.C. 1936. Observations on *Scaphiopus holbrookii* (Harlan). Copeia 1936:69.

Gibbons, J.W. and R.D. Semlitsch. 1991. Guide to the Reptiles and Amphibians of the Savannah River Site. University of Georgia Press, Athens, Georgia.

Dundee, H.A. and D.A. Rossman 1989. The Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge, Louisiana.

Jamieson, D.H. and S.E. Trauth. 1996. Dietary diversity and overlap between two subspecies of spadefoot toads (*Scaphiopus holbrookii holbrookii* and *S. h. hurterii*) in Arkansas. Proceedings of the Arkansas Academy of Science 50:75–78.

Minton, S.A., Jr. 1972. Amphibians and Reptiles of Indiana. Monograph Number 3, Indiana Academy of Science, Indianapolis, Indiana.

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Agricultural Experimental Station, Auburn University Press, Auburn, Alabama.

Pearson, P.G. 1955. Population ecology of the spadefoot toad, *Scaphiopus h. holbrooki* (Harlan). Ecological Monographs 25:233–267.

Punzo, F. 1992a. Dietary overlap and activity patterns in sympatric populations of *Scaphiopus holbrooki* (Pelobatidae) and *Bufo terrestris* (Bufonidae). Florida Scientist 55:38–44.

Richmond, N.D. 1947. Life history of *Scaphiopus holbrookii* (Harlan). Part I: larval development and behavior. Ecology 28:53–66.

Smith, P.W. 1961. The amphibians and reptiles of Illinois. Bulletin of the Illinois Natural History Survey, Number 28, Urbana, Illinois.

Stone, W. 1932. Terrestrial activity of spade-foot toads. Copeia 1932:35–36.

***Siren intermedia intermedia* - Eastern Lesser Siren**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Cagle, F.R. 1942. Herpetological fauna of Jackson and Union Counties, Illinois. American Midland Naturalist 28:164–200.

Carr, A.F., Jr. 1940a. A Contribution to the Herpetology of Florida. University of Florida Biological Publications Science Series, Volume 3, Number 1, University of Florida Press, Gainesville, Florida.

Fauth, J.E. 1999a. Interactions between branchiate mole salamanders (*Ambystoma talpoideum*) and lesser sirens (*Siren intermedia*): asymmetrical competition and intraguild predation. Amphibia-Reptilia 20:119–132.

Fauth, J.E., W.J. Resetarits Jr. and H.M. Wilbur. 1990. Interactions between larval salamanders: a case of competitive equality. Oikos 58:91–99.

Fauth, J.E. and W.J. Resetarits Jr. 1991. Interactions between the salamander *Siren intermedia* and the keystone predator *Notophthalmus viridescens.* Ecology 72:827–838.

Funderburg, J.B. and D.S. Lee. 1967. Distribution of the lesser siren, *Siren intermedia* in central Florida. Herpetologica 23:65.

Gehlbach, F.R. and S.E. Kennedy. 1978. Population ecology of a highly productive aquatic salamander *Siren intermedia*. Southwestern Naturalist 23:423–430.

Harding, J.H. 1997. Amphibians and Reptiles of the Great Lakes Region. University of Michigan Press, Ann Arbor, Michigan.

Hurter, J., Sr. 1911. Herpetology of Missouri. Transactions of the Academy of Science of St. Louis 20:59–274.

Minton, S.A., Jr. 1972. Amphibians and Reptiles of Indiana. Monograph Number 3, Indiana Academy of Science, Indianapolis, Indiana.

Minton, S.A., Jr. 2001. Amphibians and Reptiles of Indiana. Second edition. Indiana Academy of Science, Indianapolis, Indiana.

Neill, W.T. 1949b. Juveniles of *Siren lacertina* and *S. i. intermedia*. Herpetologica 5:19–20.

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C.

Scroggin, J.B. and W.B. Davis. 1956. Food habits of the Texas dwarf siren. Herpetologica 12:231–237.

Smith, P.W. and S.A. Minton Jr. 1957. A distributional summary of the herpetofauna of Indiana and Illinois. American Midland Naturalist 58:341–351.

Viosca, P., Jr. 1924b. A terrestrial form of *Siren lacertina*. Copeia 136:102–104.

***Siren lacertina* - Greater Siren**

AmphibiaWeb Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: (Accessed: Jul 17, 2009).

Duellman, W.E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bulletin of the Florida State Museum 3:181–324.

Dunn, E.R. 1924. Siren, a herbivorous salamander? Science 59:145.

Funderburg, J.B. and D.S. Lee. 1967. Distribution of the lesser siren, *Siren intermedia* in central Florida. Herpetologica 23:65.

Hanlin, H.G. 1978. Food habits of the greater siren, *Siren lacertina*, in an Alabama coastal plain pond. Copeia 1978:358–360.

Jobson, H.G.M. 1940. Reptiles and amphibians from Georgetown County, South Carolina. Herpetologica 2:39–43.

Moler, P.E. 1994. Natural history notes: *Siren lacertina* (greater siren). Diet. Herpetological Review 25:62.

Neill, W.T. 1949b. Juveniles of *Siren lacertina* and *S. i. intermedia*. Herpetologica 5:19–20.

Ultsch, G.R. 1973. Observations on the life history of *Siren lacertina*. Herpetologica 29:304–305.

Reptile References

*Agkistrodon piscivorus conanti* - Florida Cottonmouth

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Huegal, C. N., and D. G. Cook. Florida's Venomous Snakes. Florida Fish and Wildlife Conservation Commission. http://myfwc.com/docs/WildlifeHabitats/Guide_to_venomous_snakes_in_FL.pdf

King, F.W. and K.L. Krysko. 1999. Amphibians and Reptiles of Fort Matanzas National Monument. http://flmnh.ufl.edu/natsci/herpetology/FOMA/fomaherps.htm

*Alligator mississippiensis* - American Alligator

Britton, A. 1999. "Alligator mississippiensis in the Crocodilians, Natural History and Conservation" (On-line). Accessed 31 March 2000 at http://www.flmnh.ufl.edu/cnhc/csp_amis.htm.

Delany, Michael F. and C.L. Abercrombe. 1986. American Alligator Food Habits in Northcentral Florida. Journal of Wildlife Management, v.50 no.2, p.348-353 [GA-R]

Goodwin, T. M., and W. R. Marion. 1978. Aspects of the nesting ecology of American alligators (*Alligator Mississippiensis*) in north-central Florida. Herpetologica 34:43-47.

Levy, C. 1991. *Crocodiles and Alligators.*. London: The Apple Press.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009)

Pajerski, L., B. Schechter and R. Street. 2000. "*Alligator mississippiensis*" (On-line), Animal Diversity Web. Accessed July 16, 2009 at http://animaldiversity.ummz.umich.edu/site/accounts/information/Alligator_mississippiensis.html

*Apalone ferox* - Florida Softshell Turtle

Ernst, C. H., and R. W. Barbour. 1972. Turtles of the United States. Univ. Press of Kentucky, Lexington. x + 347 pp.

Heinrich, G., and D. E. Richardson. 1993. *Apalone ferox* (Florida softshell). Reproduction. Herpetol. Rev. 24: 31.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009)

***Cemophora coccinea* - Scarlet Snake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Carr, Archie Fairly .1978. A contribution to the herpetology of Florida / by Archie Fairly Carr, Jr. University of Florida. Gainesville. 118 p

Minton, S. A., Jr. 1972. Amphibians and reptiles of Indiana. Indiana Academy Science Monographs 3. v + 346 pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009)

Tennant, A. 1984. The Snakes of Texas. Texas Monthly Press, Austin, Texas. 561 pp.

Tennant, A. 1997. A field guide to snakes of Florida. Gulf Publishing Company, Houston, Texas. xiii + 257 pp.

Werler, J. E., and J. R. Dixon. 2000. Texas snakes: identification, distribution, and natural history. University of Texas Press, Austin. xv + 437 pp.

***Chelydra serpentine osceola* - Florida Snapping Turtle**

Bartlett, R.D., and P. Bartlett. 1999. *A Field Guide to Florida Reptiles and Amphibians*. Gulf Publishing Company, Houston, Texas.

Brown, G. P., and R. J. Brooks. 1994. Characteristics of and fidelity to hibernacula in a northern population of snapping turtles, *Chelydra Serpentina*. Copeia 1994:222-226.

Congdon, J. D., et al. 1987. Reproduction and nesting ecology of snapping turtles (*Chelydra Serpentina*) in southeastern Michigan. Herpetologica 43:39-54.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009)

***Clemmys guttata* - Spotted Turtle**

Ernst, C. H. 1970. Reproduction in *Clemmys Guttata*. Herpetologia 26:228-32.

Ernst, C.H. 1976. Ecology of the Spotted Turtle, *Clemmys guttata* (Reptilia, Testudines, Testudinidae), in southeastern Pennsylvania. Journal of Herpetology 10:25-33.

Harding, J. H., and J. A. Holman. 1990. Michigan Turtles and Lizards, A Field Guide and Pocket Reference. Michigan State University Museum.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009)

Netting, M. G. 1936. Hibernation and migration of the spotted turtle, CLEMMYS GUTTATA (Schneider). Copeia 1936:112.

Tyning, T. F. 1990. A guide to amphibians and reptiles. Strokes Nature Guides. Little, Brown and Company, Boston, Massachusetts.

***Deirochelys reticularia* - Chicken Turtle**

Bartlett, R.D., and P. Bartlett. 1999. *A Field Guide to Florida Reptiles and Amphibians*. Gulf Publishing Company, Houston, Texas.

Buhlmann, K. A. 1995. Habitat use, terrestrial movements, and conservation of the turtle, DEIROCHELYS RETICULARIA in Virginia. Journal of Herpetology 29:173-181.

Buhlmann Kurt A., Justin D. Congdon, J.Whitfield Gibbons, and Judith L. Greene. 2009. Ecology of Chicken Turtles (*Deirochelys Reticularia*) in a Seasonal Wetland Ecosystem: Exploiting Resource and Refuge Environments. Herpetologica, 65(1), 2009, 39–53

Demuth, Jeffery P. and Kurt A. Buhlmann. 1997. Diet of the Turtle Deirochelys reticularia on the Savannah River Site, South Carolina. Journal of Herpetology, Vol. 31, No. 3 (Sep., 1997), pp. 450-453

Jackson, D. R. 1996. Meat on the move: diet of a predatory turtle, DEIROCHELYS RETICULARIA (Testudines: Emydidae). Chelonian Conservation and Biology 2(1):105-108.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009)

Rageot, R. 1968. The occurrence of the eastern chicken turtle in southeastern Virginia. Virginia Herpetol. Soc. Bull. 57:12.

Diadophis punctatus punctatus - Southern Ringneck Snake

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Fitch, H. S. 1975. A demographic study of the ringneck snake (*Diadophis punctatus*) in Kansas . *University of Kansas Museum of Natural History Miscellaneous Publications* 62:1-53

King, F.W. and K.L. Krysko. 1999. Amphibians and Reptiles of Fort Matanzas National Monument. http://flmnh.ufl.edu/natsci/herpetology/FOMA/fomaherps.htm

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009)

Vigil, S. and J.D. Willson. Snakes of Georgia and South Carolina: Ringneck Snake. http://www.uga.edu/srelherp/snakes/diapun.htm

Willson, J. D., and M. E. Dorcas. 2004. Aspects of the ecology of small fossorial snakes in the western Piedmont of North Carolina. *Southeastern Naturalist* 3:1-12.

Drymarchon corais couperi - Eastern Indigo Snake

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Babis, W.A. 1949. Notes on the food of the indigo snake. Copeia 1949 (2):147.

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Dirk J., Karen J. Dyer, and Beth A. Willis-Stevenson. 2003. Survey and Monitoring of the Eastern Indigo Snake in Georgia . Southeastern Naturalist 2(3):393-408.

Ernst, C. H., and E. M. Ernst. 2003. Snakes of the United States and Canada. Smithsonian Books, Washington, D.C.

Grosse, A.M. and J.D. Willson. Snakes of Georgia and South Carolina: Indigo Snake. http://www.uga.edu/srelherp/snakes/drycor.htm.

Keegan, H.L. 1944. Indigo snakes feeding upon poisonous snakes. Copeia 1944 (1):59.

Kochman, H.I. 1978. Eastern indigo snake. *Drymarchon corais couperi*. Pages 68-69 *in* R.W. McDiarmid, ed. Rare and endangered biota of Florida. University Presses of Florida; Gainesville, Florida.

Lawler, H.E. 1977. The status of *Drymarchon corais couperi* (Holbrook), the eastern indigo snake, in the southeastern U.S.A. Herpetological Review 8(3):76-79.

Layne, J.N., and T.M. Steiner. 1996. Eastern indigo snake (*Drymarchon corais couperi*): summary of research conducted on Archbold Biological Station. Report prepared under Order 43910-6-0134 to the U.S. Fish and Wildlife Service; Jackson, Mississippi.

Matthews, J.R. and C.J. Moseley (eds.). 1990. The Official World Wildlife Fund Guide to Endangered Species of North America. Volume 1. Plants, Mammals. xxiii + pp 1-560 + 33 pp. appendix + 6 pp. glossary + 16 pp. index. Volume 2. Birds, Reptiles, Amphibians, Fishes, Mussels, Crustaceans, Snails, Insects, and Arachnids. xiii + pp. 561-1180. Beacham Publications, Inc., Washington, D.C.

Moler, P.E. 1985. Home range and seasonal activity of the eastern indigo snake, *Drymarchon corais couperi*, in northern Florida. Final performance report, Study E-1-06, III-A-5. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Moler, P. E. 1992. Eastern indigo snake *Drymarchon Corais Couperi* (Holbrook). Pages 181-186 in P. E. Moler, editor. Rare and endangered biota of Florida. Vol. III. Amphibians and reptiles. Univ. Press of Florida.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009)

Steiner, T.M., O.L. Bass, Jr., and J.A. Kushlan. 1983. Status of the eastern indigo snake in southern Florida National Parks and vicinity. South Florida Research Center

Tennant, A. 1997. A field guide to snakes of Florida. Gulf Publishing Company, Houston, Texas. xiii + 257 pp.

USFWS. 1999. South Florida Multi-Species Recovery Plan. Vero Beach Field Office

***Farancia abacura abacura* - Eastern Mud Snake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Neill, W.T. 1964. Taxonomy, Natural History, and Zoogeography of the Rainbow Snake, Farancia erytrogramma (Palisot Beauvois). The American Midland Naturalist. 71:257-295

Seigel, R. A., J. W. Gibbons, and T. K. Lynch. 1995. Temporal changes in reptile populations: Effects of a severe drought on aquatic snakes . Herpetologica, 51:424-434.

Semlitsch, R. D., J. H. K. Pechmann, and J. W. Gibbons. 1988. Annual emergence of juvenile mud snakes (*Farancia abacura*) at aquatic habitats. Copeia 243-245.

Willson, J.D. Snakes of Georgia and South Carolina: Mud Snake. http://www.uga.edu/srelherp/snakes/faraba.htm

Willson, J. D., C. T. Winne, M. E. Dorcas, and J. W. Gibbons. 2006. Post-drought responses of semi-aquatic snakes inhabiting an isolated wetland: Insights on different strategies for persistence in a dynamic habitat. Wetlands 26:1071-1078.

Willson, J. D., C. T. Winne, and L. A. Fedewa. 2005. Unveiling escape and capture rates of aquatic snakes and salamanders (*Siren* spp. and *Amphiuma means*) in commercial funnel traps. Journal of Freshwater Ecology 20:397-403.

***Farancia erytrogramma erytrogramma* - Rainbow Snake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Neill, W.T. 1964. Taxonomy, Natural History, and Zoogeography of the Rainbow Snake, Farancia erytrogramma (Palisot Beauvois). The American Midland Naturalist. 71:257-295

***Kinosternon baurii*- Striped Mud Turtle**

Bartlett, R.D., and P. Bartlett. 1999. *A Field Guide to Florida Reptiles and Amphibians*. Gulf Publishing Company, Houston, Texas.

Einem, G. E. 1956. Certain aspects of the natural history of the mud turtle, *Kinosternon Baurii*. Copeia 1956:186-188.

Lamb, T. and J. Lovich. 1990. Morphometric validation of the striped mud turtle (*Kinosternon baurii*) in the Carolinas and Virginia. Copeia 1990(3):613-618.

Mushinsky, H. R., and D. S. Wilson. 1992. Seasonal occurrence of *Kinosternon Baurii* on a sandhill in central Florida. J. Herpetol. 26:207-209.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 19, 2009).

Wilson, D. S. 1998. Nesting ecology of the striped mud turtle (*Kinosternon Baurii*) in central Florida. Chelonian Conservation and Biology 3:142-143.

Wygoda, M.L. 1979. Terrestrial activity of striped mud turtles, *Kinosternon baurii* (Reptilia, Testudines, Kinosternidae) in west-central Florida. Journal of Herpetology 13:469-480

***Kinosternon subrubrum subrubrum* - Eastern Mud Turtle**

Bartlett, R.D., and P. Bartlett. 1999. *A Field Guide to Florida Reptiles and Amphibians*. Gulf Publishing Company, Houston, Texas.

Farzer, J., J. Whitfield Gibbons and J.L. Greene. 1991. Life History and Demography of the Common Mud Turtle Kinosternon Subrubrum in South Carolina. Ecology, Vol. 72, No. 6, pp. 2218-2231.

Gibbons, J. W. 1983. Reproductive Characteristics and Ecology of the Mud Turtle, Kinosternon subrubrum (Lacepede). Herpetologica, Vol. 39, No. 3, pp. 254-271.

Mount, R.H. 1975. The reptiles and amphibians of Alabama. Auburn Univ. Agr. Exp. Sta. Auburn, Alabama, USA.

Muhmoud, I.Y. 1968. Feeding behavior in kinosternid turtles. Herpetologica 24:300-305

***Malaclemys terrapin* – Diamondback Terrapin**

Burger, J. 1976. Behavior of Hatchling Diamondback Terrapins (Malaclemys terrapin) in the Field. Copeia, Vol. 1976, No. 4, pp. 742-748.

Seigel, R.A. 1980. Nesting Habits of Diamondback Terrapins (Malaclemys terrapin) on the Atlantic Coast of Florida. Transactions of the Kansas Academy of Science (1903-), Vol. 83, No. 4 (1980), pp. 239- 246.

Tucker, A.D., N.N. FitzSimmons, J.W. Gibbons. 1995. Resource Partitioning by the Estuarine Turtle Malaclemys terrapin: Trophic, Spatial, and Temporal Foraging Constraints. Herpetologica, Vol. 51, No. 2, pp. 167-181.

***Nerodia floridana* - Florida Green Watersnake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Bloom, B. Snakes of Georgia and South Carolina: Florida Green Watersnake. http://www.uga.edu/srelherp/snakes/nerflo.htm

Gibbons, J. Whitfield, and Michael E. Dorcas. 2004. *North American watersnakes: a natural history*. Animal natural history series, v. 8. Norman: University of Oklahoma.

Seigel, R.A., J.W. Gibbons,and T.K. Lynch. 1995. Temporal changes in reptile populations: Effects of a severe drought on aquatic snakes . Herpetologica 51:424-434
Willson, J. D., C. T. Winne, M. E. Dorcas, and J. W. Gibbons. 2006. Post-drought responses of semi-aquatic snakes inhabiting an isolated wetland: Insights on different strategies for persistence in a dynamic habitat. Wetlands 26:1071-1078.

***Nerodia taxisilota* – Brown Watersnake**

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Mills, M.S. C.J. Hudson, and H.J. Berna. 1995. Spatial Ecology and Movements of the Brown Watersnake (Nerodia taxispilota). Herpetologica. 51(4): 412-423.

Vigil, S. and J.D. Willson. Snakes of Georgia and South Carolina: Brown Watersnake. http://www.uga.edu/srelherp/snakes/nertax.htm.

<u>*Opheodrys aestivus* - Rough Green Snake</u>

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Goldsmith, S. K. 1984. Aspects of the Natural History of the Rough Green Snake. Opheodrys Aestivius (Colubridae). The Southwestern Naturalist. 29(4): 445-452.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 19, 2009).

Plummer, M. V. 1997. Population ecology of green snakes (*Opheodrys aestivus*) revisited. Herpetological Monographs 11:102-123.

Willson, J.D. Snakes of Georgia and South Carolina: Rough Green Snake. http://www.uga.edu/srelherp/snakes/ophaes.htm

<u>*Pseudemys floridana peninsularis* – Peninsula Cooter</u>

Bartlett, R.D., and P. Bartlett. 1999. *A Field Guide to Florida Reptiles and Amphibians*. Gulf Publishing Company, Houston, Texas.

Corkscrew Swamp Sanctuary's Common Turtles http://www.corkscrew.audubon.org/Wildlife/Turtles.html

Hubbs, C. 1995. Springs and spring runs as unique aquatic systems. *Copeia*. 1995(4): 989-991.

<u>*Pseudemys nelsoni* – Florida Red-bellied Turtle</u>

Bartlett, R.D., and P. Bartlett. 1999. *A Field Guide to Florida Reptiles and Amphibians*. Gulf Publishing Company, Houston, Texas.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 19, 2009).

Regina alleni - Striped Crayfish Snake

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Godley, J.S. 1980. Foraging Ecology of the Striped Swamp Snake, Regina alleni, in Southern Florida. Ecological Monographs. 50(4): 411-436.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 19, 2009).

Slone, J. Snakes of Georgia and South Carolina: Striped Crayfish Snake. http://www.uga.edu/srelherp/snakes/regall.htm

Regina rigida - Glossy Crayfish Snake

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J. L., and F. W. King. 1979. The Audubon Society field guide to North American reptiles and amphibians. Alfred A. Knopf, New York. 719 pp.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Ernst, C. H., and E. M. Ernst. 2003. Snakes of the United States and Canada. Smithsonian Books, Washington, D.C.

Gibbons, J. Whitfield, and Michael E. Dorcas. 2004. North American Watersnakes: A Natural History. University of Oklahoma Press.

Huheey, J.E. and W.M. Palmer. 1962. The Eastern Glossy Water Snake, Regina Rigida Rigida, in North Carolina. Herpetologica. 18(2): 140-141.

Mount, R. H. 1975. The reptiles and amphibians of Alabama. Auburn University Agricultural Experiment Station, Auburn, Alabama. vii + 347 pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 19, 2009).

Willson, J.D. Snakes of Georgia and South Carolina: Glossy Crayfish Snake. http://www.uga.edu/srelherp/snakes/regrig.htm

Willson, J. D., C. T. Winne, and L. A. Fedewa. 2005. Unveiling escape and capture rates of aquatic snakes and salamanders (*Siren* spp. and *Amphiuma means*) in commercial funnel traps. Journal of Freshwater Ecology 20:397-403

Seminatrix pygaea pygaea **- North Florida Swamp Snake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Dodd, C. K., Jr. 1993. Population structure, body mass, activity, and orientation of an aquatic snake (*Seminatrix pygaea*) during a drought. Canadian Journal of Zoology 71:1281-1288.

Godley, J. S. 1980. Foraging ecology of the striped swamp snake, *Regina alleni* , in Southern Florida . Ecological Monographs 50:411-436.

Hopkins, W.A., C.T. Winne & S.E. DuRant. 2005. Differential swimming performance of two Natricine snakes exposed to a cholinesterase-inhibiting pesticide. Environmental Pollution 133:531-540.

Hopkins, W.A. & C.T. Winne . 2006. Influence of body size on swimming performance of four species of neonatal natricine snakes acutely exposed to a cholinesterase-inhibiting pesticide. Environmental Toxicology and Chemistry 25:1208-1213.

Seigel, R. A., J. W. Gibbons, and T. K. Lynch. 1995. Temporal changes in reptile populations: effects of a severe drought on aquatic snakes. Herpetologica 51:424-434.

Seigel, R. A., R. K. Loraine, and J. W. Gibbons. 1995. Reproductive cycles and temporal variation in fecundity in the black swamp snake, *Seminatrix pygaea* . American Midland Naturalist 134:371-377.

Willson, J.D. Snakes of Georgia and South Carolina: Black Swamp Snake. http://www.uga.edu/srelherp/snakes/sempyg.htm

Willson, J.D., C.T. Winne , M.E. Dorcas & J.W. Gibbons. 2006. Post-drought responses of semi-aquatic snakes inhabiting an isolated wetland: Insights on different strategies for persisting in a dynamic habitat. Wetlands 26:1071-1078.

Willson, J.D., C.T. Winne & L.A. Fedewa. 2005. Unveiling escape and capture rates in aquatic snakes and salamanders (*Siren* spp. and *Amphiuma means*) in commercial funnel traps. Journal of Freshwater Ecology 20:397-403.

Winne, C.T. & W.A. Hopkins. 2006. Influence of sex and reproductive condition on terrestrial and aquatic locomotor performance in the semi-aquatic snake *Seminatrix pygaea*. Functional Ecology 20:1054-1061.

Winne, C.T. , J.D. Willson & J.W. Gibbons. 2006. Income breeding allows an aquatic snake (*Seminatrix pygaea*) to reproduce normally following prolonged drought-induced aestivation. Journal of Animal Ecology 75: 1352–1360.

Winne, C.T. 2005. Increases in capture rates of an aquatic snake (*Seminatrix pygaea*) using naturally baited minnow traps: evidence for aquatic funnel trapping as a measure of foraging activity. Herpetological Review 36:411–413.

Winne, C.T. , M.D. Dorcas & S.M. Poppy. 2005. Population structure, body size, and seasonal activity of Black Swamp Snakes (*Seminatrix pygaea*). Southeastern Naturalist 4:1-14. Cover Photo.

Winne, C.T. , T.J. Ryan, Y. Leiden & M.E. Dorcas. 2001. A comparison of evaporative water loss in two natricine snakes: *Nerodia fasciata* and *Seminatrix pygaea*. Journal of Herpetology 35:129-133.

***Sistrurus miliarius barbouri* - Dusky Pygmy Rattlesnake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

King, F. W., and K. Wray. 1996. Florida Museum of Natural History's Guide to Venomous Snakes. www.flmnh.ufl.edu/herpetology/FL-GUIDE/Venomsnk.htm

May, P. G., T. M. Farrell, S. T. Heulett, M. A. Pilgrim, L. A. Bishop, D. J. Spence, A. M. Rabatsky, M. G. Campbell, A. D. Aycrigg, and W. E. Richardson. 1996. The seasonal abundance and activity of a rattlesnake (*Sistrurus miliarius barbouri*) in central Florida . Copeia 1996:389-401.

Meadows, A. and J.D. Willson. Snakes of Georgia and South Carolina: Pygmy Rattlesnake. http://www.uga.edu/srelherp/snakes/sismil.htm

Roth, E. D., P. G. May, and T. M. Farrell. 1999. Pigmy rattlesnakes use frog-derived chemical cues to select foraging sites. Copeia 1999:772-774.

***Sternotherus minor minor* – Loggerhead Musk Turtle**

Ashton, R. E., Jr., and P. S. Ashton. 1985. Handbook of reptiles and amphibians of Florida. Part two. Lizards, turtles & crocodilians. Windward Pub., Inc., Miami. 191 pp.

Carr, A. 1952. *The turtles of the United States, Canada, and Baja California.* Cornell University Press, Ithaca, NY, USA

Ernst, C. H., and R. W. Barbour. 1972. Turtles of the United States. Univ. Press of Kentucky, Lexington. x + 347 pp.

Ernst, C. H., R. W. Barbour, and J. E. Lovich. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington, D.C. xxxviii + 578 pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 20, 2009).

Tinkle, D.W. 1958. The systematics and ecology of the *Sternotherus carinatus* complex (Testudinata: Chelydridae). Tulane Stud. Zool. 6:3-36

***Sternotherus odoratus*- Common Musk Turtle**

Ernst, C. H., and R. W. Barbour. 1989. Turtles of the world. Smithsonian Institution Press, Washington, D.C. xii + 313 pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 20, 2009).

***Storeria dekayi victa* - Florida Brown Snake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Florida Museum of Natural History. Florida Brown Snake, Dekay's Brown Snake. http://www.flmnh.ufl.edu/herpetology/FL-GUIDE/Storeriadvicta.htm. Date accessed; July 20, 2009.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 20, 2009).

Thomas, G. and J.D. Willson. Snakes of Georgia and South Carolina: Brown Snake. http://www.uga.edu/srelherp/snakes/stodek.htm

Willson, J. D. and M. E. Dorcas. 2004. Aspects of the ecology of small fossorial snakes in the western Piedmont of North Carolina. Southeastern Naturalist 3:1-12.

***Storeria occipitomaculata obscura* - Florida Red-bellied Snake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Florida Museum of Natural History. Florida Redbelly Snake. http://www.flmnh.ufl.edu/herpetology/FL-GUIDE/Storeriaoobscura.htm. Date accessed; July 20, 2009.

Harding, J. 1997. *Amphibians and Reptiles of the Great Lakes Region*. Ann Arbor, Michigan: University of Michigan Press.

Overduijin, Kelly. Snakes of Georgia and South Carolina: Florida Redbellied Snake. http://www.uga.edu/srelherp/snakes/stocc.htm

Semlitsch, R.D. and G.B. Moran. 1984. Ecology of the Redbelly Snake (*Storeria occipitomaculata*) Using Mesic Habitats in South Carolina. American Midland Naturalist. 111(1): 33-40.

Willson, J. D. and M. E. Dorcas. 2004. Aspects of the ecology of small fossorial snakes in the western Piedmont of North Carolina. Southeastern Naturalist 3:1-12.

***Thamnophis sauritus sackenii* - Peninsula Ribbon Snake**

Ashton Jr, R.E., and P.S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida. Windward Publishing, Inc., Miami, Florida, USA

Baker, C. and J.D. Willson. Snakes of Georgia and South Carolina: Eastern Ribbon Snake. http://www.uga.edu/srelherp/snakes/thasau.htm

Bartlett, R.D., and P. Bartlett. 2003. Florida's Snakes: A Guide to Their Identification and Habits. University Press of Florida, Gainesville, Florida, USA.

Behler, J.L., and F. W. King. 2008. National Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York, New York, USA

Carpenter C.C. 1952. Comparative Ecology of the Common Garter Snake (*Thamnophis s. sirtalis*), the Ribbon Snake (*Thamnophis s. sauritus*), and Butler 's Garter Snake (*Thamnophis butleri*) in mixed populations. Ecological Monographs. 22:235-258.

King, F.W. and K.L. Krysko. 1999. Amphibians and Reptiles of Fort Matanzas National Monument. http://flmnh.ufl.edu/natsci/herpetology/FOMA/fomaherps.htm

Bird References

***Agelaius phoeniceus* - Red-winged Blackbird**

Orians, G. H. 1961. The ecology of blackbird (*Agelaius*) social systems. Ecol. Monogr. 31:285-312.

Robertson, R. J. 1972. Optimal niche space of the Red-winged Blackbird (*Agelaius phoeniceus*). I. Nesting success in marsh and upland habitat. Can. J. Zool. 50:247-263

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Yasukawa, Ken and William A. Searcy. 1995. Red-winged Blackbird (*Agelaius phoeniceus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/184

***Aix sponsa* - Wood Duck**

Bellrose, F. C. 1955. Housing for Wood Ducks. III. Nat. Hist. Surv. Circ. 45.

Bellrose, F. C. 1976b. Ducks, geese and swans of North America. Stackpole Books, Harrisburg, PA.

Bellrose, F. C. and D. J. Holm. 1994. Ecology and management of the Wood Duck. Stackpole Books, Harrisburg, PA.

Gilmer, D. S., I. J. Ball, L. M. Cowardin, J. E. Mathisen, and J. H. Riechmann. 1978. Natural cavities used by Wood Ducks in north-central Minnesota. J. Wildl. Manage. 42:288-298.

Hepp, Gary R. and Frank C. Bellrose. 1995. Wood Duck (*Aix sponsa*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/169

Hepp, G. R. and J. D. Hair. 1977. Wood Duck brood mobility and utilization of beaver pond habitats. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 31:216-225.

Hocutt, G. E. and R. W. Dimmick. 1971. Summer food habits of juvenile Wood Ducks in east Tennessee. J. Wildl. Manage. 35:286-292.

McGilvrey, F. B. 1968. A guide to Wood Duck production habitat requirements. Resour. Publ. 60. Bur. Sport Fish. Wildl. Washington, D.C.

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Soulliere, G. J. 1990a. Regional and site-specific trends in Wood Duck use of nest boxes. Pages 235-244 *in* Proc. 1988 N. Am. Wood Duck symp. (Frederickson, L. H., G. V. Burger, S. P. Havera, D. A. Graber, R. E. Kirby, and T. S. Taylor, Eds.)

Tolle, D. A. 1973. Fall movements of Wood Ducks in northeastern Ohio. Master's Thesis. Ohio State Univ. Columbus.

***Anas fulvigula* - Mottled Duck**

Breininger, D. R. and R. B. Smith. 1990. Waterbird use of coastal impoundments and management implications in east-central Florida. Wetlands 10:223-241.

Fogarty, M. J. and D. E. LaHart. 1971. Florida Duck movements. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 25:191-202.

Gray, P. N. 1993. Biology of the southern Mallard, Florida's Mottled Duck. Phd Thesis. Univ. Fla. Gainesville.

Johnson, F. A., F. Montalbano III, J. D. Truitt, and D. R. Eggeman. 1991. Distribution, abundance, and habitat use by Mottled Ducks in Florida. J. Wildl. Manage. 55:476-482.

Johnson, T. W. 1973. The wing molt of the Florida Duck. Condor 85:77-78.

Lahart, D. E. and G. W. Cornwell. 1969. Habitat preference and survival of Florida Duck broods. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 23:117-121.

Lotter, C. F. 1969. Habitat requirements and procedures for measuring various population parameters of the Florida Duck, *Anas platyrhynchos fulvigula* Ridgway. Master's Thesis. Univ. Fla., Gainesville.

Montalbano III, F. 1980. Summer use of two central Florida phosphate settling ponds by Florida Ducks. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 34:584-590.

Moorman, T. E. and P. N. Gray. 1994. Mottled Duck (*Anas fulvigula*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/081

Stieglitz, W. O. and C. T. Wilson. 1968. Breeding biology of the Florida Duck. J. Wildl. Manage. 32:921-934.

Thomas, C. 1982. Wintering ecology of dabbling ducks in central Florida. Master's Thesis. Univ. Missouri, Columbia.

White, D. H. and D. James. 1978. Differential use of freshwater environments by wintering waterfowl of coastal Texas. Wilson Bull. 90:99-111.

Anhinga anhinga - Anhinga

Bent, A. C. 1922. Life histories of North American petrels and pelicans and their allies. U.S. Natl. Mus. Bull. 121.

Del Hoyo, J., A. Elliott and J. Sargatal. 1992. Handbook of the birds of the world. Vol. 1. Lynx Edicions, Barcelona.

Owre, O. T. 1975. Notes on the food of some Guyana birds. Ardea 63: 146–147.

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Aramus guarauna - Limpkin

Bryan, Dana C. 2002. Limpkin (*Aramus guarauna*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/627

Robertson, W. B. and G. E. Woolfenden. 1992. Florida bird species: an annotated list. Fla. Ornithol. Soc. Spec. Publ. 6, Gainesville.

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Ardea alba **- Great Egret**

Bancroft, G. T., S. D. Jewell and A. M. Strong. 1990. Foraging and nesting ecology of herons in the lower Everglades relative to water conditions. Final rep. to South Florida Water Manage. District, West Palm Beach.

Baynard, O. E. 1912. Food of herons and ibises. Wilson Bull. 24: 167–169.

Hoffman, R. D. 1978. The diets of herons and egrets in southwestern Lake Erie. Pp. 365–369 *in*Wading birds (A. Sprunt, IV, J. C. Ogden, and S. Winckler, eds.). Res. rep. no. 7. National Audubon Soc., New York.

Howell, A. H. 1924. Birds of Alabama. Alabama Dep. Game Fish, Montgomery.

McCrimmon, Jr., Donald A., John C. Ogden and G. Thomas Bancroft. 2001. Great Egret (*Ardea alba*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/570

Nesbitt, S. A., J. C. Ogden, H. W. Kale, II, B. W. Patty and L. A. Rowe. 1982. Florida atlas of breeding sites for herons and their allies: 1976–1978. U.S. Dep. Int., Fish Wildl. Serv. Biol. Serv. Program FWS/OBS-81/49, Washington, D.C.

Palmer, R. S. 1962. Handbook of North American birds. Vol. 1: loons through flamingos. Yale Univ. Press, New Haven, CT.

Schlorff, R. W. 1978. Predatory ecology of the Great Egret at Humboldt Bay, California. Pp. 347–353 *in*Wading birds (A. Sprunt, IV, J. C. Ogden, and S. Winckler, eds.). Res. rep. no. 7. National Audubon Soc., New York.

Spendelow, J. A. and S. R. Patton. 1988. National atlas of coastal waterbird colonies in the contiguous United States: 1976–82. U.S. Fish Wildl. Serv. Biol. Rep. 88: 1–326.

Trautman, M. B. 1940. The birds of Buckeye Lake, Ohio. Univ. Mich. Mus. Zool. Misc. Publ. no. 44.

Ardea herodias **- Great Blue Heron**

Butler, R. 1991. Habitat selection and time of breeding in the Great Blue Heron (*Ardea herodias*). Phd Thesis. Univ. of Brit. Col. Vancouver.

Butler, Robert W. 1992. Great Blue Heron (*Ardea herodias*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/025

Hom, C. W. 1983. Foraging ecology of herons in a southern San Francisco Bay saltmarsh. Colonial Waterbirds 6:37-44.

Kushlan, J. A. 1978. Feeding ecology of wading birds. Pages 249-298 *in* Wading birds. (Sprunt IV, A., J. C. Ogden, and S. Winkler, Eds.) Natl. Audubon Soc. Res. Rep. No. 7, New York.

Palmer, R. S. 1962. Handbook of North American birds. Vol. 1. Yale Univ. Press, New Haven, CT.

Parker, J. 1980. Great Blue Herons (*Ardea herodias*) in Northwestern Montana: nesting habitat use and the effects of human disturbance. Master's Thesis. Univ. Montana, Missoula.

Peifer, R. W. 1979. Great Blue Herons foraging for small mammals. Wilson Bull. 91:63-631.

Quinney, T. E. and P. C. Smith. 1979. Reproductive success, growth of nestlings and foraging behaviour of the Great Blue Heron (*Ardea herodias herodias L.*). contract rept. No. KL229-5-7077. Can. Wildl. Serv. Ottawa.

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Verbeek, N. A. M. and R. W. Butler. 1989. Feeding ecology of shoreline birds in the Strait of Georgia. Pages 74-81 *in* The ecology and status of marine and shoreline birds in the Strait of Georgia, British Columbia. (Vermeer, K. and R. W. Butler, Eds.) Can. Wildl. Serv. Spec. Publ. Ottawa.

Bubulcus ibis **- Cattle Egret**

Heather, B. D. 1982. The Cattle Egret in New Zealand, 1978-1980. Notornis 29:241-268.

Jenni, D. A. 1969. A study of the ecology of four species of herons during the breeding season at Lake Alice, Alachua County. Florida. Ecol. Monogr. 39:245-270.

Krebs, E. A., D. Riven-Ramsey, and W. Hunte. 1994. The colonization of Barbados by Cattle Egrets (*Bubulcus ibis*) 1956-1990. Colon. Waterbirds 17:86-90.

Ruiz, X. 1984. Reflexiones acerca de la expansión de la garcilla bueyera *Bubulcus ibis* (L., 1758) (Aves, Ardeidae). P. Dept. Zool. Barcelona 10:73-91.

Siegfried, W. R. 1971b. Feeding activity of the Cattle Egret. Ardea 59:38-46.

Singh, N., N. Sodhi, and S. Khera. 1988. Biology of the Cattle Egret *Bubulcus ibis cormandus* (Boddaert). Records Zool. Sur. India 104:1-143.

Sodhi, N. 1989. Monthly variation in diet of Cattle Egret *Bubulcus ibis coromandus* in and around Chandigarh. J. Bombay Nat. Hist. Soc. 86:440-443.

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Tejera, V. H. and V. de Wilson. 1990. Un estudio de *Bubulcus ibis* en Panama (Ciconiiformes, Ardeidae). Scientia (Panama) 5:61-71.

Telfair II, Raymond C. 2006. Cattle Egret (*Bubulcus ibis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/113

Buteo brachyurus - Short-tailed Hawk

Brandt, H. W. 1924. The nesting of the Short-tailed Hawk. Auk 41: 59–64.

Miller, Karl E. and Kenneth D. Meyer. 2002. Short-tailed Hawk (*Buteo brachyurus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/674

Millsap, B. A., M. Robson and D. E. Runde. 1989. Short-tailed Hawk surveys. Fla. Game and Fresh Water Fish Comm., Nongame Wildl. Prog. Annu. Perf. Rep., Tallahassee, FL.

Millsap, B. A., M. S. Robson and B. R. Toland. 1996. Short-tailed Hawk. Pp. 315–322 *in*Rare and endangered biota of Florida. Vol. 5: birds (J. Rodgers, ed.). Florida Committee on Rare and Endangered Plants and Animals. Univ. Press of Florida, Gainesville.

Moore, J. C., L. A. Stimson and W. B. Robertson. 1953. Observation of the Short-tailed Hawk in Florida. Auk 70: 470–478.

Nicholson, D. J. 1951. Notes on the very rare Short-tailed Hawk. Fla. Nat. 24: 32–33.

Ogden, J. C. 1974. The Short-tailed Hawk in Florida. I. Migration, habitat, hunting techniques, and food habits. Auk 91: 95–110.

Ogden, J. C. 1988. Short-tailed Hawk. Pp. 34–47 *in*Handbook of North American birds. Vol. 5. Diurnal raptors. Pt. 2 (R. S. Palmer, ed.) Yale Univ. Press, New Haven, CT.

Pennock, C. J. 1890. Notes on the nesting of *Buteo brachyurus*at St. Marks, Florida. Auk 7: 56–57.

Scott, W. E. D. 1889. On the specific identity of *Buteo brachyurus*and *Buteo fuliginosus*, with additional records of their occurrence in Florida. Auk 6: 243–245.

Sprunt, A., Jr. 1939. Short-tailed Hawk in Florida. Auk 56: 330–331.

***Buteo lineatus* - Red-shouldered Hawk**

Balcerzak, M. J. and P. B. Wood. 2003. Red-shouldered Hawk (*Buteo lineatus*): abundance and habitat in a reclaimed mine landscape. Journal of Raptor Research 37(3):188-197.

Bednarz, J. C. and J. J. Dinsmore. 1982. Nest sites and habitat of Red-shouldered Hawks Buteo-lineatus and Red-tailed Hawks Buteo-jamaicensis in Iowa USA. Wilson Bulletin 94(1):31-45.

Bohall, P. G. and M. W. Collopy. 1984. Seasonal abundance, habitat use, and perch sites of 4 raptor species in north-central Florida. Journal of Field Ornithology 55(2):181-189.

Bosakowski, T., D. G. Smith, and R. Speiser. 1992. Status, nesting density, and macrohabitat selection of Red-shouldered Hawks in northern New Jersey. Wilson Bulletin 104(3):434-446.

Coward, S. J. 1985. Opportunistic feeding behavior in Red-shouldered Hawks. Oriole 50:38-39.

Dykstra, C. R., J. L. Hays, F. B. Daniel, and M. M. Simon. 2000. Nest site selection and productivity of suburban Red-shouldered Hawks in southern Ohio. Condor 102(2):401-408.

Dykstra, C. R., F. B. Daniel, J. L. Hays, and M. M. Simon. 2001. Correlation of Red-shouldered Hawk abundance and macrohabitat characteristics in southern Ohio. Condor 103(3):652-656.

Dykstra, Cheryl R., Jeffrey L. Hays and Scott T. Crocoll. 2008. Red-shouldered Hawk (Buteo lineatus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/107

Florida Fish and Wildlife Conservation Commission. 2003, January 6. Florida's breeding bird atlas: A collaborative study of Florida's birdlife. http://www.myfwc.com/bba/ (Date accessed 07/13/2009).

Howell, D. L. and B. R. Chapman. 1997. Home range and habitat use of Red-shouldered Hawks in Georgia. Wilson Bulletin 109(1):131-144.

McLeod, M. A., B. A. Belleman, D. E. Andersen, and G. W. Oehlert. 2000. Red-shouldered Hawk nest site selection in north-central Minnesota. Wilson Bulletin 112(2):203-213.

Moorman, C. E. and B. R. Chapman. 1996. Nest-site selection of Red-shouldered and Red-tailed Hawks in a managed forest. Wilson Bulletin 108(2):357-368.

Portnoy, J. W. and W. E. Dodge. 1979. Red-shouldered Hawk nesting ecology and behavior. Wilson Bulletin 91(1):104-117.

Townsend, K. A. L. 2006. Nesting ecology and sibling behavior of Red-shouldered Hawks at the St. Francis sunken lands wildlife management area in northeastern arkansas. Ph.D. dissertation, Arkansas State University.

***Butorides virescens* - Green Heron**

Adams, L. W., L. E. Dove, and T. M. Franklin. 1985. Use of urban stormwater control impoundments by wetland birds. Wilson Bull. 97:120-122.

Bent, A. C. 1926. Life histories of North American marsh birds. U.S. Natl. Mus. Bull. No. 135.

Brooks, W. S. 1923. An interesting adaptation. Auk 40:121-122.

Brown, L. H., E. K. Urban, and K. Newman. 1982. The birds of Africa. Vol. I. Academic Press, New York.

Bryant, H. C. 1914. Birds as destroyers of grasshoppers in California. Auk 31:168-177.Clarke, J. A., B. A. Harrington, T. Hruby, and F. E. Wasserman. 1984. The effect of ditching for mosquito control on salt marsh use by birds in Rowley, Massachusetts. J. Field Ornithol. 55:160-180.

Davis, Jr., W. E. and J. A. Kushlan. 1994. Green Heron (*Butorides virescens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/129

Kaiser, M. S. and F. A. Reid. 1987. A comparison of Green-backed Heron nesting in two freshwater ecosystems. Colon. Waterbirds 10:78-83.

Monroe, Jr., B. L. and M. R. Browning. 1992. A re-analysis of *Butorides*. Bull. Br. Ornithol. Club 112:81-85.

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA.

***Catoptrophorus semipalmatus* – Willet**

Bent, A. C. 1929. Life histories of North American shore birds. Pt. 2: order Limicolae. U.S. Natl. Mus. Bull. 146.

Burger, J. and J. Shisler. 1978. Nest-site selection of Willets in New Jersey salt marsh. Wilson Bull. 90: 599–607.

Douglas, H. D., III. 1996. Communication, evolution and ecology in the Willet (*Catoptrophorus semipalmatus*): its implications for shorebirds (Suborder Charadrii). M.S. thesis, Wake Forest Univ., Winston-Salem, NC.

Hansen, G. L. 1979. Territorial and foraging behaviour of the Eastern Willet (*Catoptrophorus semipalmatus semipalmatus*[Gmelin]). M.Sc. thesis, Acadia Univ., Wolfville, NS.

Howe, M. A. 1982. Social organization in a nesting population of Eastern Willets (*Catoptrophorus semipalmatus*). Auk 99: 88–102.

Lowther, Peter E., Hector D. Douglas, Iii and Cheri L. Gratto-Trevor. 2001. Willet (*Tringa semipalmata*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/579

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Tomkins, I. R. 1965. The Willets of Georgia and South Carolina. Wilson Bull. 77: 151–167.

***Ceryle alcyon* - Belted Kingfisher**

Bent, A. C. 1940. Life histories of North American cuckoos, goatsuckers, hummingbirds and their allies. U.S. Natl. Mus. Bull. 176.

Cornwell, G. W. 1963. Observations on the breeding biology and behavior of a nesting population of Belted Kingfishers. Condor 65:426-431.

Coues, E. 1878. Habits of the kingfisher (*Ceryle alcyon*). Bull. Nuttall Ornithol. Club 3:92.

Davis, W. J. 1980. The Belted Kingfisher, *Megaceryle alcyon* : Its ecology and territoriality. M.Sc. Thesis. Univ. Cincinnati, Cincinnati, OH.

Forbush, E. H. 1925. The birds of Massachusetts and other New England states, 3 Vols. Commonwealth of Mass. Boston.

Kelly, Jeffrey F., Eli S. Bridge and Michael J. Hamas. 2009. Belted Kingfisher (*Megaceryle alcyon*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/084

Prose, B. L. 1985. Habitat suitability index models: Belted Kingfisher. Biol. Rep. No. 82 (10.87) U.S. Fish Wildl. Serv.

Roberts, T. S. 1932. The birds of Minnesota. Vol. 1. Univ. Minnesota Press, Minneapolis.

Salyer, J. C. and K. F. Lagler. 1946. The Eastern Belted Kingfisher, *Megaceryle alcyon alcyon* (Linnaeus) in relation to fish management. Trans. Am. Fish. Soc. 76:97-117.

Terres, J. K. 1968. Kingfishers eating bullfrog tadpoles. Auk 85:140.

White, H. C. 1939b. Bird control to increase the Margaree River Salmon. Bull. Fish. Res. Board Can., No. 58.

Charadrius wilsonia - Wilson's Plover

Bergstrom, P. W. 1982. Ecology of incubation in Wilson's Plover (*Charadrius wilsonius*). Phd Thesis. Univ. of Chicago, Chicago, IL.

Corbat, Carol A. and Peter W. Bergstrom. 2000. Wilson's Plover (*Charadrius wilsonia*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/516
Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Morrier, A. and R. McNeil. 1991. Time-activity budget of Wilson's and Semipalmated plovers in a tropical environment. Wilson Bull. 103:598-620.

Strauch, Jr., J. G. and L. G. Abele. 1979. Feeding ecology of three species of plovers wintering on the bay of Panama, Central America. Stud. Avian Biol. 2:217-230.

Thibault, M. and R. McNeil. 1994. Daylight variation in habitat use by Wilson's Plovers in northeastern Venezuela. Wilson Bull. 106:299-310.

Thibault, M. and R. McNeil. 1995. Predator-prey relationship between Wilson's Plovers and Fiddler Crabs in northeastern Venezuela. Wilson Bull. 107:73-80.

Tomkins, I. R. 1944. Wilson's Plover in its summer home. Auk 61:259-269.

Coccyzus americanus - Yellow-billed Cuckoo

Gaines, D. and S. A. Laymon. 1984. Decline, status, and preservation of the Yellow-billed Cuckoo in California. West. Birds 15: 49–80.

Hughes, Janice M. 1999. Yellow-billed Cuckoo (*Coccyzus americanus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/418

Laymon, S. A. 1980. Feeding and nesting behavior of the Yellow-billed Cuckoo in the Sacramento Valley. Wildl. Manage. Admin. Rep. 802, Calif. Dept. Fish and Wildlife, Sacramento.

Nolan, V., Jr. and C. F. Thompson. 1975. The occurrence and significance of anomalous reproductive activities in two North American nonparasitic cuckoos *Coccyzus*spp. Ibis 117: 496–503.

Corvus ossifragus - Fish Crow

Barrows, W. B. 1888. The food of crows. U.S. Dep. Agric. Rep. 1888: 498–535.

Jackson, D. R. and R. N. Walker. 1997. Reproduction in the Suwannee cooter, *Pseudemys concinna suwanniensis* . Bull. Fla. Mus. Nat. Hist. 41: 69–167.

McGowan, Kevin J. 2001. Fish Crow (*Corvus ossifragus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/589

***Dendroica dominica* - Yellow-throated Warbler**

Bent, A. C. 1953. Life histories of North American wood warblers. U.S. Natl. Mus. Bull. 203.

Hall, George A. 1996. Yellow-throated Warbler (*Dendroica dominica*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/223

***Egretta caerulea* - Little Blue Heron**

Bancroft, G. T., S. D. Jewell, and A. M. Strong. 1990. Foraging and nesting ecology of herons in the lower everglades relative to water conditions. Final report to South Fla. Water Manage. Dist. West Palm Beach, FL.

Blake, E. R. 1977. Manual of neotropical birds. Univ. of Chicago Press, Chicago.

Custer, T. W. and R. G. Osborn. 1978. Feeding habitat use by colonially-breeding herons, egrets, and ibises in North Carolina. Auk 95:733-743.

Domby, A. J. and R. W. McFarlane. 1978. Feeding ecology of Little Blue Herons at a radionuclide-contaminated reservoir. Pages 361-364 *in* Wading birds. (Sprunt IV, A., J. C. Ogden, and S. W. Winckler, Eds.) Res. rept. no. 7, Nat. Audubon Soc., New York.

Erwin, R. M. 1983. Feeding habits of nesting wading birds: spatial use and social influences. Auk 100:960-970.

Erwin, R. M. 1984. Feeding flights of nesting wading birds at a Virginia colony. Colon. Waterbirds 7:74-79.

Hanebrink, E. L. and G. Denton. 1969. Feeding behavior and analysis of regurgitated food collected from the Cattle Egret (*Bubulcus ibis*) and the Little Blue Heron (*Florida caerulea*). Arkansas Acad. Sci. Proc. 23:74-79.

Hilty, S. L. and W. L. Brown. 1986. A guide to the birds of Colombia. Princeton Univ. Press, Princeton, NJ.

Jenni, D. A. 1969. A study of the ecology of four species of herons during the breeding season at Lake Alice, Alachua County, Florida. Ecol. Monogr. 39:245-270.

Knoder, C. E., P. D. Plaza, and A. Sprunt IV. 1980. Status and distribution of the Jabiro Stork and other wading birds in western Mexico. Pages 58-127 *in* Proc. Natl. Audubon Soc. Symp., the birds of Mexico: their ecology and conservation. (Schaeffer, P. P. and S. M. Ehlers, Eds.) Natl. Audubon Soc. New York.

Kushlan, J. A. 1978c. Feeding ecology of wading birds. Pages 249-297 *in* Wading birds. (IV, A. Sprunt, J. C. Ogden, and S. Winckler, Eds.) Res. rept. no. 7, Nat. Audubon Soc., New York.

Maxwell II, G. R. and H. W. H. W. Kale II. 1977b. Breeding biology of five species of herons in coastal Florida. Auk 94:689-700.

Niethammer, K. R. and M. S. Kaiser. 1983. Late summer food habits of three heron species in northeastern Louisiana. Colon. Waterbirds 6:148-153.

Palmer, R. S. 1962. Handbook of North American birds. Vol. 1. Yale Univ. Press, New Haven, CT.

Rodgers, Jr., J. A. 1982. Food of nestling Little Blue Herons on the west coast of Florida. Fla. Field Nat. 10:25-30.

Rodgers, Jr., J. A. 1980b. Breeding ecology of the Little Blue Heron on the west coast of Florida. Condor 82:161-169.

Rodgers, Jr., James A. and Henry T. Smith. 1995. Little Blue Heron (*Egretta caerulea*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/145

Stiles, F. G. and A. F. Skutch. 1989. A guide to the birds of Costa Rica. Cornell Univ. Press, Ithaca, NY.

Telfair II, R. C. 1981. Cattle Egrets, inland heronries, and the availability of crayfish. Southwest. Nat. 26:37-41.

Wetmore, A. 1981. The birds of the republic of Panama, part 1: Tinamidae (tinamous) to Rynchopidae (skimmers). Smithsonian Institution Press, Washington, D.C.

Willard, D. E. 1977. The feeding ecology and behavior of five species of herons in southeastern New Jersey. Condor 79:462-470.

***Egretta rufescens* - Reddish egret**

Bancroft, G. 1927. Breeding birds of Scammons Lagoon, Lower California. Condor 29: 29–57.

Bent, A. C. 1924. Birds observed in southeastern Texas in May, 1923. Wilson Bull. 36: 1–20.

Cahn, A. R. 1923. Louisiana Herons and Reddish Egrets at home. Nat. Hist. 23: 470–485.

Lowther, Peter E. and Richard T. Paul. 2002. Reddish Egret (*Egretta rufescens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/633

Paul, R. T. 1996. Reddish Egret. *Egretta rufescens*. Pp. 281–294 *in*Rare and endangered biota of Florida (J. A. Rogers, Jr., H. W. Kale II, and H. T. Smith, eds.). Vol. V. Birds. Univ. of Florida Press, Gainesville.

Paul, R. T., H. W. Kale, II and D. A. Nelson. 1979. Reddish Egrets nesting on Florida's east coast. Florida Field Nat. 7: 24–25.

Paul, R. T., A. J. Meyerriecks and F. M. Dunstan. 1975. Return of Reddish Egrets as breeding birds in Tampa Bay, FL. Florida Field Nat. 3: 9–10.

Stevenson, H. M. and B. H. Anderson. 1994. The birdlife of Florida. Univ. Press of Florida, Gainesville.

Voous, K. H. 1983. Birds of the Netherlands Antilles. 2nd ed. De Walburg Pers, Curaçao.

Egretta thula – Snowy Egret

Jenni, D. A. 1969. A study of the ecology of four species of herons during breeding season at Lake Alice, Alachua County, Florida. Ecol. Monogr. 39: 245–270.

Kushlan, J. A. 1978a.Feeding ecology of wading birds. Pp. 249–297 *in*Wading birds (A. Sprunt IV, J. C. Ogden, and S. Winckler, eds.). Natl. Audubon Soc. Res. Rep. no. 7, New York.

Kushlan, J. A. 1978b.Nonrigorous foraging by robbing egrets. Ecology 59: 649–653.

Parsons, Katharine C. and Terry L. Master. 2000. Snowy Egret (*Egretta thula*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/489

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

Egretta tricolor - Tricolored Heron

Frederick, Peter C. 1997. Tricolored Heron (*Egretta tricolor*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/306

Jenni, D. A. 1969. A study of the ecology of four species of herons during breeding season at Lake Alice, Alachua County, Florida. Ecol. Monogr. 39: 245–270.

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA

***Elanoides forficatus* - Swallow-tailed Kite**

Cely, J. E. 1979. Status of the Swallow-tailed Kite and factors affecting its distribution. Pages 144-150 *in* Proc. of the first South Carolina endangered species symposium. (Forsythe, D. M. and W. B. Ezell, Jr., Eds.) South Carolina Wildl. and Mar. Resour. Dept. Columbia, SC.

Cely, J. E. and J. A. Sorrow. 1990. The American Swallow-tailed Kite in South Carolina. Nongame and Heritage Trust Fund publ. no. 1. South Carolina Wildl. and Mar. Resour. Dept. Columbia, SC.

Meyer, K. D. 1993. Communal roosts of the American Swallow-tailed Kite in Florida: habitat associations, critical sites, and a technique for monitoring population status. Final report. Florida Game and Fresh Water Fish Comm. Tallahassee, FL.

Meyer, Kenneth D. 1995. Swallow-tailed Kite (*Elanoides forficatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/138doi:10.2173/bna.138

Meyer, K. D. and M. W. Collopy. 1990. Status, distribution, and habitat requirements of the American Swallow-tailed Kite (*Elanoides forficatus forficatus*) in Florida. Final report. Florida Game and Fresh Water Fish Comm. Tallahassee, FL.

Robertson, Jr., W. B. 1988. American Swallow-tailed Kite. Pages 109-131 *in* Handbook of North American birds. Vol. 4 (Palmer, R. S., Ed.) Yale Univ. Press, New Haven, CT.

Snyder, N. F. R. 1974. Breeding biology of Swallow-tailed Kites in Florida. Living Bird 13:73-97.

Sutton, I. D. 1955. Nesting of the Swallow-tailed Kite. Everglades Nat. Hist. 3:72-84.

***Empidonax virescens* - Acadian Flycatcher**

Askins, R. A., J. F. Lynch and R. Greenberg. 1990. Population declines in migratory birds in eastern North America. Curr. Ornithol. 7: 1–57.

Christy, B. H. 1942. Acadian Flycatcher *Empidonax virescens*. Pp. 183–203 *in*Life histories of North American flycatchers, larks, swallows, and their allies (A. C. Bent, ed.). U.S. Natl. Mus. Bull. 179.

Freemark, K. and B. Collins. 1992. Landscape ecology of birds breeding in temperate forest fragments. Pp. 443–454 *in*Ecology and conservation of Neotropical migrant landbirds (J. M. Hagan, III, and D. W. Johnston, eds.). Smithson. Inst. Press, Washington, D.C.

Mumford, R. E. 1964. The breeding biology of the Acadian Flycatcher. Mus. Zool., Univ. of Michigan Misc. Publ. no. 125.

Oberholser, H. C. 1974. The bird life of Texas. Vol. 2. Univ. of Texas Press, Austin.

Robinson, S. K., F. R. Thompson, III, T. M. Donovan, D. R. Whitehead and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. Science 267: 1987–1990.

Sprunt, A., Jr. and E. B. Chamberlain. 1970. South Carolina bird life. Rev. ed. Univ. of South Carolina Press, Columbia.

Stevenson, H. M. and B. H. Anderson. 1994. The birdlife of Florida. Univ. Press of Florida, Gainesville.

Whitehead, Donald R. and Terry Taylor. 2002. Acadian Flycatcher (*Empidonax virescens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/614

***Eudocimus albus* - White Ibis**

Bailey, R. G. 1978. Description of the ecoregions of the United States. Forest Service, U.S. Dept. Agric. Ogden, UT.

Bildstein, K. L. 1983. Age-related differences in the flocking and foraging behavior of White Ibises in a South Carolina salt marsh. Colonial Waterbirds 6:45-53.

Bildstein, K. L. 1990. Status, conservation and management of the Scarlet Ibis, *Eudocimus ruber* in the Caroni Swamp, Trinidad, West Indies. Biol. Conserv. 54:6178.

Bildstein, K. L., W. Post, P. Frederick, and J. W. Johnston. 1990. Freshwater wetlands, rainfall, and the breeding ecology of White Ibises in coastal South Carolina. Wilson Bull. 102:84-98.

Custer, T. W. and R. G. Osborn. 1978. Feeding habitat use by colonially breeding herons, egrets, and ibises in North Carolina. Auk 95:733-743.

Gawlik, D. E., R. D. Slack, J. A. Thomas, and D. N. Harpole. 1998. Long-term trends in population and community measures of colonial-nesting waterbirds in Galveston Bay Estuary. Colonial Waterbirds 21(2):143-151.

Heath, Julie A., Peter Frederick, James A. Kushlan and Keith L. Bildstein. 2009. White Ibis (*Eudocimus albus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/009

Henderson, E. G. 1981. Behavioral ecology of the searching behavior of the White Ibis (*Eudocimus albus*) Master's Thesis. Univ. South Carolina, Columbia.

Johnston, J. W. and K. L. Bildstein. 1990. Dietary salt as a physiological constraint in White Ibises breeding in an estuary. Physiol. Zool. 63:190-207.

Kushlan, J. A. 1979a. Feeding ecology and prey selection in the White Ibis. Condor 81:376-389.

Kushlan, J. A. and M. S. Kushlan. 1975. Food of the White Ibis in southern Florida. Fla. Field Nat. 3:31-38.

Nesbitt, S. A., W. M. Hetrick, and L. E. Williams, Jr. 1975. Foods of the White Ibis from seven collection sites in Florida. Proc. Ann. Conf. Southeast. Assoc. Game and Fish Comm. Vol. 28.

***Fulica americana* - American Coot**

Alisauskas, R. T. and T. W. Arnold. 1994. American Coot. Pp. 127–143 *in*Migratory shore and upland game bird management in North America (T. C. Tacha and C. E. Braun, eds.). Int. Assoc. Fish Wildl. Agencies, Allen Press, Lawrence, KS.

American Ornithologists' Union. 1998. Check-list of North American birds. 7th ed. Am. Ornithol. Union, Washington, D.C.

Bent, A. C. 1926. Life histories of North American marsh birds. U.S. Natl. Mus. Bull. 135.

Bett, T. A. 1983. Influences of habitat composition on the breeding ecology of the American Coot (*Fulica americana*). Master's thesis, Univ. of Wisconsin—Oshkosh, Oshkosh.

Brisbin, Jr., I. Lehr and Thomas B. Mowbray. 2002. American Coot (*Fulica americana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/697a

Carpenter, R. E. and M. A. Stafford. 1970. The secretary rates and the chemical stimulus for secretion of the nasal salt glands in the Rallidae. Condor 72: 316–324.

Fitzner, R. E., E. T. Sipco and R. G. Schreckhise. 1980. American Coot nesting and feeding habits in southeastern Washington. Northwest Sci. 54: 244–252.

Harrison, C. 1978. A field guide to the nests, eggs and nestlings of North American birds. William Collins Sons & Co. Ltd., Glasgow, U.K.

Jones, J. C. 1940. Food habits of the American Coot with notes on distribution. U.S. Dep. Int. Wildl. Res. Bull. no. 2.

Kiel, W. H., Jr. 1955. Nesting studies of the coots in southwestern Manitoba. J. Wildl. Manage. 19: 189–198.

Ripley, S. D. 1977. Rails of the world: a monograph of the family Rallidae. David R. Godine, Boston, MA.

Sugden, L. G. 1979. Habitat use by nesting American Coots in Saskatchewan Parklands. Wilson Bull. 91: 599–607.

Sutherland, J. M. 1991. Effects of drought on American Coot, *Fulica americana*, reproduction in Saskatchewan Parklands. Can. Field-Nat. 105: 267–273.

Sutherland, J. M. and W. J. Maher. 1987. Nest-site selection of the American Coot in the Aspen Parklands of Saskatchewan. Condor 89: 804–810.

Swiderek, P. K., A. S. Johnson, P. E. Hale and R. L. Joyner. 1988. Production, management, and waterfowl use of sea purslane, Gulf Coast muskgrass, and widgeongrass in brackish impoundments. Pp. 441–457 *in*Waterfowl in winter (M. W. Weller, ed.). Univ. of Minnesota Press, Minneapolis.

Gallinula chloropus - Common Moorhen

Amos, E. J. R. 1991. A guide to the birds of Bermuda. E. J. R. Amos, Warwick, Bermuda

Bannor, Brett K. and Erik Kiviat. 2002. Common Moorhen (*Gallinula chloropus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/685doi:10.2173/bna.685

Bell, G. R. 1976. Ecological observations of Common (*Gallinula chloropus*) and Purple gallinules (*Porphyrula martinica*) on Lacassine National Wildlife Refuge, Cameron Parish, Louisiana. Master's thesis, Univ. of Southwestern Louisiana, Lafayette.

Bent, A. C. 1926. Life histories of North American marsh birds. U.S. Natl. Mus. Bull. 135.

Brackney, A. W. 1979. Population ecology of Common Gallinules in southwestern Lake Erie marshes. Master's thesis, Ohio State Univ., Columbus.

Bull, J., E. Bull, G. Gold and P. D. Prall. 1985. Birds of North America: eastern region. Macmillan Publ. Co., New York.

Chabot, A. 1996. Preliminary results from the marsh monitoring program in 1995. Great Lakes Wetlands 7: 7–11.

Cogswell, H. L. 1977. Water birds of California. Univ. of California Press, Berkeley.

Fredrickson, L. H. 1971. Common Gallinule breeding biology and development. Auk 88: 914–919.

Haag, K. H., J. C. Joyce, W. M. Hetrick and J. C. Jordan. 1987. Predation on waterhyacinth weevils and other aquatic insects by three wetland birds on Florida. Fla. Entomol. 70: 457–471.

Mulholland, R. and H. F. Percival. 1982. Food habits of the Common Moorhen and Purple Gallinule in north-central Florida. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 36: 527–536.

O'Meara, T. E., W. R. Marion, O. B. Myers and W. M. Hetrick. 1982. Food habits of three bird species on phosphate-mine settling ponds and natural wetlands. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 36: 527–526.

Wetmore, A. 1916. Birds of Porto Rico. U.S. Dep. Agric. Bull. 326.

Geothlypis trichas - Common Yellowthroat

Burleigh, T. D. 1958. Georgia birds. Univ. of Oklahoma Press, Norman.

Guzy, Michael J. and Gary Ritchison. 1999. Common Yellowthroat (*Geothlypis trichas*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/448

Hofslund, P. B. 1959. A life history study of the Yellowthroat, *Geothlypis trichas* . Proc. Minn. Acad. Sci. 27: 144–174.

Lowther, P. E. 1993a.Tallgrass prairie I. J. Field Ornithol. 64 (suppl.): 103.

Lowther, P. E. 1993b.Tallgrass prairie II. J. Field Ornithol. 64 (suppl.): 103–104.

Lowther, P. E. 1993c.Tallgrass prairie III. J. Field Ornithol. 64 (suppl.): 104.

Rosenberg, K. V., R. D. Ohmart and B. W. Anderson. 1982. Com-munity organization of riparian breeding birds: Response to an annual resource peak. Auk 99: 260–274.

Stevenson, H. M. and B. H. Anderson. 1994. The birdlife of Florida. Univ. Press of Florida, Gainesville.

Stewart, R. E. 1953. A life history study of the Yellowthroat. Wilson Bull. 65: 99–115.

Grus canadensis pratensis **- Sandhill Crane**

Bishop, M.A. 1988. Factors affecting productivity and habitat use of Florida sandhill cranes: an evaluation of three areas in central Florida for a nonmigratory population of whooping cranes. Ph.D. Diss., Univ. Florida, Gainesville.

Depkin, F.C., L.A. Brandt, and F.J. Mazzotti. !994. Nest sites of Florida sandshill cranes in southwestern Florida. Fla. Field Nat. 22:39-47.

Dwyer, N.C., and G.W. Tanner. 1992. Nesting success in Florida sandhill cranes. Wilson Bull. 104:22-31.

Layne, J,A. 1981. Nesting, development of the young, and parental behavior of a pair of Florida sandhill cranes. Fla. Filed Nat. 10:74-76.

Layne, J.A. 1983. Productivity of sandhill cranes in south central Florida. J. Wildl. Manage. 47:178-185.

Layne, J. N. 1982a. Dry ground nests of Florida Sandhill Cranes. Fla. Field Nat. 10:55-56.

Nesbitt, S. A. and K. S. Williams. 1990. Home range and habitat use of Florida Sandhill Cranes. J. Wildl. Manage. 54:92-96.

Stys, B. 1997. Ecology of the Florida sandhill crane. Florida Game and Freshwater Fish Commission, Nongame Wildlife Program Technical Report No. 15. Tallahassee, FL. 20 pp.

Tacha, T. C., S. A. Nesbitt and P. A. Vohs. 1992. Sandhill Crane (*Grus canadensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/031

Walkinshaw, L.H. 1949. The sandhill cranes. Cranbook Inst. Sci. Bull. 29. Bloomfield Hills, Mich. 202 pp.

Walkinshaw, L.H. 1973. Cranes of the World. Winchester Press New York, N.Y. 370 pp.

Walkinshaw, L.H. 1982. Nesting of the Florida sandhill crane in central Florida. Pages 53-62 *in* J.C. Lewis, ed. Preoc. 1981 Crane Workshop. Natl. Audubon Soc., Tavernier, Florida.

Haematopus palliatus **- American Oystercatcher**

Humphrey, R. C. 1990. Status and range expansion of the American Oystercatcher on the Atlantic coast. Trans. Northeast Sect. Wildl. Soc. 47:54-61.

Lauro, B. and J. Burger. 1989. Nest-site selection of American Oystercatchers (*Haematopus palliatus*) in salt marshes. Auk 106:185-192.

Nol, Erica and Robert C. Humphrey. 1994. American Oystercatcher (*Haematopus palliatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/082

Zaradusky, J. D. 1985. Breeding status of the American Oystercatcher in the town of Hempstead. Kingbird 35:105-113.

***Haliaeetus leucocephalus* - Bald Eagle**

Andrew, J. M. and J. A. Mosher. 1982. Bald Eagle nest site selection and nesting habitat in Maryland. J. Wildl. Manage. 46: 382–390.

Anthony, R. G. and F. B. Isaacs. 1989. Characteristics of Bald Eagle nest sites in Oregon. J. Wildl. Manage. 53: 148–159.

Buehler, David A. 2000. Bald Eagle (*Haliaeetus leucocephalus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/506

Buehler, D. A., S. K. Chandler, T. J. Mersmann, J. D. Fraser and J. K. D. Seegar. 1992a.Nonbreeding Bald Eagle perch habitat on the northern Chesapeake Bay. Wilson Bull. 104: 540–545.

Curnutt, J.L. 1996. Southern bald eagle (*Haliaeetus leucocephalus leucocephalus*). Pages 179-187 in *Rare and Endangered Biota of Florida, Volume V. Birds* (J.A. Rodgers, H.W. Kale, and H.T. Smith, editors). University Press of Florida, Gainesville, FL.

Florida Fish and Wildlife Conservation Commission, 2009. Bald Eagle Management Plan (*Haliateeus leucocephalus*). Florida Fish and Wildlife Conservation Commission. Adopted April 9, 2008.

Fraser, J. D. 1985. The impact of human activities on Bald Eagle populations—a review. Pp. 68–84 *in* The Bald Eagle in Canada (J. M. Gerrard and T. M. Ingram, eds.). White Horse Plains Publ., Headingley, Manitoba.

Fraser, J. D., L. D. Frenzel and J. E. Mathisen. 1985. The impact of human activities on breeding Bald Eagles in north-central Minnesota. J. Wildl. Manage. 49: 585–592.

Gerrard, J. M., P. N. Gerrard, W. J. Maher and D. W. A. Whitfield. 1975. Factors influencing nest site selection of Bald Eagles in northern Saskatchewan and Manitoba. Blue Jay 33: 169–176.

Herrick, F. H. 1924. Daily life of the American eagle: late phase. Auk 41: 389–422, 517–541.

Livingston, S. A., C. S. Todd, W. B. Krohn and R. B. Owen, Jr. 1990. Habitat models for nesting Bald Eagles in Maine. J. Wildl. Manage. 54: 644–653.

Macdonald, P. R. N. and P. J. Austin-Smith. 1989. Bald Eagle, *Haliaeetus leucocephalus* , nest distribution in Cape Breton Island, Nova Scotia. Can. Field-Nat. 103: 293–296.

McEwan, L. C. and D. H. Hirth. 1979. Southern Bald Eagle productivity and nest site selection. J. Wildl. Manage. 43: 585–594.

McEwan, L.C. and D.H. Hirth. 1980. Food habits of the bald eagle in north-central Florida. *Condor* 82:229-231.

McGarigal, K., R. G. Anthony and F. B. Isaacs. 1991. Interactions of humans and Bald Eagles on the Columbia River estuary. Wildl. Monogr. 115.

Millsap, B., T. Breen, E. McConnell, T Steffer, L. Phillips, N. Douglass, and S. Taylor. 2004 Comparative fecundity and survival of bald eagles fledged from suburban and rural natal areas in Florida. *Journal of Wildlife Management* 68: 1, 018 – 1,031.

Mojica, E.K. 2006. Migration, home range, and important use areas of Florida sub-adult bald eagles. Master's thesis, University of Georgia, Athens, GA.

Stalmaster, M. V. 1987. The Bald Eagle. Universe Books, New York.

Stevenson H.M., and B.H. Anderson. 1994. *The Birdlife of Florida.* University Press of Florida, Gainesville, FL.

Wood, P. B., T. C. Edwards and M. W. Collopy. 1989. Characteristics of Bald Eagle nesting habitat in Florida. J. Wildl. Manage. 53: 441–449.

Swenson, J. E., K. L. Alt and R. L. Eng. 1986. Ecology of Bald Eagles in the greater Yellowstone ecosystem. Wildl. Monogr. 95.

***Himantopus mexicanus* - Black-necked stilt**

Dinsmore, J. J. 1977. Notes on avocets and stilts in Tampa Bay, Florida. Fla. Field Nat. 5: 25–30.

Florida Fish and Wildlife Conservation Commission. 2003, January 6. Florida's breeding bird atlas: A collaborative study of Florida's birdlife. http://www.myfwc.com/bba/ (Date accessed 07/13/2009).

Hamilton, R. B. 1975. Comparative behavior of the American Avocet and the Black-necked Stilt (Recurvirostridae). Ornithol. Monogr. 17.

Robinson, Julie A., J. Michael Reed, Joseph P. Skorupa and Lewis W. Oring. 1999. Black-necked Stilt (*Himantopus mexicanus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/449

Wetmore, A. 1925. Food of American phalaropes, avocets, and stilts. Bull. 1359. U.S. Dept. Agric., Washington, D.C.

***Ixobrychus exilis* - Least Bittern**

Bent, A. C. 1926. Life histories of North American marsh birds. U.S. Natl. Mus. Bull. No. 135.

Frederick, P. C., N. Dwyer, S. Fitzgerald, and R. E. Bennetts. 1990. Relative abundance and habitat preferences of Least Bitterns (*Ixobrychus exilis*) in the Everglades. Fla. Field Nat. 18:1-20.

Gibbs, J. P., F. A. Reid, S. M. Melvin, Alan F. Poole and Peter Lowther. 2009. **Least Bittern** (*Ixobrychus exilis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/017

Howell, A. H. 1932. Florida bird life. U.S. Bur. Biol. Surv. and Fla. Dep. Game and Freshwater Fish, Coward-McCann, New York, NY.

Palmer, R. S. 1962. Handbook of North American birds. Vol. 1. Yale Univ. Press, New Haven, CT.

Swift, B. L. 1989. Avian breeding habitats in Hudson River tidal marshes. Unpubl. rept., New York Dep. Environ. Conserv., Div. Fish and Wildl. Delmar, NY.

Warren, B. H. 1890. Birds of Pennsylvania. Pennsylvania State Board Agric. Harrisburg, PA.

Weller, M. W. 1961. Breeding biology of the Least Bittern. Wilson Bull. 73:11-35.

***Larus atricilla* - Laughing Gull**

Bent, A. C. 1921. Life histories of North American gulls and terns. U.S. Natl. Mus. Bull. 113.

Buckley, F. G., M. Gochfeld, and P. A. Buckley. 1978. Breeding Laughing Gulls return to Long Island. Kingbird 28:202-207.

Burger, J. 1983. Jamaica Bay studies III: abiotic determinants of distribution and abundance of gulls (*Larus*). Estuarine, Coastal and Shelf Sci. 16:191-216.

Burger, J. 1988. Foraging behavior in gulls: differences in method, prey, and habitat. Colon. Waterbirds 11:9-23.

Burger, J. 1996. Laughing Gull (*Larus atricilla*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/225

Burger, J. and M. Gochfeld. 1985. Nest site selection by Laughing Gulls: comparison of tropical colonies (Culebra, Puerto Rico) with temperate colonies (New Jersey). Condor 87:364-373.

Burger, J., J. Shisler, and F. H. Lesser. 1982. Avian utilization on six salt marshes in New Jersey. Biol. Conserv. 23:187-212.

Burger, J. and L. Wagner. 1995. Laughing Gull. Pages 375-380 *in* Habitat requirements of Delaware Bay birds. (Dove, L. E. and R. Nyman, Eds.) U.S. Environ. Protect. Agency, Columbia, MD.

Bongiorno, S. F. 1970. Nest-site selection by adult Laughing Gulls (*Larus atricilla*). Anim. Behav. 18:434-444.

Frohring, P. C. and J. A. Kushlan. 1986. Nesting status and colony site variability of Laughing Gulls in southern Florida. Fla. Field Nat. 14:1-28.

Nisbet, I. C. T. 1971. The Laughing Gull in the northeast. Am. Birds 25:677-683.

Patton, S. R. 1988. Abundance of gulls at Tampa Bay landfills. Wilson Bull. 100:431-442.

Robertson, Jr., W. B. and G. E. Woolfenden. 1992. Florida bird species: an annotated list. Fla. Ornithol. Soc. Spec. Publ. no. 6.

Schreiber, E. A., R. W. Schreiber, and J. J. Dinsmore. 1979. Breeding biology of Laughing Gulls in Florida. Part I: nesting, egg, and incubation parameters. Bird Banding 50:304-321.

Stone, W. 1937. Bird studies at Old Cape May. Delaware Valley Ornithol. Club, Philadelphia, PA.

White, D. H., C. A. Mitchell, and R. M. Prouty. 1983a. Nesting biology of Laughing Gulls in relation to agricultural chemicals in south Texas, 1978-81. Wilson Bull. 95:540-551.

***Laterallus jamaicensis* - Black Rail**

Eddleman, W. R., R. E. Flores and M. Legare. 1994. **Black Rail** (*Laterallus jamaicensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/123

Harlow, R. C. 1913. Nesting of the Black Rail (*Creciscus jamaicensis*) in New Jersey. Auk 30:269.

Stephens, F. 1909. Notes on the California Black Rail. Condor 11:47-49.

Weske, J. S. 1969. An ecological study of the Black Rail in Dorchester County, Maryland. Master's Thesis. Cornell Univ. Ithaca, NY.

***Mycteria americana* - Wood Stork**

Bryan, Jr., A. L., M. C. Coulter, and C. J. Pennycuick. 1995. Foraging strategies and energetic costs of foraging flights by breeding Wood Storks. Condor 97:133-140.

Coulter, M. C., J. A. Rodgers, J. C. Ogden and F. C. Depkin. 1999. Wood Stork (*Mycteria americana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/409

Pearson, S. M., J. M. Walsh, and J. Pickering. 1992. Wood Stork use of wetland habitats around Cumberland Island, Georgia. Colon. Waterbirds 15:33-42.

Rodgers, Jr., J. A. 1987b. Wood Stork movements. Final performance report, study no. 7512. Florida Game and Fresh Water Fish Comm. Tallahassee, FL.

Rodgers, Jr., J. A., S. T. Schwikert, and A. Shapiro-Wenner. 1996. Nesting habitat of Wood Storks in north and central Florida, USA. Colon. Waterbirds 19:1-21.

***Nyctanassa violacea* - Yellow-crowned Night-Heron**

Watts, Bryan D. 1995. Yellow-crowned Night-Heron (*Nyctanassa violacea*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/161

***Nycticorax nycticorax* - Black Crowned Night Heron**

Allen, R. P. 1938. Black-crowned Night Heron colonies on Long Island. Proc. Linn. Soc. New York 49(1937):43-51.

Bailey, W. 1915. The Plum Island night herons. Auk 32:424-441.

Bent, A. C. 1926. Life histories of North American marsh birds. Smithsonian Institution, U.S. Natl. Mus. Bull. No. 135, Washington, D.C.

Cramp, S. 1977. Handbook of the birds of Europe the Middle East and North Africa: the birds of the Western Palearctic. Vol. 1. Oxford Univ. Press, Oxford.

Davis, Jr., William E. 1993. Black-crowned Night-Heron (*Nycticorax nycticorax*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/074

Hancock, J. and J. Kushlan. 1984. The herons handbook. Harper and Row, New York.

Kushlan, J. A. 1978. Feeding ecology of wading birds. Pages 249-297 *in* Wading birds. (Sprunt, et al., Ed.) Nat. Aud. Soc. Res. Rep. No. 7, New York.

Nickell, W. P. 1966. The nesting of the Black-crowned Night Heron and its associates. Jack-Pine Warbler 44:130-139.

Palmer, R. S. 1962. Handbook of North American birds. Vol. I: loons through flamingos. Yale Univ. Press, New Haven, CT.

***Pandion haliaetus* – Osprey**

Bent, A. C. 1937. Life histories of North American birds of prey. Pt. 1. U.S. Natl. Mus. Bull. 167.

Cramp, S. and K. E. L. Simmons. 1980. Osprey. Pp. 265–277 *in* The birds of the Western Palearctic. Vol. 2: hawks to bustards. Oxford Univ. Press, Oxford, U.K.

Edwards, T. C. and M. W. Collopy. 1988. Nest tree preference of Ospreys in northcentral Florida. J. Wildl. Manage. 52: 103–107.

Ewins, P. J. 1996. The use of artificial nest sites by an increasing population of Osprey in the Canadian Great Lakes basin. Pp. 109–123 *in* Raptors in human landscapes (D. M. Bird, D. E. Varland, and J. J. Negro, eds.). Academic Press Inc., San Diego, CA.

Palmer, R. S. 1988. Handbook of North American birds. Vol. 4: diurnal raptors. Pt. 1. Yale Univ. Press, New Haven, CT.

Poole, A. 1989a. Ospreys: a natural and unnatural history. Cambridge Univ. Press. Cambridge, U.K.

Poole, Alan F., Rob O. Bierregaard and Mark S. Martell. 2002. Osprey (*Pandion haliaetus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/683

***Parula americana* - Nothern Parula Warbler**

Bent, A. C. 1953. Life histories of the North American wood warblers. U.S. Natl. Mus. Bull. 203.

Moldenhauer, Ralph R. and Daniel J. Regelski. 1996. Northern Parula (*Parula americana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/215

Morse, D. H. 1967. Competitive relationships between Parula Warblers and other species during the breeding season. Auk 84:490-502.

***Pelecanus occidentalis* - Brown Pelican**

McNair, D. B. 2000. The status of three species of marine-estuarine birds in the interior of Florida: attraction to phosphate mines of the central peninsula. N. Am. Birds 54: 137–145.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009).

Nesbitt, S. A. 1996. Eastern Brown Pelican. Pp. 144–155 *in* Rare and endangered biota of Florida. Vol. V. Birds (J. A. Rodgers, Jr., H. W. Kale, II, and H. T. Smith, eds.). Univ. Press of Florida, Gainesville.

Shields, Mark. 2002. Brown Pelican (*Pelecanus occidentalis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/609

Smith, J. P. and C. B. Goguen. 1993. Inland nesting of the Brown Pelican. Fla. Field Nat. 21: 29–33.

***Phalacrocorax auritus* - Double-crested Cormorant**

Hatch, Jeremy J. and D. V. Weseloh. 1999. **Double-crested Cormorant** (*Phalacrocorax auritus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/441

***Plegadis falcinellus* - Glossy ibis**

Davis, Jr., William E. and John Kricher. 2000. Glossy Ibis (*Plegadis falcinellus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/545

Del Hoyo, J., A. Elliott and J. Sargatal. 1992. Handbook of the birds of the world. Vol. 1. Lynx Edicions, Barcelona.

Frederick, P. C. and S. M. McGehee. 1994. Wading bird use of wastewater treatment wetlands in central Florida. Colon. Waterbirds 17: 50–59.

***Podilymbus* *podiceps* - Pied-billed grebe**

Andrle, R. F. and J. R. Carroll. 1988. The atlas of breeding birds in New York state. Cornell Univ. Press, Ithaca, NY.

Bent, A. C. 1919. Life histories of North American diving birds. U.S. Natl. Mus. Bull. no. 107.

Boesman, P. 1998. Some new information on the distribution of Venezuelan birds. Cotinga 9:27-39.

Chabreck, R. H. 1963. Breeding habits of the Pied-billed Grebe in an impounded coastal marsh in Louisiana. Auk 80:447-452.

Cramp, S. and K. E. L. Simmons. 1977. The birds of the Western Palearctic. Vol. 1. Oxford Univ. Press, Oxford, UK.

Dahl, T. E. and C. E. Johnson. 1991. Status and trends in wetlands in the conterminous United States, mid-1970's to mid-1980's. U. S. Dept. Int., Fish and Wildl. Serv. Washington D.C.

Faaborg, J. 1976. Habitat selection and territorial behavior of the small grebes of North Dakota. Wilson Bull. 88:390-399.

Fjeldså, J. 1981. Comparative ecology of Peruvian grebes-a study of the mechanisms of evolution of ecological isolation. Vidensk. Meddr dansk naturh. Foren. 143:125-249.

Gibbs, J. P. and S. M. Melvin. 1992. Pied-billed Grebe, *Podilymbus podiceps*. Pages 31-49 *in* Migratory nongame birds of management concern in the Northeast. (Schneider, K. J. and D. M. Pence, Eds.) U.S. Dep. Inter., Fish and Wildl. Serv. Newton Corner, MA.

Kantrud, H. A. and R. E. Stewart. 1984. Ecological distribution and crude density of breeding birds on prairie wetlands. J. Wildl. Manage. 48:426-437.

Krapu, G. L., D. R. Parsons, and M. W. Weller. 1970. Waterfowl in relation to land use and water levels on the Spring Run area. Iowa State J. Sci. 44:437-452.

McCowan, M. 1973. Pied-billed Grebe nesting observations. Blue Jay 31:97-98.

Miller, R. F. 1942. The Pied-billed Grebe, a breeding bird of the Philadelphia region. Cassinia 32:22-34.

Muller, M. J. 1995. Pied-billed Grebes nesting on Green Lake, Seattle, Washington. Wash. Birds 4:35-59.

Muller, Martin J. and Robert W. Storer. 1999. Pied-billed Grebe (*Podilymbus podiceps*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/410

Otto, J. E. 1983b. Breeding ecology of the Pied-billed Grebe (*Podilymbus podiceps* [Linnaeus]) on Rush Lake, Winnebago County, Wisconsin. Master's Thesis. Univ. of Wisconsin, Oshkosh.

Smith, M. R., P. W. Mattocks, Jr., and K. M. Cassidy. 1997. Breeding birds of Washington state. *in* Washington State Gap Analysis-Final Report. Vol. 4 (Cassidy, K. M., C. E. Grue, M. R. Smith, and K. M. Dvornich, Eds.) Seattle Audubon Soc. Publs. in Zool. no. 1, Seattle, WA.

Yocom, C. F., S. W. Harris, and H. E. Hansen. 1958. Status of grebes in eastern Washington. Auk 75:36-47.

***Porphyrio martinica* - Purple Gallinule**

American Ornithologists' Union. 1998. Check-list of North American birds. 7th ed. Am. Ornithol. Union, Washington, D.C.

Bell, G. 1976. Ecological observations of Common and Purple gallinules on Lacassine National Wildlife Refuge. M.S. thesis, Univ. of Southwestern Louisiana, Lafayette

Eddleman, W. R., F. L. Knopf, B. Meanley, F. A. Ried and R. Zembal. 1988. Conservation of North American rallids. Wilson Bull. 100: 458–475.

Esler, D. 1990. Avian community responses to hydrilla invasion. Wilson Bull. 102: 427–440.

Helm, R. N. 1982. Chronological nesting study of Common and Purple gallinules in the marshlands and rice fields of southwestern Louisiana. M.S. thesis, Louisiana State Univ., Baton Rouge, La.

Helm, R. N. 1994. Purple Gallinule. Pp. 158–165 *in* Management of migratory shore and upland game birds in North America (T. C. Tacha and C. E. Braun, eds.). Int. Assoc. Fish Wild. Agencies, Washington, D.C., in cooperation with U.S. Fish Wildlife Serv.

Howell, A. H. 1932. Florida bird life. Coward-McCann, New York.

Hunter, L. A. 1986. Cooperative breeding behavior of Purple Gallinules. Doctoral diss. Univ. of Montana.

Mckay, W. D. 1981. Notes on Purple Gallinules in Colombian rice fields. Wilson Bull. 93: 267–271.

Mulholland, R. 1983. Feeding ecology of the Common Moorhen and Purple Gallinule on Orange Lake, Florida. M.S. thesis. Univ. of Florida, Gainesville.

Mulholland, R. and H. F. Percival. 1982. Food habits of the Common Moorhen and Purple Gallinule in north-central Florida. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 36: 527–536.

Oberholser, H. C. 1974. The bird life of Texas. Vol. 1. Univ. of Texas Press, Austin.

Sprunt, A., Jr. and E. B. Chamberlain. 1970. South Carolina bird life. Rev. ed. Univ. of South Carolina Press, Columbia.

Tiner, R. W., Jr. 1984. Wetlands of United States: current status and recent trends. National Wetlands Inventory, Fish Wildl. Serv., U.S. Dep. Int. Washington, D.C.

Trautman, M. B. and S. J. Glines. 1964. A nesting of the Purple Gallinule (*Porphyrula martinica*) in Ohio. Auk 81: 224–226.

West, Richard L. and Gene K. Hess. 2002. Purple Gallinule (*Porphyrio martinica*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/626

***Protonotaria* *citrea* - Prothonotary Warbler**

Bent, A. C. 1953. Life histories of North American wood warblers. U.S. Natl. Mus. Bull. 203.

Blem, C. R. and L. B. Blem. 1991. Nest-box selection by Prothonotary Warblers. J. Field Ornithol. 62:299-307.

Conway, A. E. 1946. Unusual nesting of the Prothonotary Warbler. Auk 63:250.

Dunn, J. and K. Garrett. 1997. A field guide to warblers of North America. Houghton Mifflin, New York.

Faaborg, J. and W. J. Arendt. 1984. Population sizes and philopatry of winter resident warblers in Puerto Rico. J. Field Ornithol. 5:376-378.

Harrison, H. H. 1984. Wood warblers' world. Simon and Schuster, New York.

Kahl, R. B., T. S. Baskett, J. A. Ellis, and J. N. Burroughs. 1985. Characteristics of summer habitats of selected nongame birds in Missouri. Res. Bull. 1056. Agric Exp. Sta., Univ. of Missouri, Columbia.

Keast, A. and E. S. Morton. 1980. Migrant birds in the Neotropics: Ecology, behavior, distribution, and conservation. Smithson. Inst. Press, Washington, D.C.

Lefebvre, G., B. Poulin, and R. McNeil. 1992. Abundance, feeding behavior, and body condition of Nearctic warblers wintering in Venezuelan mangroves. Wilson Bull. 104:400-412.

Lefebvre, G., B. Poulin, and R. McNeil. 1994. Spatial and social behaviour of Nearctic warblers wintering in Venezuelan mangroves. Can. J. Zool. 72:757-764.

Petit, Lisa J. 1999. Prothonotary Warbler (*Protonotaria citrea*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/408

Petit, L. J., W. J. Fleming, K. E. Petit, and D. R. Petit. 1987. Nest-box use by Prothonotary Warblers (*Prothonotaria citrea*) in riverine habitat. Wilson Bull. 99:485-488.

Petit, L. J. and D. R. Petit. 1988b. Use of Red-winged Blackbird nest by a Prothonotary Warbler. Wilson Bull. 100:305-306.

Petit, L. J., D. R. Petit, K. E. Petit, and W. J. Fleming. 1990a. Intersexual and temporal variation in foraging ecology of Prothonotary Warblers during the breeding season. Auk 107:133-145.

Petit, L. J., D. R. Petit, K. E. Petit, and W. J. Fleming. 1990b. Annual variation in foraging ecology of Prothonotary Warblers during the breeding season. Auk 107:146-152.

Russell, S. M. 1980. Distribution and abundance of North American migrants in lowlands of northern Colombia. Pages 249-252 *in* Migrant birds in the Neotropics: Ecology, behavior, distribution, and conservation. (Keast, A. and E. S. Morton, Eds.) Smithson. Inst. Press, Washington, D.C.

Thompson, M. C. and C. Ely. 1992. Birds in Kansas. Univ. Kansas Mus. Nat. Hist. Publ. 12.

Walkinshaw, L. H. 1953. Life-history of the Prothonotary Warbler. Wilson Bull. 65:152-168.

***Quiscalus major* - Boat-tailed Grackle**

Audubon, J. J. 1834. Ornithological biography. Vol. 2. Adam and Charles Black, Edinburgh.

Bancroft, G. T. 1983. Reproductive tactics of the sexually dimorphic Boat-tailed Grackle (Aves). Phd Thesis. Univ. of South Florida, Tampa.

Mcilhenny, E. A. 1937. Life history of the Boat-tailed Grackle in Louisiana. Auk 54:274-295.

Post, W., J. P. Poston and G. T. Bancroft. 1996. Boat-tailed Grackle (*Quiscalus major*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/207

Post, W. and C. A. Seals. 1991. Bird density and productivity in an impounded cattail marsh. J. Field Ornithol. 62:195-199.

Stevenson, H. M. and B. H. Anderson. 1994. The birdlife of Florida. University Presses of Florida, Gainesville.

***Rallus elegans* - King rail**

Poole, Alan F., L. R. Bevier, C. A. Marantz and Brooke Meanley. 2005. King Rail (*Rallus elegans*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/003

Reid, F. A. 1989. Differential habitat use by waterbirds in a managed wetland complex. Ph. D. diss. Univ. Missouri, Columbia.

***Rallus longirostris* - Clapper rail**

Clark, J. D. and J. C. Lewis. 1983. A validity test of a habitat suitability index model for Clapper Rail. Proc. Ann. Conf. Southeast. Assoc. Fish Wildl. Agen. 37:95-102.

Eddleman, William R. and Courtney J. Conway. 1998. Clapper Rail (*Rallus longirostris*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/340

Jorgensen, P. D. and H. L. Ferguson. 1982. Clapper Rail preys on Savannah Sparrow. Wilson Bull. 94:215.

Lewis, J. C. and R. L. Garrison. 1983. Habitat suitability index models: Clapper Rail. FWS/OBS-83/10. U.S. Fish Wildl. Serv.

Meanley, B. 1985. The marsh hen: A natural history of the Clapper Rail of the Atlantic coast salt marsh. Tidewater Publ. Centreville, MD.

Simmons, G. F. 1914. Notes on the Louisiana Clapper Rail (*Rallus longirostris saturatus*) in Texas. Auk 31:363-384.

Segre, A., J. P. Hailman, and C. G. Beer. 1968. Complex interactions between Clapper Rails and Laughing Gulls. Wilson Bull. 80:213-219.

Spendelow, J. A. and H. R. Spendelow, Jr. 1980. Clapper Rail kills birds in a net. J. Field Ornithol. 51:175-176.

Test, F. H. and A. R. Test. 1942. Food of the California Clapper Rail. Condor 44:228.

Zembal, R. and J. M. Fancher. 1988. Foraging behavior and foods of the Light-footed Clapper Rail. Condor 90:959-962.

***Rostrhamus sociabilis plumbeus* - Snail Kite**

Cottam, C. and P. Knappen. 1939. Food of some uncommon North American birds. Auk 56:138-169.

Snyder, N. F. R. and H. A. Snyder. 1969. A comparative study of mollusc predation by Limpkins, Everglade Kites, and Boat-tailed Grackles. Living Bird 8:177-223.

Stieglitz, W. O. and R. L. Thompson. 1967. Status and life history of the Everglade Kite in the United States. Bureau Sport Fisheries and Wildl., Spec. Sci. Rep. Wildl. 109.

Sykes, Jr., P. W. 1987a. The feeding habits of the Snail Kite in Florida, USA. Colon. Waterbirds 10:84-92.

Sykes, Jr., P. W. 1987b. Snail Kite nesting ecology in Florida. Fla. Field Nat. 15:57-84.

Sykes, Jr., P. W. and H. W. Kale II. 1974. Everglade Kites feed on non-snail prey. Auk 91:818-820.

Sykes, Jr., P. W., J. A. Rodgers, Jr. and R. E. Bennetts. 1995. Snail Kite (*Rostrhamus sociabilis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/171

***Rynchops niger* - Black Skimmer**

Bent, A. C. 1921. Life histories of North American gulls and terns. U.S. Natl. Mus. Bull. 113:1-337.

Burger, J. and M. Gochfeld. 1990. The Black Skimmer: social dynamics of a colonial species. Columbia Univ. Press, New York.

Clapp, R. B., D. Morgan-Jacobs, and R. C. Banks. 1983. Marine birds of the Southeastern United States. U.S. Fish & Wildl. Serv., FWS/OBS 83/30, Washington, D.C.

Erwin, R. M. 1979. Species interactions in a mixed colony of Common Terns (*Sterna hirundo*) and Black Skimmers (*Rynchops niger*) Anim. Behav. 27:1054-1062.

Erwin, R. M. 1980. Breeding habitat use by colonially nesting waterbirds under different regimes of disturbance. Biol. Conserv. 18:39-51.

Fisk, E. J. 1978. Roof-nesting terns, skimmers, and plovers in Florida. Fla. Field Nat. 6:1-8.

Gochfeld, Michael and Joanna Burger. 1994. Black Skimmer (*Rynchops niger*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/108

Gore, J. A. 1987. Black Skimmers on roofs in northwestern Florida. Fla. Field Nat. 15:77-79.

Gore, J. A. 1991. Distribution and abundance of nesting Least Terns and Black Skimmers in northwest Florida. Fla. Field Nat. 19:65-72.

Greene, L. L. and H. W. Kale II. 1976. Roof-nesting by Black Skimmers. Fla. Field Nat. 4:15-17.

Langridge, H. P. and G. S. Hunter. 1986. Inland nesting of Black Skimmers. Fla. Field Nat. 14:73-74.

Leavitt, B. B. 1957. Food of the Black Skimmer (*Rynchops nigra*). Auk 74:394.

Robertson, Jr., W. B. and G. E. Woolfenden. 1992. Florida bird species: an annotated list. Fla. Ornithol. Soc. Gainesville.

Schreiber, R. W. and E. A. Schreiber. 1978. Colonial bird use and plant succession on dredged material islands in Florida. vol. 1. Sea and wading bird colonies. Tech. Rept. D-78-14. U.S. Army Eng. Waterways Exper. Station, Vicksburg, MS.

Tomkins, I. R. 1933. Ways of the Black Skimmer. Wilson Bull. 45:147-151.

Valiela, I. 1984. Marine ecological processes. Springer-Verlag, New York.

Scolopax minor **- American Woodcock**

Cushwa, C. T., J. E. Barnard, and R. B. Barnes. 1977. Trends in woodcock habitat in the United States. Pages 31-38 *in* Proc. Sixth Woodcock Symp. (Keppie, D. M. and R. B. Owen, Jr., Eds.) New Brunswick Dept. Nat. Resour. Fredericton.

Dobell, J. V. 1977. Determination of woodcock habitat changes from aerial photography in New Brunswick. Pages 73-81 *in* Proc. Sixth Woodcock Symp. (Keppie, D. M. and R. B. Owen, Jr., Eds.) New Brunswick Dept. Nat. Resour. Fredericton.

Keppie, D. M. and R. M. Whiting, Jr. 1994. American Woodcock (*Scolopax minor*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/100

Mendall, H. L. and C. M. Aldous. 1943. The ecology and management of the American Woodcock. Maine Coop. Wildl. Res. Unit, Univ. of Maine, Orono.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 16, 2009).

Owen, Jr., R. B. 1977. American Woodcock (*Philohela minor* = *Scolopax minor* of Edwards 1974) Pages 149-186 *in* Management of migratory shore and upland game birds in North America. (Sanderson, G. C., Ed.) Intern. Assoc. Fish Wildl. Agencies, Washington, D.C.

Pursglove, S. 1992. Yesterday, today, and tomorrow (editorial). RGS Contents 4(4):6-7, 28-29.

Robertson, Jr., W. B. and G. E. Woolfenden. 1992. Florida bird species: an annotated list. Florida Ornithol. Soc., Spec. Publ. 6.

Sperry, C. C. 1940. Food habits of a group of shorebirds: woodcock, snipe, knot and dowitcher. U.S. Biol. Survey, Wildl. Res. Bull. 1.

Straw, J. A., D. G. Krementz, M. W. Olinde, and G. F. Sepik. 1994. American Woodcock. Pages 97-114 IN T.C. Tacha and C.E. Braun, editors. Migratory Shore and Upland Game Bird Management in North America. International Association of Fish and Wildlife Agencies, Washington, D.C.

***Sterna antillarum* - Least Tern**

Atwood, J. L. and P. R. Kelly. 1984. Fish dropped on breeding colonies as indicators of Least Tern food habits. Wilson Bull. 96:34-47.

Burger, J. 1984. Colony stability in Least Terns. Condor 86:61-67.

Burger, J. and M. Gochfeld. 1990a. Nest site selection in Least Terns (*Sterna antillarum*) in New Jersey and New York. Colon. Waterbirds 13:31-40.

Downing, R. L. 1973. A preliminary nesting survey of Least Terns and Black Skimmers in the East. Am. Birds 27:946-949.

Ganier, A. F. 1930. Breeding of the Least Tern on the Mississippi River. Wilson Bull. 42:103-107.

Jackson, J. A. 1976. Some aspects of the nesting ecology of Least Terns on the Mississippi Gulf coast. Mississippi Kite 6:25-34.

Massey, B. W. 1974. Breeding biology of the California Least Tern. Proc. Linn. Soc. N.Y. 72:1-24.

Sidle, J. G., J. J. Dinan, M. P. Dryer, J. P. Rumancik, Jr., and J. W. Smith. 1988. Distribution of the Least Tern in interior North America. Am. Birds 42:195-201.

Smith, J. W. and R. B. Renken. 1991. Least Tern nesting habitat in the Mississippi River Valley adjacent to Missouri. J. Field Ornithol. 62:497-504.

Thompson, Bruce C., Jerome A. Jackson, Joannna Burger, Laura A. Hill, Eileen M. Kirsch and Jonathan L. Atwood. 1997. Least Tern (*Sterna antillarum*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/290

***Sterna maxima* - Royal Tern**

Buckley, P. A. and Francine G. Buckley. 2002. Royal Tern (*Sterna maxima*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/700

***Sterna nilotica* - Gull-billed Tern**

Bogliani, G., M. Fasola, L. Canova, and N. Saino. 1990. Food and foraging rhythm of a specialized Gull-billed Tern population *Gelochelidon nilotica*. Ethol. Ecol. and Evol. 2:175-182.

Chaney, A. H., B. R. Chapman, J. P. Karges, D. A. Nelson, R. R. Schmidt, and L. C. Thebeau. 1978. Use of dredged material islands by colonial seabirds and wading birds in Texas. Tech. Rep. D-78-8. U.S. Army Engineer Waterways Exp. Stn. Vicksburg, MS

Erwin, R. M., T. B. Eyler, J. S. Hatfield, and S. McGary. 1998a. Diets of nestling Gull-billed Terns in coastal Virginia. Colonial Waterbirds 21(3):323-327.

Molina, K. C. 2009. The diets of nestling Gull-billed Terns at the Salon Sea, 2007 and 2008. Unpubl. report to Sonny Bono Salton Sea natl. Wildl. Refuge, Calipatria, CA.

Molina, K. C. and D. A. Marschalek. 2003. Foraging behavior and diet of breeding Western Gull-billed Terns (*Sterna nilotica vanrossemi*) in San Diego Bay, California. Species Conservation and Recovery Program Rep. 2008-01. California Department of Fish and Game, Habitat Conservation Planning Branch, Sacramento, CA.

Molina, K. C., J. F. Parnell and R. M. Erwin. 2009. Gull-billed Tern (*Sterna nilotica*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/140

Parnell, J. F. and R. F. Soots, Jr. 1979. Atlas of colonial waterbirds of North Carolina estuaries. UNC-SG-78-10, North Carolina State University, UNC Sea Grant, Raleigh, NC.

Portnoy, J. W. 1977. Nesting colonies of seabirds and wading birds-coastal Louisiana, Mississippi, and Alabama. FWS/OBS-77/07, U.S. Fish and Wildl. Serv. Biol. Serv. Progr. Washington, D.C.

Quinn, J. S. and D. A. Wiggins. 1990. Differences in prey delivered to chicks by individual Gull-billed Terns. Colonial Waterbirds 13(1):67-69.

Rohwer, S. A. and G. E. Woolfenden. 1968. The varied diet of the Gull-billed Tern (*Gelochelidon nilotica*). Wilson Bull. 80:330-331.

Schreiber, R. W. and E. A. Schreiber. 1978. Succession on dredged material islands in Florida. Report D-78-14. U.S. Army Engineer Waterways Exp. Stn. Vicksburg, MS

***Strix varia* - Barred Owl**

Applegate, R. D. 1975. Co-roosting of Barred Owls and Common Grackles. Bird-Banding 46: 169–170.

Bent, A. C. 1938. Life histories of North American birds of prey. Pt. 2. U.S. Natl. Mus. Bull. 170.

Devereux, J. G. and J. A. Mosher. 1984. Breeding ecology of Barred Owls in the central Appalachians. J. Raptor Res. 18: 49–58.

Dunstan, T. C. and S. D. Sample. 1972. Biology of Barred Owls in Minnesota. Loon 44: 111–115.

Elderkin, M. F. 1987. The breeding and feeding ecology of a Barred Owl *Strix varia* Barton population in Kings County, Nova Scotia. Master's thesis, Acadia Univ., Wolfville, NS.

Johnson, D. H. 1987. Barred owls and nest boxes—results of a five-year study in Minnesota. Pp. 129–134 *in* Biology and conservation of northern forest owls: symposium proceedings, 1987 February 3–7, Winnipeg, Manitoba (R. W. Nero, R. J Clark, R. J. Knapton and R. H. Hamre, eds.). Gen. Tech. Rep. RM-142. U.S. Dept. Agric., For. Serv., Rocky Mtn. For. and Range Exp. Stn., Fort Collins, CO.

Mazur, Kurt M. and Paul C. James. 2000. Barred Owl (*Strix varia*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/508

Nicholls, T. H. and M. R. Fuller. 1987. Territorial aspects of Barred Owl home range and behavior in Minnesota. Pp. 121–128 *in* Biology and conservation of northern forest owls: symposium proceedings, 1987 February 3–7, Winnipeg, Manitoba (R. W. Nero, R. J. Clark, R. J. Knapton and R. H. Hamre, eds.). Gen. Tech. Rep. RM-142. U.S. Dept. Agric., For. Serv., Rocky Mtn. For. and Range Exp. Stn., Fort Collins, CO.

Smith, D. G., A. Devine and D. Devine. 1983. Observations of fishing by a Barred Owl. J. Field Ornithol. 54: 88–89.

Soucy, J. L. J. 1976. Barred Owl nest. N. Am. Bird Bander 1: 68–69.

Takats, D. L. 1998. Barred Owl habitat use and distribution in the Foothills Model Forest. Master's thesis, Univ. of Alberta, Edmonton.

Wintering Bird References

***Actitis macularius* – Spotted Sandpiper**

Oring, Lewis W., Elizabeth M. Gray and J. Michael Reed. 1997. Spotted Sandpiper (*Actitis macularius*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/289.

Oring, L. W., J. M. Reed, J. A. R. Alberico, and R. C. Fleischer. 1993. Female control of paternity: more than meets the eye. Trends Ecol. Evol. 8:259.

Rubbelke, D. L. 1976. Distribution and relative abundance of potential prey of Spotted Sandpipers (*Actitis macularia* L.) on Little Pelican Island, Leech Lake, Cass Co., Minnesota. Master's thesis. Univ. of North Dakota, Grand Forks.

***Ajaia ajaia* - Roseate Spoonbill**

Dumas, Jeannette V. 2000. Roseate Spoonbill (*Platalea ajaja*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/490.

Hancock, J. A., J. A. Kushlann and M. P. Kahl. 1992. Storks, ibises and spoonbills of the world. Academic Press, San Diego, CA.

Haverschmidt, F. 1968. Birds of Surinam. Oliver & Boyd, Edinburgh, London.

***Ammodramus maritimus* – Seaside Sparrow**

Martin, A. C., H. S. Zim, and A. L. Nelson. 1951. American wildlife and plants. McGraw-Hill, New York.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Post, W. and J. S. Greenlaw. 1994. Seaside Sparrow (*Ammodramus maritimus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/127.

Werner, H. W. 1975. The biology of the Cape Sable Sparrow. Project completion report prepared for the U.S. Nat. Park Serv. Everglades Nat. Park, FL.

***Anas americana* – American Wigeon**

Bellrose, F. C. 1980. Ducks, geese and swans of North America. Stackpole Books, Harrisburg, PA.

Mowbray, Thomas. 1999. American Wigeon (*Anas americana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/401.

Wishart, R. A. 1983. The behavioral ecology of the American Wigeon (*Anas americana*) over its annual cycle. Ph.D. thesis. Univ. of Manitoba, Winnipeg.

Anas crecca - Green-winged Teal

Fredrickson, L. H. and M. E. Heitmeyer. 1988. Waterfowl use of forested wetlands of the southern United States: an overview. Pages 307-323 *in* Waterfowl in Winter. (Weller, M. W., Ed.) Univ. of Minnesota Press, Minneapolis.

Johnson, Kevin. 1995. Green-winged Teal (*Anas crecca*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/193.

Moison, G., R. I. Smith, and R. K. Martinson. 1967. The Green-winged Teal: its distribution, migration, and population dynamics. U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl. 100.

Nummi, P. 1993. Food-niche relationships of sympatric Mallards and Green-winged Teals. Can. J. Zool. 71:49-55.

Quinlan, E. A. and G. A. Baldassarre. 1984. Activity budgets of nonbreeding Green-winged Teal on playa lakes in Texas. J. Wildl. Manage. 48:838-845.

Anas discors – Blue-winged Teal

Bellrose, F. C. 1980. Ducks, geese, and swans of North America. 2nd ed. Stackpole Books, Harrisburg, PA.

Botero, J. E. and D. H. Rusch. 1994. Foods of Blue-winged Teal in two neotropical wetlands. Journal of Wildlife Management 58:561-565.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Rohwer, Frank C., William P. Johnson and Elizabeth R. Loos. 2002. Blue-winged Teal (*Anas discors*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/625.

***Anas platyrhynchos* – Mallard**

Drilling, Nancy, Rodger Titman and Frank Mckinney. 2002. Mallard (*Anas platyrhynchos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/658.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

***Anthus rubescens* - American Pipit**

Verbeek, N. A. and P. Hendricks. 1994. American Pipit (*Anthus rubescens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/095.

Bent, A. C. 1950. Life histories of North American wagtails, shrikes, vireos, and their allies. U.S. Natl. Mus. Bull. No. 197.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

***Aythya collaris*- Ring-necked duck**

American Ornithologists' Union (AOU). 1998. Check-list of North American birds. Seventh edition. American Ornithologists' Union, Washington, DC. 829 pp.

Hohman, William L. and Robert T. Eberhardt. 1998. Ring-necked Duck (*Aythya collaris*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/329.

Johnson, F. A. and F. Montalbano III. 1984. Selection of plant communities by wintering waterfowl on Lake Okeechobee, Florida. Journal of Wildlife Management. 48:174-178.

Mendall, H. L. 1958. Ring-necked Duck in the Northeast. Univ. of Maine Stud. no. 73, Orono.

Stiles, F. G. and A. F. Skutch. 1989. A guide to the birds of Costa Rica. Cornell University Press, Ithaca, New York, USA. 511 pp.

***Botaurus lentiginosus* - American Bittern**

Lowther, Peter, Alan F. Poole, J. P. Gibbs, S. Melvin and F. A. Reid. 2009. American Bittern (*Botaurus lentiginosus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/018.

Stevenson, H.M. and B.H. Anderson. 1994. Birdlife of Florida. University Press of Florida, Gainesville, Florida, USA

***Calidris alba* - Sanderling**

Connors, P. G., J. P. Myers, C. S. W. Connors and F. A. Pitelka. 1981. Interhabitat movements by Sanderlings in relation to foraging profitability and the tidal cycle. Auk 98: 49–64.

Macwhirter, Bruce, Peter Austin-Smith, Jr. and Donald Kroodsma. 2002. Sanderling (*Calidris alba*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/653.

Myers, J. P. 1979. Ecological control of spacing behavior in non-breeding shorebirds. Ph.D. diss., Univ. of California, Berkeley.

Myers, J. P. and L. P. Myers. 1979. Shorebirds of coastal Buenos Aires province, Argentina. Ibis 121: 186–200.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

***Calidris alpina* - Dunlin**

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Warnock, Nils D. and Robert E. Gill. 1996. Dunlin (*Calidris alpina*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/203.

***Calidris mauri* - Western Sandpiper**

Wilson, W. Herbert. 1994. Western Sandpiper (*Calidris mauri*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/090.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

***Calidris minutilla* - Least Sandpiper**

Ashmole, M. J. 1970. Feeding of Western and Semipalmated Sandpipers in Peruvian winter quarters. Auk 87:131-135.

Baker, M. C. and A. E. M. Baker. 1973. Niche relationships among six species of shorebirds on their wintering and breeding ranges. Ecol. Monog. 43:193-212.

Baldassarre, G. A. and D. H. Fischer. 1984. Food habits of fall migrant shorebirds on the Texas high plains. J. Field Ornithol. 55:220-229.

Burger, J. 1984. Abiotic factors affecting migrant shorebirds. Pages 1-72 *in* Shorebirds: migration and foraging behavior. Behavior of marine animals, vol. 6. (Burger, J. and B. L. Olla, Eds.) Plenum Press, New York.

Brooks, W. S. 1967. Food and feeding habits of autumn migrant shorebirds at a small midwestern pond. Wilson Bull. 79:307-315.

Colwell, M. A. and S. L. Landrum. 1993. Nonrandom shorebird distribution and fine-scale variation in prey abundance. Condor 95:94-103.

Couch, A. B. 1966. Feeding ecology of four species of sandpipers in western Washington. Master's Thesis. Univ. Washington, Seattle.

Gerstenberg, R. H. 1979. Habitat utilization by wintering and migrating shorebirds on Humboldt Bay, California. Pages 33-40 *in* Shorebirds in marine environments. Studies in avian biology, no. 2. (Pitelka, F. A., Ed.) Cooper Ornithol. Society, Lawrence, KS.

Grinnell, J. and R. Hunt. 1929. Notes on waterbirds at Morro Bay, California. Condor 31:62-73.

Hands, H. M., M. R. Ryan, and J. W. Smith. 1991. Migrant shorebird use of marsh, moist-soil, and flooded agricultural habitats. Wildl. Soc. Bull. 19:457-464.

Hilty, S. L. and W. L. Brown. 1986. A guide to the birds of Colombia. Princeton Univ. Press, Princeton, NJ.

Long, L. L. and C. J. Ralph. 2001. Dynamics of habitat use by shorebirds in estuarine and agricultural habitats in northwestern California. Wilson Bulletin 113(1):41-52.

Manning, T. H. 1952. Birds of the west James Bay and southern Hudson Bay coasts. Natl. Mus. Canada, Ottawa.

Morrison, R. I. G., R. K. Ross, and B. de Jong. 1989. The Guianas. Pages 167-177 *in* Atlas of nearctic shorebirds on the coast of South America. (Morrison, R. I. G. and R. K. Ross, Eds.) Can. Wildl. Service, Ottawa.

Mugica Valdes, L., M. Acosta Cruz, and D. Denis Avila. 2001. Temporal dynamic of the bird community associated with Sur del Jibaro rice culture. Revista Biologia (Havana) 15(2):86-97.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Nebel, Silke and John M. Cooper. 2008. Least Sandpiper (*Calidris minutilla*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/115.

Page, G. 1974. Molt of wintering Least Sandpipers. Bird-Banding 45:93-105.

Page, G. W., L. E. Stenzel, and C. M. Wolfe. 1979. Aspects of the occurrence of shorebirds on a central California estuary. Pages 15-32 *in* Shorebirds in marine environments. Studies in avian biology, no. 2. (Pitelka, F. A., Ed.) Cooper Ornithol. Society, Lawrence, KS.

Paulson, D. 1993. Shorebirds of the Pacific Northwest. UBC Press, Vancouver, BC.

Recher, H. F. and J. A. Recher. 1969. Some aspects of the ecology of migrant shorebirds II. Aggression. Wilson Bull. 81:140-154.

Robert, M., R. McNeil, and A. Leduc. 1989. Conditions and significance of night feeding in shorebirds and other waterbirds in a tropical lagoon. Auk 106:94-101.

Safran, R. J., C. R. Isola, M. A. Colwell, and O. E. Williams. 1997. Benthic invertebrates at foraging locations of nine waterbird species in managed wetlands of the northern San Joaquin Valley, California. Wetlands 17(3):407-415.

Skagen, S. K. and F. L. Knopf. 1994. Migrating shorebirds and habitat dynamics at a prairie wetland complex. Wilson Bull. 106:91-105.

Spaans, A. L. 1978. Status and numerical fluctuations of some North American waders along the Surinam coast. Wilson Bull. 90:60-83.

Spaans, A. L. 1979. Wader studies in Surinam, South America. Wader Study Group Bull. 25:32-37.

Thomas, B. T. 1987. Spring shorebird migration through central Venezuela. Wilson Bull. 99:571-578.

Veit, R. R. and L. Jonsson. 1984. Field identification of smaller sandpipers within the genus *Calidris* Am. Birds 38:853-876.

***Charadrius melodus* -Piping Plover**

Drake, K. R., J. E. Thompson, K. L. Drake, and C. Zonick. 2001. Movements, habitat use, and survival of nonbreeding Piping Plovers. Condor 103:259-267.

Elliott-Smith, Elise and Susan M. Haig. 2004. Piping Plover (*Charadrius melodus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/002.

Haig, S. M. and L. W. Oring. 1985. The distribution and status of the Piping Plover throughout the annual cycle. J. Field Ornithol. 56:334-345.

Johnson, C. M. and G. A. Baldassarre. 1988. Aspects of the wintering ecology of Piping Plovers in coastal Alabama. Wilson Bull. 100:214-233.

Mabee, T. J., J. H. Plissner, S. M. Haig, and J. P. Goossen. 2001. Winter distributions of North American plover in the Laguna Madre regions of Tamaulipas, Mexico and Texas, USA. Wader Study Group Bull. 94:39-43.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Nicholls, J. L. 1989. Distribution and other ecological aspects of Piping Plovers wintering along the Atlantic and Gulf coasts. M. S. thesis. Auburn Univ. Auburn, AL.

Nicholls, J. L. and G. A. Baldassarre. 1990. Habitat selection and interspecific associations of Piping Plovers wintering in the United States. Wilson Bull. 102:581-590.

Sprandel, G. L., J. A. Gore, and D. T. Cobb. 2000. Distribution of wintering shorebirds in coastal Florida. J. Field Ornithol. 71:708-720.

Wilkinson, P. M. and M. Spinks. 1994. Winter distribution and habitat utilization of Piping Plovers in South Carolina. Chat 58:33-37.

Zonick, C. A. 2000. he winter ecology of Piping Plovers (*Charadrius Melodus*) along the Texas Gulf Coast. Dissertation. Univ. Missouri, Columbia.

***Circus cyaneus* - Northern Harrier**

Bildstein, K. L. 1976. Behavior of wintering Northern Harriers (*Circus cyaneus hudsonius*) and other raptorial birds at communal roosts in south-central Ohio. Master's Thesis. Ohio State Univ. Columbus.

Bildstein, K. L. 1979b. Fluctuations in the number of Northern Harriers (*Circus cyaneus hudsonius*) at communal roosts in south central Ohio. Raptor Res. 13:40-46.

Bildstein, K. L. 1987. Behavioral ecology of Red-tailed Hawks (*Buteo jamaicensis*), Rough-legged Hawks (*Buteo lagopus*), Northern Harriers (*Circus cyaneus*), and American Kestrels (*Falco sparverius*) in south central Ohio. Ohio Biol. Surv. Biol. Notes 18.

Bildstein, K. L. 1988. Northern Harrier *Circus cyaneus*. Pages 251-303 *in* Handbook of North American birds. Vol. 4 (Palmer, R. S., Ed.) Yale Univ. Press, New Haven, CT.

Bosakowski, T. 1983. Density and roosting habits of Northern Harriers wintering in the Hackensack meadowlands. Rec. New Jersey Birds 9:50-54.

Christiansen, D. A. and S. E. Reinert. 1990. Habitat use of the Northern Harrier in a coastal Massachusetts shrubland with notes on population trends in southeastern New England. J. Raptor Res. 24:84-90.

Collopy, M. W. and K. L. Bildstein. 1987. Foraging behavior of Northern Harriers wintering in southeastern salt and freshwater marshes. Auk 104:11-16.

Linner, S. C. 1980. Resource partitioning in breeding populations of Marsh Hawks and Short-eared Owls. Master's Thesis. Utah State Univ. Logan.

Macwhirter, R. Bruce and Keith L. Bildstein. 1996. Northern Harrier (*Circus cyaneus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/210.

Preston, C. R. 1990. Distribution of raptor foraging in relation to prey biomass and habitat structure. Condor 92:107-112.

Temeles, E. J. 1986. Reversed sexual size dimorphism: effect on resource defense and foraging behaviors of nonbreeding Northern Harriers. Auk 103:70-78.

***Cistothorus palustris* - Marsh Wren**

Kroodsma, Donald E. and Jared Verner. 1997. Marsh Wren (*Cistothorus palustris*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/308.

Stevenson, H. M. and B. H. Anderson. 1994. The birdlife of Florida. Univ. Press of Florida, Gainesville.

Verner, J. 1965b. Time budget of the male Long-billed Marsh Wren during the breeding season. Condor 67:125-139.

***Cistothorus platensis* - Sedge Wren**

Herkert, James R., Donald E. Kroodsma and James P. Gibbs. 2001. Sedge Wren (*Cistothorus platensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/582.

Mcnair, D. B. 1998. Henslow's Sparrow and Sedge Wren response to a dormant-season prescribed burn in a pine savanna. Fla. Field Nat. 26: 46–47.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Schramm, P., D. S. Schramm and S. G. Johnson. 1986. Seasonal phenology and habitat selection of the Sedge Wren *Cistothorus platensis*in a restored tallgrass prairie. Proc. N. Am. Prairie Conf. 9: 95–99.

Sprunt, A., Jr. 1954. Florida bird life. Coward-McCann, Inc., New York.

Walkinshaw, L. R. 1935. Studies of the Short-billed Marsh Wren (*Cistothorus stellaris*) in Michigan. Wilson Bull. 52: 361–368.

***Euphagus carolinus* - Rusty Blackbird**

Avery, Michael L. 1995. Rusty Blackbird (*Euphagus carolinus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/200.

Meanley, B. 1995. Some foods of the Rusty Blackbird in the Great Dismal Swamp region. Raven 66:9-10.

Neff, J. A. and B. Meanley. 1952. Experiences in banding blackbirds in eastern Arkansas. Bird-Banding 23:154-157.

Robinson, J. C. 1990. An annotated checklist of the birds of Tennessee. Univ. of Tennessee Press, Knoxville.

Robbins, Jr., S. D. 1991. Wisconsin birdlife. Univ. of Wisconsin Press, Madison.

Rosenberg, K. V., R. D. Ohmart, W. C. Hunter, and B. W. Anderson. 1991. Birds of the lower Colorado River valley. Univ. of Arizona Press, Tucson.

Sibley, D. 1993. Birds of Cape May. New Jersey Audubon Soc. Cape May Point, NJ.

***Gallinago delicata* -Wilson's Snipe**

Mueller, Helmut. 1999. Wilson's Snipe (*Gallinago delicata*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/417.

Tuck, L. M. 1972. The snipes: a study of the genus *Capella*. Can. Wildl. Ser. Monogr. Ser., No. 5.

***Hylocichla mustelina* - Wood Thrush**

Bertin, R. I. 1977. Breeding habitats of the Wood Thrush and Veery. Condor 79:303-311.

Holmes, R. T. and S. K. Robinson. 1988. Spatial patterns, foraging tactics, and diets of ground-foraging birds in a northern hardwoods forest. Wilson Bull. 100:377-394.

James, F. C., R. F. Johnston, N. O. Wamer, G. J. Niemi, and W. J. Boecklen. 1984. The Grinnellian niche of the Wood Thrush. Am. Nat. 124:17-47.

Laughlin, S. B. and D. P. Kibbe. 1985. The atlas of breeding birds of Vermont. Univ. Press of New England, Hanover, NH.

Longcore, J. R. and R. E. Jones. 1969. Reproductive success of the Wood Thrush in a Delaware woodlot. Wilson Bull. 81:396-406.

Noon, B. R. 1981. The distribution of an avian guild along a temperate elevational gradient; the importance and expression of competition. Ecol. Monogr. 51:105-124.

Robbins, C. S., D. K. Dawson, and B. A. Dowell. 1989. Habitat area requirements of breeding forest birds of the middle Atlantic states. Wildl. Monogr. 103:1-34.

Robbins, Jr., S. D. 1991. Wisconsin birdlife. Univ. of Wisconsin Press, Madison.

Robertson, Jr., W. B. and G. E. Woolfenden. 1992. Florida bird species: an annotated list. Fla. Ornithol. Soc. Spec. Publ. no. 6.

Roth, R. R. 1987. Assessment of habitat quality for Wood Thrush in a residential area. Pages 139-149 *in* Integrating man and nature in the metropolitan environment. (Adams, L. W. and D. L. Le, Eds.) Natl. Inst. Urban Wildl. Columbia, MD.

Roth, R. R., M. S. Johnson and T. J. Underwood. 1996. Wood Thrush (*Hylocichla mustelina*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology;

Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/246.

Simons, T. and G. Farnsworth. 1996. Evaluating Great Smoky Mountains National Park as a population source for Wood Thrush. 1995 Annual Report. Natl. Biol. Surv. Raleigh, NC.

Weinberg, H. J. 1994. Impact of forest size and landscape urbanization on a Neotropical migrant, the Wood Thrush. Master's Thesis. Univ. of Delaware, Newark.

Willis, E. O. 1966. The role of migrant birds at swarms of army ants. Living Bird 5:187-231.

***Larus delawarensis* -Ring-billed Gull**

Kirkham, I. R. and R. D. Morris. 1979. Feeding ecology of Ring-billed Gull (*Larus delawarensis*) chicks. Can. J. Zool. 57:1086-1090.

Ryder, John P. 1993. Ring-billed Gull (*Larus delawarensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/033.

***Limnodromus griseus* -Short-billed Dowitcher**

Jehl, Jr., Joseph R., Joanna Klima and Ross E. Harris. 2001. Short-billed Dowitcher (*Limnodromus griseus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/564.

***Limnodromus scolopaceus* - Long-billed Dowitcher**

Cogswell, H. L. 1977. Water birds of California. Univ. of California Press, Berkeley.

Kessel, B. 1989. Birds of the Seward Peninsula, Alaska. Univ. of Alaska Press, Fairbanks.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Pitelka, F. A. 1950. Geographic variation and the species problem in the shorebird genus *Limnodromus*. Univ. Calif. Publ. Zool. 50: 1–108.

Sperry, C. C. 1940. Food habits of a group of shorebirds: woodcock, snipe, knot and dowitcher. U.S. Dep. Int., Wildl. Resour. Bull. no. 1.

Stevenson, H. M. and B. H. Anderson. 1994. The birdlife of Florida. Univ. of Florida Press, Gainesville.

Takekawa, John Y. and Nils Warnock. 2000. Long-billed Dowitcher (*Limnodromus scolopaceus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/493.

***Lophodytes cucullatus* - Hooded Merganser**

Barbour, D. B. and A. R. DeGrange. 1982. Communal roosting in wintering Hooded Mergansers. J. Field Ornithol. 53:279-280.

Bellrose, F. C. 1976. Ducks, geese and swans of North America. 2 ed. Stackpole Books, Harrisburg, PA.

Dugger, B. D., K. M. Dugger and L. H. Fredrickson. 2009. Hooded Merganser (*Lophodytes cucullatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/098.

Root, T. 1988. Atlas of wintering North American birds: an analysis of Christmas bird count data. Univ. Chicago Press, Chicago, IL.

Sibley, D. 1993. The birds of Cape May. New Jersey Audubon Society, Cape May Point, NJ.

Veit, R. R. and W. R. Petersen. 1993. Birds of Massachusetts. Massachusetts Audubon Society, Lincoln.

***Melospiza georgiana* - Swamp Sparrow**

Howell, S. N. G. and S. Webb. 1995. A guide to the birds of Mexico and northern Central America. Oxford Univ. Press, New York.

James, D. A. and J. C. Neal. 1986. Arkansas birds their distribution and abundance. Univ. of Arkansas Press, Fayetteville.

Mowbray, Thomas B. 1997. Swamp Sparrow (*Melospiza georgiana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/279.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Rising, J. D. 1996. A guide to the identification and natural history of the sparrows of the United States and Canada. Academic Press, San Diego.

Root, T. 1988. Atlas of wintering North American birds: an analysis of Christmas bird count data. Univ. Chicago Press, Chicago, IL.

Stevenson, H.M. and B.H. Anderson. 1994. *Birdlife of Florida*. University Press of Florida, Gainesville, Florida, USA.

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

Fraser, G. S. 1994a. Feeding and nesting behaviors of the Forster's Tern on Lake Osakis, Minnesota. M.S. thesis, North Dakota State Univ., Fargo.

Fraser, G. S. 1994b. Possible predation of a Forster's Tern chick by a snapping turtle. Prairie Nat. 26: 33–35.

Fraser, G. S. 1997. Feeding ecology of Forster's Terns on Lake Osakis, Minnesota. Colon. Waterbirds 20: 87–94.

Mcnicholl, M. K. 1971. The breeding biology and ecology of Forster's Tern (*Sterna forsteri*) at Delta, Manitoba. M.Sc. thesis, Univ. of Manitoba, Winnipeg.

Mcnicholl, M. K. 1984. Food and feeding behaviour of Forster's Terns. Colon. Waterbird Group Newsl. 8(3): 28.

Mcnicholl, Martin K., Peter E. Lowther and John A. Hall. 2001. Forster's Tern (*Sterna forsteri*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/595.

Reed, J. M. 1985. Relative energetics of two foraging behaviors of Forster's Terns. Colon. Waterbirds 8: 79–82.

Salt, G. W. and D. E. Willard. 1971. The hunting behavior and success of Forster's Tern. Ecology 52: 989–998.

Stevenson, H. M. and B. H. Anderson. 1994. The birdlife of Florida. Univ. of Florida Press, Gainesville.

***Tachycineta bicolor* - Tree Swallow**

Beal, F. E. L. 1918. Food habits of the swallows, a family of valuable native birds. U.S. Dept. Agric. Bull. 619.

Hausman, L. A. 1927. On the winter food of the Tree Swallow (*Iridoprocne bicolor*) and the Myrtle Warbler (*Dendroica coronata*). Am. Nat. 61:379-382.

Place, A. R. and E. W. Stiles. 1992. Living off the wax of the land: bayberries and Yellow-rumped Warblers. Auk 109:334-345.

Robertson, R. J., B. J. Stutchbury and R. R. Cohen. 1992. Tree Swallow (*Tachycineta bicolor*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/011.

***Tringa flavipes* - Lesser Yellowlegs**

Bannerman, D. A. 1961. The birds of the British Isles. Vol 9. Oliver & Boyd, Edinburgh, Scotland.

Canales, A. G. 1996. Migratory bird activity in the bay of Lake Titicaca, Puno, Peru. Int. Wader Stud. 8: 62.

Cramp, S. and K. E. L. Simmons. 1983. Handbook of the birds of Europe, the Middle East and North Africa: the birds of the western Palearctic. Vol. 3. Oxford Univ. Press, Oxford.

Meyer De Schauensee, R. and W. H. Phelps, Jr. 1978. A guide to the birds of Venezuela. Princeton Univ. Press, Princeton, NJ.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Oberholser, H. C. 1974. Bird life of Texas. Vol. 1. (E. B. Kincaid Jr., ed.). Univ. of Texas Press, Austin.

Semenchuk, G. P. 1992. The atlas of breeding birds of Alberta. Fed. of Alberta Nat., Edmonton.

Small, A. 1994. California birds: their status and distribution. Ibis Publ. Co., Vista, CA.

Stone, W. 1937. Bird studies at old Cape May: an ornithology of coastal New Jersey. Delaware Valley Ornithol. Club, Philadelphia, PA.

Taylor, D. M., C. H. Trost and B. Jamison. 1992. Abundance and chronology of migrant shorebirds in Idaho. West. Birds 23: 49–78.

Tibbitts, T. Lee and William Moskoff. 1999. Lesser Yellowlegs (*Tringa flavipes*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/427.

Weber, M. J., P. A. Vohs, Jr. and L. D. Flake. 1982. Use of prairie wetlands by selected bird species in South Dakota. Wilson Bull. 94: 550–554.

Wunderle, J. M., Jr., R. B. Waide and J. Fernandez. 1989. Seasonal abundance of shorebirds in the Jobos Bay estuary in southern Puerto Rico. J. Field Ornithol. 60: 329–339.

***Tringa melanoleuca* - Greater Yellowlegs**

Elphick, Chris S. and T. Lee Tibbitts. 1998. Greater Yellowlegs (*Tringa melanoleuca*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.lp.hscl.ufl.edu/bna/species/355.

Gill, Jr., R. and P. D. Jorgensen. 1979. A preliminary assessment of timing and migration of shorebirds along the north central Alaska Peninsula. Stud. Avian Biol. 2:113-124.

Hayes, F. E. and J. A. Fox. 1991. Seasonality, habitat use, and flock sizes of shorebirds at the Bahia de Asunción, Paraguay. Wilson Bull. 103:637-649.

Hicklin, P. W. 1987. The migration of shorebirds in the Bay of Fundy. Wilson Bull. 99:540-570.

Meyer De Schauensee, R. and W. H. Phelps, Jr. 1978. A guide to the birds of Venezuela. Princeton Univ. Press, Princeton, NJ.

Morrison, R. I. G. and R. K. Ross. 1989. Atlas of Nearctic shorebirds on the coast of South America. Can. Wildl. Serv. Ottawa.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: July 18, 2009).

Recher, H. F. 1966. Some aspects of the ecology of migrant shorebirds. Ecology 47:393-407.

Spaans, A. L. 1978. Status and numerical fluctuations of some North American waders along the Suriname coast. Wilson Bull. 90:60-83.

Veit, R. R. and W. R. Petersen. 1993. Birds of Massachusetts. Massachusetts Audubon Society, Lincoln, MA.

Mammal References

***Castor Canadensis* - Beaver**

Allen, A. W. 1982. Habitat suitability index models: Beaver. United States Department of the Interior. Fish and Wildlife Services. FWS/OBS-82/10.30. 20 pp.

"Beaver" Wildlife in Connecticut: Informational Series. http://www.ct.gov/dep/lib/dep/wildlife/pdf_files/outreach/fact_sheets/beaver.pdf Date accessed: July 8 2009.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

***Eptesicus fuscus* - Big Brown Bat**

Barbour, R. W., and W. H. Davis. 1969. Bats of America. The University of Kentucky Press, Lexington, Kentucky.

Kurta, A. 1995. *Mammals of the Great Lakes Region*. Ann Arbor: The University of Michigan Press

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Patterson, B.D., G. Ceballos, W. Sechrest, M.F. Tognelli, T. Brooks, L. Luna, P. Ortega, I. Salazar, and B.E. Young. 2003. Digital Distribution Maps of the Mammals of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA.

Schmidly, D. J. 1991. The bats of Texas. Texas A & M Univ. Press, College Station. 188 pp.

***Lasionycteris noctivagans* - Silver-haired Bat**

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: July 9, 2009.

***Lasiurus borealis* - Eastern Red Bat**

Constantine, D. G. 1958. Ecological observation on Lasiurine bats in Georgia. J. Mamm., 39:64-70.

Constantine, D. G. 1959. Ecological observation on Lasiurine bats in the North Bay area of California. J. Mamm., 40:13-15.

Constantine, D. G. 1966. Ecological observations on Lasiurine bats in Iowa. J. Mamm., 47:34-41.

Kunz, T. H. 1971. Reproduction of some vespertilionid bats in central Iowa. American Midlland Nat., 86:477-486.

Mammalian Species. *Lasiurus borealis.* Karl A. Shump, Jr. and Ann U. Shump. Published 18, June 1982. American Society of Mammalogists.

McClure, H.E. 1942. Summer activities of bats (genus Lasiurus) in Iowa. Jour. Mamm. 23(4):430-434.

Mumford, R. E. 1973. Natural history of the red bat (*Lasiurus borealis*) in Indiana. Period. Biol., 75:155-158.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Ross, A. 1967. Ecological aspects of the food habits on insectivorous bats. Proc. Western Found. Vert. Zool., 1:204-263.

Schmidly, D. J. 1991. The bats of Texas. Texas A & M Univ. Press, College Station. 188 pp.

***Lasiurus cinereus* - Hoary Bat**

InfoNatura: Animals and Ecosystems of Latin America. 2007. Version 5.0 . Arlington, Virginia (USA): NatureServe. Available: http://www.natureserve.org/infonatura. Date accessed: July 10, 2009.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

***Lasiurus seminolus* - Seminole Bat**

Barbour, R. W., and W. H. Davis. 1969. Bats of America. University Press Kentucky, Lexington, 286 pp.

Constantine, D. 1958. Ecological observation of lasiurine bats in Georgia. *Journal of Mammalogy*, 39: 64-70.

Constantine, D. 1965. Ecological observation of lasiurine bats in Iowa. *Journal of Mammalogy*, 47: 34-41.

Ivey, R. D. 1959. The Mammals of Palm Valley, Florida. Journal of Mammology. 40:585-591.

Jennings, W. L. 1958. The Ecological Distribution of Bats in Florida. Unpubl. Ph.D. dissert., University of Florida, Gainesville, 126pp.

Laerm, J., B.J. Freeman, L. J. Vitt, J. M. Meyers, and L.Logan. 1980. Vertebrates of the Okefenokee Swamp. Brimleyana, 4:47-73.

Menzel, M., T. Carter, B. Chapman, J. Laerm. 1998. Quantitative comparison of tree roosts used by red bats and seminole bats. Canadian Journal of Zoology, 76(4): 630-634.

Moore, J.C. 1949. Putnam County and other Florida mammal notes. J. Mamm.,30:57-66.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: July 17, 2009.

Sherman, H.B. 1935. Food habits of the Seminole bat. J. Mamm.,16:224.

Wilkins, Kenneth T. 1987. Mammalian Species. *Lasiurus seminolus*. Published 27 February 1987. The American Society of Mammalogists. No. 280:1-5.

Zinn, T. L. 1977. Community ecology of Florida bats with emphasis on *Myotis austroriparius*. Unpublished M.S. thesis, University of Florida, Gainesville, 88pp.

***Lutra canadensis* - River Otter**

Boyle, S. 2006. North American River Otter (*Luntra canadensis*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. http://www.fs.fed.us/r2/projects/scp/assessments/northamericanriverotter.pdf Date accessed: July 7, 2009.

Hill, Edward P. 1994. The Handbook: Prevention and Control of Wildlife Damage. Internet Center for Wildlife Damage. c:108-112 Species Profile: River Otter. Environmental Protection Agency. http://www.epa.gov/region1/ge/thesite/restofriver/reports/final_era/B%20-%20Focus%20Species%20Profiles/EcoRiskProfile_river_otter.pdf. Date accessed: July 7, 2009.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

***Lynx rufus* - Bobcat**

―Bobcat". MyFWC.com. Florida Fish and Wildlife Conservation Commission. http://myfwc.com/WILDLIFEHABITATS/SpeciesInfo_Bobcat.htm Date accessed: July 10, 2009

Mallow, Tim. Bobcats, Corridors and the Eastern Florida Flatwoods Ecoregion. Coryi Organization. www.coryi.org/ecoregion.html. Date accessed: July 7, 2009.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Myotis grisescens - Gray Bat

Kentucky Bat Working Group, 1999. "Gray Bat" (On-line). Accessed November 2, 2001 at http://www.biology.eku.edu/bats/graybat.htm.

Lacki, M. J., L. S. Burford, and J. O. Whitaker, Jr. 1995. Food habits of gray bats in Kentucky. Journal of Mammalogy 76:1256-1259.

LaVal, R. K., R. L. Clawson, M. L. LaVal, and W. Caire. 1977. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. J. Mamm. 58:592-599.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: July 17, 2009.

Patterson, B.D., G. Ceballos, W. Sechrest, M.F. Tognelli, T. Brooks, L. Luna, P. Ortega, I. Salazar, and B.E. Young. 2003. Digital Distribution Maps of the Mammals of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA.

Tuttle, M. 1986. "Endangered Gray Bat Benefits From Protection" (On-line). http://www.batcon.org/batsmag/v4n4-1.html. Date accessed: July 9, 2009

U.S. Fish and Wildlife Service Division of Endangered Species, 1991. "Gray Bat" (On-line). Accessed November 2, 2001 at http://endangered.fws.gov/i/a/saa4l.html.

U.S. Fish and Wildlife Service, 1992. "Gray Bat in North Carolina" (On-line). Accessed November 2, 2001 at http://nc-es.fws.gov/mammal/graybat.html.

U.S. Fish and Wildlife Service, 1997. "Gray Bat" (On-line). November 2, 2001 at http://midwest.fws.gov/endangered/mammals/grbat_fc.html.

Myotis lucifugus - Little Brown Bat

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: July 9, 2009.

Patterson, B.D., G. Ceballos, W. Sechrest, M.F. Tognelli, T. Brooks, L. Luna, P. Ortega, I. Salazar, and B.E. Young. 2003. Digital Distribution Maps of the Mammals of the Western Hemisphere, version 1.0. NatureServe, Arlington, Virginia, USA.

Whitaker, J.O. Jr., and B. Lawhead. 1992. Foods of *Myotis lucifugus* in a maternity colony in Central Alaska. J. Mammology. 73(3):646-648.

Neofiber alleni – Round Tailed Muskrat

Birkenholz, Dale E. 1972. *Neofiber alleni*. Mammalian Species. 15:1-4.

Layne, J. N., editor. 1978. Rare and endangered biota of Florida. Vol. 1. Mammals. State of Florida Game and Freshwater Fish Commission. xx + 52 pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Round Tailed Muskrat. Field Guide to the Rare Animals of Florida. Florida Natural Areas Inventory. http://www.fnai.org/FieldGuide/pdf/Neofiber_alleni.pdf Date accessed: July 9, 2009

Neotoma floridana - Eastern Woodrat

Bunch Mar, S. Miller, and D. Webster. Eastern Woodrat. http://www.dnr.sc.gov/cwcs/pdf/easternwoodrat.pdf. Date accessed: July 9, 2009

―Eastern Woodrat." The Mammals of Texas-Online Edition. http.hsrl.ttu.edu/tmot1/ochrnutt.html. Date accessed: July 9, 2009.

Golley, F. B. 1962. Mammals of Georgia. University of Georgia Press, Atlanta, Georgia. 218 pp.

Hamilton, W. J., Jr., and J. O. Whitaker, Jr. 1979. Mammals of the eastern United States. Cornell Univ. Press, Ithaca, New York. 346 pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Pearson, P. G. 1952. Observations concerning the life history and ecology of the wood rat NEOTOMA FLORIDANA FLORIDANA (Ord). Journal of Mammalogy 33:459-63.

Schwartz, C. W., and E. R. Schwartz. 1981. The wild mammals of Missouri. University of Missouri Press, Columbia. 356 pp.

Neovison vison lutensis - Mink

Humphrey, S. R., and H. W. Setzer. 1989. Geographic variation and taxonomic revision of mink (*Mustela vison*) in Florida. J. Mamm. 70(2):241-252.

Layne, J. N., editor. 1978. Rare and endangered biota of Florida. Vol. 1. Mammals. State of Florida Game and Freshwater Fish Commission. xx + 52 pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

***Ochrotomys nuttalli* - Golden Mouse**

–Golden Mouse.” The Mammals of Texas-Online Edition. http.hsrl.ttu.edu/tmot1/ochrnutt.html. Date accessed: July 9 2009.

Hofman, Joyce E. and J.E. Gardener. 1986. A limited survey for the occurrence of the golden mouse (Ochrotomys nuttailli) and the marsh rice rat (*Oryzomys palustris* within the TR 88A Project Area, Bay Creek, Pope County, Illinois. Final Report. Bureau of Locations and Environment. Illinois Department of Transportation. Springfield, Illinois.

Linzey, Donald W. 1968. An ecological study of the Golden mouse, *Ochrotomys nuttalli*, in the Great Smokey Mountains Park. American Midland Naturalist. 79: 320-345.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

***Oryzomys palustris* - Marsh Rice Rat**

Hofman, Joyce E. and J.E. Gardener. 1986. A limited survey for the occurrence of the golden mouse (*Ochrotomys nuttailli*) and the marsh rice rat (*Oryzomys palustris* within the TR 88A Project Area, Bay Creek, Pope County, Illinois. Final Report. Bureau of Locations and Environment. Illinois Department of Transportation. Springfield, Illinois.

Kruchek, Beth. 2004. Use of tidal marsh and upland habitats by the marsh rice rat. Journal of Mammology. 85(3):569-575.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Negus, N.C., E. Gould, and R.K. Chapman. 1961. Ecology of the rice rat, Oryzomys palutris (Harlan) on Breton Island, Gulf of Mexico, with a critique on the social stress theory.Tulane Stud. Zool. 8:93-123

***Procyon lotor* - Raccoon**

Armstrong, D. M. 1975. Rocky Mountain mammals. Rocky Mountain Nature Asscoc., Inc. 174 pp.

Dewey, T. and R. Fox. 2001. "*Procyon lotor*" (On-line), Animal Diversity Web. http://animaldiversity.ummz.umich.edu/site/accounts/information/Procyon_lotor.html. Date accessed: July 09, 2009

Goldman, Edward A. 1950. Raccoons of North America. North American Fauna 60. United States. Government Printing Office. Washington D.C.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Raccoon-Procyon lotor. 2002. Western North Carolina Nature Center. http://www.wildwnc.org/education/animals/raccoon-procyon-lotor. Date accessed: July 10, 2009.

*Sorex longirostris* - Southeastern Shrew

French, Thomas M. 1980. *Sorex longirostris*. Mammalian Species. 143:1-3.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

*Sylvilagus palustris* - Marsh Rabbit

Chapman, Joseph A. and Gale R. Willner. 1981. ―Sylvilagus palustris." Mammalian Species. 153:1-3

Handley, C. O., Jr. 1991. Mammals. Pages 539-616 in K. Terwilliger, coordinator. Virginia's endangered species: proceedings of a symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Thompson, L. and S. Frost. 2008. "*Sylvilagus palustris*" (On-line), Animal Diversity Web.http://animaldiversity.ummz.umich.edu/site/accounts/information/Sylvilagus_palustris.html . Date accessed: July 08, 2009

*Ursus americanus* - Black Bear

Maehr, D. S., and J. B. Wooding. 1992. Florida black bear URSUS AMERICANUS FLORIDANUS. Pages 265-275 in S. R. Humphrey, editor. Rare and endangered biota of Florida. Vol. I. Mammals. Univ. Press of Florida, Gainesville. xviii + 392 pp.

Maehr, David S., T Hoctor, L. Quinn, and J. Smith. Black Bear Habitat Management Guidelines for Florida. 2001. Technical Report No. 17. Florida Fish and Wildlife Conservation Commission. Tallahassee, Florida, USA.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. Date accessed: June 30, 2009.

Tankersley Roger. 1996. Black Bear Habitat in the Southeastern United States: A Biometric Model of Habitat Conditions in the Southern Appalachians. University of Tennessee.

Wooding, J. B., and T. S. Hardisky. 1992. Denning by black bears in northcentral Florida. J. Mammalogy 73:895-898.

Appendix I

ERPs Used to Develop Future Land Use GIS Layer for the Matanzas Project Area

Project Name	Application#	Date Issued
Southwood Phase III	40-109-28456-7	Jun. 2004
Southwood Phase IV	40-109-28456-9	Feb. 2008
Deerfield Meadows	40-109-95374-1	Oct. 2007
Watson Woods Unit 2	40-109-28637-3	Nov. 2007
Cobblestone Prof Park	40-109-84097-2	Mar. 2008
Deerchase	42-109-107336-2	Jun. 2008
Sea View Landings	40-109-103312-1	Aug. 2006
Gateway to St. Johns	4-109-97981-2	Dec. 2007
Twin Lake Property	40-109-90773-3	Nov. 2005
Treaty Oaks Phase 1, 2	4-109-104797-1	Nov. 2006
Coquina Crossing Phase 3	40-109-28510-13	Jun. 2005
South Shore Plaza	42-109-102446-1	Mar. 2006
The Villages of Valencia	4-109-96559-1	May 2006
Chelsea Woods	40-109-28437-6	Aug. 2005
Cypress Lakes Phase 5	40-109-21387-15	Apr. 2004
Confederate State Fish Pond	4-109-105392-2	Feb. 2009
St. Augustine Lakes	4-109-91940-4	Feb. 2007
Double Bridges	4-109-82540-1	Jun. 2002
Our Lady of Hope Community	40-109-99195-1	Mar. 2009
State Road 207 aka Old Field	4-109-105858-2	Jan. 2008
First Coast Dist Center	42-109-109327-1	Apr. 2007
Terra Pines	4-109-92922-2	Sep. 2008
Dupont Center	40-109-88683-1	Aug. 2005
Deerfield Preserve	40-109-101310-1, 2	Mar. 2006
Coastal Site Borrow Pit	4-109-21593-2	Sep. 2004
Morgan’s Cove	4-109-107476-2	Dec. 2007
Peppertree Town Center	40-109-102634-1	Apr. 2006
Good News Church	40-109-76002-2	Nov. 2008
Ind. Complex at St. Aug	40-109-110361-1	Nov. 2008
Makarios South	40-109-116287-1, 2	Oct. 2008
Stonebridge Oaks	40-109-102450-2	Aug. 2007
NLS Warehousing	40-109-103181-1	Jun. 2007
Jabrad Borrow Pit	4-109-105378-1	Nov. 2006
Forest Oaks	42-109-102456-1	Aug. 2006
Haupt Center	40-109-103557-1	Apr. 2006
Hammock Dunes Phase 1	40-035-18433-35	Mar. 2009
Matanzas Shores	4-035-18442-8	Dec. 2005
Hammock Landing	4-035-101955-1	Sep. 2007
Palm Coast Park Tracks 18,20	4-035-102595-4	Apr. 2008
Hewitts Saw Mill Park	40-035-112351-1	Sep. 2007
Sawmill Creek	4-035-102595-5	Jan. 2008
Castello del Lago	4-035-104307-1	Jun. 2007
Palm Coast Fire Station #24	40-035-115381-1	Jun. 2008
Beach Haven	40-035-99654-1	Jun 2005
Costa Trans Warehouse	40-035-106617-1	Nov. 2008
Belle Terre Parkway Exp	4-035-18518-8	Sep. 2007
Old Hammock Cove Condo	40-035-103203-1	Apr. 2006
Edwards S/D at Palm Coast	40-035-99299-1	Jan. 2006