

**A Species Action Plan for the
Eastern Chipmunk
*Tamias striatus***

September 26, 2018



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EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) developed this plan as a component of Florida's Imperiled Species Management Plan (FWC 2016). In 2015, the FWC convened a biological review group (BRG) to reassess the status of the eastern chipmunk (*Tamias striatus*) using criteria specified in Rule 68A-27.001, Florida Administrative Code (F.A.C.). The BSR concluded that the eastern chipmunk does not meet state listing criteria, and FWC staff recommends that the species be removed from the Florida Endangered and Threatened Species List; these findings are published in a Biological Status Review report (BSR, FWC 2015).

The goal of this plan is to maintain or improve the conservation status of the eastern chipmunk so that the species will not again need to be listed on the Florida Endangered and Threatened Species List. The following objectives were designed to achieve this goal:

- I. Ensure the statewide population of the eastern chipmunk is stable or increasing.
- II. Develop a more complete understanding of the specific habitat requirements of the eastern chipmunk in Florida and incorporate this information into habitat management guidelines for public conservation lands.
- III. Determine the significant factors affecting chipmunk population persistence in Florida.

This plan establishes strategies and actions that act as a framework to conservation and recovery of the eastern chipmunk in Florida. The implementation of this plan will require the cooperation of local governments; regional, state, and federal agencies; non-governmental organizations; business interests; academic institutions; and the public. Although this plan was developed by FWC in collaboration with stakeholders, it cannot be successfully implemented without significant direct involvement of these agencies, non-governmental organizations, and the public.

This plan details the actions necessary to maintain the conservation status of the osprey in Monroe County. A summary of this plan is included in Florida's Imperiled Species Management Plan (ISMP), in satisfaction of the management plan requirements in Rule 68A-27, F.A.C., Rules Relating to Endangered or Threatened Species. The ISMP addresses comprehensive management needs for Florida's imperiled species and includes an implementation plan; regulatory framework; relevant policies; anticipated economic, ecological, and social impacts; projected costs of implementation; and a revision schedule. Achieving the objectives of the ISMP depends heavily on stakeholder input and partner support.

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GLOSSARY OF TERMS AND ACRONYMS

Area of occupancy (AOO): The area within its extent of occurrence (See Extent of Occurrence), which is occupied by a taxon, excluding cases of vagrancy. This reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats (as defined by IUCN).

BRG: Biological Review Group, a group of taxa experts convened to assess the biological status of taxa using criteria specified in Rule 68A-27, F.A.C., and following the protocols in the Guidelines for Application of the International Union for Conservation of Nature (IUCN) Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List of Categories and Criteria (Version 8.1).

BSR: Biological status review report, the summary of the biological review group's findings. Includes a Florida Fish and Wildlife Conservation Commission (FWC) staff recommendation on whether or not the species status meets the listing criteria in Chapter 68A-27.001, Florida Administrative Code. These criteria, based on IUCN criteria and IUCN guidelines, are used to help decide if a species should be added or removed from the Florida Endangered or Threatened Species List. In addition, FWC staff may provide within the report a biologically justified opinion that differs from the criteria-based finding.

Clinal gradation: A continuous variation in form between members of the same species having a wide variable geographical or ecological range.

Conspecifics: Pertaining to another organism (such as an animal) of the same species.

Dorsoventrally: Relating to, involving, or extending along the axis joining the dorsal (top) and ventral (bottom) sides.

Estrus: The phase of the reproductive cycle when the female is sexually receptive.

Extent of occurrence (EOO): The geographic area encompassing all observations of individuals of a species, including intervening areas of unoccupied habitat. Synonymous with range. See Also Area of Occupancy (as defined by IUCN).

F.A.C.: Florida Administrative Code. The Department of State's Administrative Code, Register and Laws Section is the filing point for rules promulgated by state regulatory agencies. Agency rulemaking is governed by Chapter 120, Florida Statutes, the Administrative Procedures Act. Rules are published in the Florida Administrative Code.

FNAI: Florida's Natural Areas Inventory

FWC: The Florida Fish and Wildlife Conservation Commission, the state agency legally mandated to protect and manage Florida's native fish and wildlife resources.

GIS: Geographic Information System

ISMP: [Florida's Imperiled Species Management Plan](#)

IUCN: International Union for Conservation of Nature, a professional global conservation network.

IUCN Red List: (IUCN Red List of Threatened Species) An objective, global approach for evaluating the conservation status of plant and animal species, the goals of which are to: Identify and document those species most in need of conservation attention if global extinction rates are to be reduced; and provide a global index of the state of change of biodiversity.

Refugia: Refuge or hideaway used as protection from predators and harsh weather.

Species Focal Area: An area containing features (such as unique subpopulation units or habitat types) important to the long-term conservation of the species, as identified in Species Conservation Measures and Permitting Guidelines.

Torpor: A state of decreased physiological activity in an animal, usually characterized by a reduced body temperature and rate of metabolism.

INTRODUCTION

Biological Background

Taxonomy

The eastern chipmunk (*Tamias striatus*; hereafter, chipmunk) comprises 11 subspecies ranging from Canada to Louisiana and portions of northern Florida (Snyder 1982, Thorington et al. 2012). Chipmunks in Florida are typically included in the *T. s. pipilans* subspecies, in the southern most portion of the species range (Louisiana, Mississippi, Alabama, Georgia, and Florida; Snyder 1982; but see Jones and Suttkus 1979). The *T. striatus* subspecies are considered to be separated only by clinal gradation (Snyder 1982, Whitaker and Hamilton 1998). No obvious barriers to movement are known that may isolate *T. s. pipilans* in Florida. Therefore, it is likely that chipmunks in Florida are neither isolated nor endemic (Winchester and Gore 2015).

Description

The eastern chipmunk is a small ground squirrel weighing around 80 to 125 g (2.8 to 4.4 oz) with prominent black and white lateral stripes (Snyder 1982, [Figure 1](#)). Total body length measures between 22.5 and 26.8 cm (8.9 and 10.6 in), with a tail length between 7.2 and 10.1 cm (2.9 and 4 in) (Snyder 1982). A set of light and dark facial stripes borders the prominent eyes. The dorsoventrally flattened tail is well-haired but not bushy (Snyder 1982). Internal cheek pouches are large and particularly noticeable when filled with food items (Snyder 1982).

Life History

The eastern chipmunk typically inhabits deciduous forests that contain numerous observation posts and abundant crevice refugia (Snyder 1982). Preferred habitat in Florida is hardwood hammock and mixed hardwood-pine forests having oaks as the dominant species, especially in areas where those habitats are associated with mixed wetland forests along or near streams and rivers (Gore 1990, Winchester and Gore 2015). The eastern chipmunk is not evenly distributed across its range in the northwestern portion of the Florida panhandle, and much of the deciduous forest habitat that appears suitable remains unoccupied (Gore 1990, Winchester and Gore 2015). Multiple, secure refuges from predators (e.g., rock crevices) are expected to be important resources for individual chipmunks within their home ranges, along with elevated sites (e.g., downed logs) that provide a good view of the surrounding area (Snyder 1982). Chipmunks also may occur in urban, residential areas where hardwood trees, artificial refugia (e.g., under porches or sheds, or in rock walls), and supplemental food resources (e.g., bird feeders) are available (Ryan and Larson 1976, Yahner 1978, Winchester and Gore 2015).

The eastern chipmunk lives in solitary, dispersed territories (Yahner 1978). Individuals are active during the day, mostly within 15 m (49 ft) of a burrow (Yahner 1978, Snyder 1982). Burrows are separated from each other by an average of 35 m (114.8 ft) and core areas are intensely defended against conspecifics (Yahner 1978).



Figure 1. Photo of an eastern chipmunk taken by a Florida Fish and Wildlife Conservation Commission camera trap on 9 October 2012 in Blackwater River State Forest. This photo was taken during the pilot study by Winchester and Gore (2015) in which they evaluated the effectiveness of camera traps, track tubes (pictured behind the chipmunk), and live traps to detect chipmunks.

Density varies geographically and over time, ranging from 0.3 to 37.6 individuals per 1 ha (2.5 ac) (Yerger 1953). Winchester and Gore (2015) estimated the total chipmunk population in Florida is between 3,618 (their occupancy data) and 19,728 (extrapolating Yerger's [1953] minimum density estimate). Adult breeding female density is probably determined by the availability of food resources, while male density seems to be dependent on female density (Galloway and Boonstra 1989).

Forest clear-cutting may have no significant effect on eastern chipmunk densities or age structure, if essential resource needs are met, but forest fragmentation decreases chipmunk survival rates (Mahan and Yahner 1998, Nupp and Swihart 1998). In areas of fragmented forest habitat, chipmunk density decreases with patch size and chipmunks may become absent when patches are not well connected to other forested areas by corridors of suitable habitat (Rosenblatt et al. 1999, Reunanen and Grubb 2004).

Eastern chipmunk females breed once or twice a year in the spring and/or summer (Snyder 1982). Estrus lasts only a short period of time during which males intensively guard access to females (Yahner 1978). Litter size averages between 4 and 5 individuals, and juveniles emerge at 5 to 7 weeks old, at which time they are self-reliant (Yahner 1978, Snyder 1982). Most juveniles

disperse to a new residence within 2 weeks of first emergence. Individuals usually become sexually mature after their first winter and average life expectancy is 1.3 years (Snyder 1982). In the northern part of their range, chipmunks spend most of their time underground in various degrees of torpor from late fall to early spring, but in favorable weather they sometimes appear above ground (Snyder 1982). This annual cycle of torpor seems to be inherent to the biology of the chipmunk rather than determined by ambient temperature, and juveniles tend to delay the onset of torpor longer than adults (as reviewed in Snyder 1982). It is unclear whether the species undergoes seasonal torpor in the southern part of its range. Stevenson (1962) believed the eastern chipmunk was inactive in winter in Florida, but Jones and Suttkus (1979) observed or collected individuals throughout the year. Food items (e.g., seeds, nuts, and acorns) for overwinter survival are cached in burrow systems (Snyder 1982).

Geographic Range and Distribution

The eastern chipmunk ranges from Canada, in the southeastern corner of Saskatchewan eastward to the Gulf of St. Lawrence, and then southward nearly to the Gulf of Mexico (Snyder 1982, [Figure 2](#)). Along the southern edge of its range, the eastern chipmunk occurs in a few parishes in eastern Louisiana near the Mississippi River; throughout much of Mississippi and Alabama, in northwestern Georgia, and in a small portion of northwest Florida (Snyder 1982). The eastern chipmunk's historical range in Florida is unknown, but its current range is restricted to the area west of the Apalachicola River, in general between Interstate Highway 10 and the Alabama state line (Snyder 1982, Gore 1990, Winchester and Gore 2015).



Figure 2. Range of the eastern chipmunk. From the Smithsonian Natural History Museum.

Based on data collected between 1986 and 1988, Gore (1990) estimated the chipmunk's Florida range at approximately 1,230 km² (475 mi²) spread over 3 areas, encompassing portions of Escambia, Santa Rosa, Okaloosa, Walton, and Holmes counties and centered on the upper reaches of the Yellow, Blackwater, Escambia, and Choctawhatchee Rivers. The extent of occurrence (EOO) was previously estimated to be 4,429 km² (1,710 mi², FWC 2011), but Winchester and Gore (2015) determined the EOO for the chipmunk is 6,566 km² (32% larger than the 2011 estimate) and extends across 6 counties (adding Jackson county to those identified previously). The new EOO includes prior locations along with areas where chipmunks were considered previously absent or

unconfirmed including Milton, Crestview, and southern areas of Black Water River State Forest (Winchester and Gore 2015, [Figure 3](#)). However, Winchester and Gore (2015) were clear in attributing the increase to “results from our more effective methods, particularly the web-based survey, rather than a real increase in EOO.”

Chipmunks likely do not occur in all suitable habitat throughout the EOO (Gore 1990, Winchester and Gore 2015; [Figure 3](#)). The area of occupancy (AOO) is estimated to be 657.6

km² (253.9 mi²), of which 95.5 km² (36.8 mi²) occurs on public lands and 562.1 km² (217.0 mi²) on private lands (Winchester and Gore 2015).

Conservation History

The eastern chipmunk was first documented in Florida in Okaloosa County by Stevenson (1962), who detected them at several locations within a 5 km² (2 mi²) area near the Alabama border. Based on the small size of the known distribution, chipmunks were considered rare by the Florida Committee on Rare and Endangered Plants and Animals (Jones 1978), and the Florida Game and Fresh Water Fish Commission (predecessor to the Florida Fish and Wildlife Conservation Commission [FWC]) listed the chipmunk as a Species of Special Concern (Wood 1988).

Research by Gore (1990) expanded the known distribution of chipmunks to areas along the upper reaches of the Escambia, Blackwater, Yellow, and Choctawhatchee Rivers. However, that apparent increase in range was believed to be the result of a broader sampling effort rather than a real expansion of range (Gore 1990). Based on the observed distribution, the chipmunk population in Florida was described as locally and unevenly distributed, but not declining in size (Gore 1989). However, Gore (1989) recommended that the status of Species of Special Concern be retained since estimated range in Florida was small and the statewide population size was uncertain.

No targeted conservation measures were undertaken for the eastern chipmunk in Florida between 1990 and 2010. Land acquisition programs may have protected areas of hardwood hammock, or similar habitat within conservation lands that is valuable for chipmunks, though it is unknown how this may have affected the statewide population.

In 2010, FWC convened a Biological Review Group (BRG) to assess the status of the chipmunk in Florida using listing criteria established by FWC in Chapter 68A-27 of the Florida Administrative Code. The Biological Status Review report (BSR) produced by the 2010 BRG concluded that the chipmunk should remain a Species of Special Concern until more current data on range, the EOO, the AOO, and total population size in Florida could be collected and used to more completely evaluate chipmunk status against the listing criteria (FWC 2011). In 2013, FWC completed the original Species Action Plan for the Eastern Chipmunk to guide research efforts by identifying specific objectives aimed at determining the status of the chipmunk population in Florida.

The 2010 BRG concluded from the biological assessment that the eastern chipmunk did not meet any listing criteria. However, peer reviewers expressed concern that the primary data available for making this evaluation were not sufficient for the assessment; specifically, that much of the available information was more than 10 years old. In consideration of the peer review, staff recommended listing the eastern chipmunk as a Species of Special Concern until more data could be collected to address the identified information gaps (FWC 2011).

In 2015, Winchester and Gore (2015) completed research that effectively addressed the data needs identified by the BRG. Winchester and Gore (2015) conducted surveys to determine where chipmunks occur in Florida and then used those data to expand the range of the chipmunk in

Florida. They estimated the EOO is 32% larger than the EOO of 4,429 km² estimated for the Biological Status Review that was based on 1990 data (FWC 2011). This research also produced a more reliable measure of the AOO and found “no indication of extreme fluctuations in chipmunk [population] numbers” in Florida (Winchester and Gore 2015). As a result, this new information, the eastern chipmunk was removed from Florida’s Threatened and Endangered Species List in 2017 (FWC 2017).

In 2018, the FWC staff developed [Species Conservation Measures and Permitting Guidelines](#) (FWC 2018) for the eastern chipmunk to further inform the public on measures that may benefit the species during project planning and other activities.

Threats and Recommended Listing Status

Threats

The eastern chipmunk does not meet any criteria for listing (FWC 2015). However, there are ongoing threats that may affect the chipmunk in the future. The chipmunk depends on quality hardwood hammock and/or mixed hardwood-pine forests having oaks as the dominant species, typically along or near streams west of the Apalachicola River (Gore 1990, Winchester and Gore 2015). Because of this habitat specificity, major threats to the chipmunk include loss and degradation of habitat caused by fragmentation and conversion to other uses. Threats in urbanized areas also include increased rates of mortality from predation by feral and domestic cats (Winchester and Gore 2015).

Recommended Listing Status

The eastern chipmunk is listed as a species of Least Concern (LC) by the International Union for Conservation of Nature (IUCN) because it is widespread, abundant, and subject to no major threats (Linzey and Hammerson 2008). In 2017, the eastern chipmunk was removed from the Florida Endangered and Threatened Species List. The change in listing status was informed by research (Winchester and Gore 2015) that filled data gaps on the population status, species range, and occupancy of available suitable habitat within the EOO (the AOO). Data collected by Winchester and Gore (2015) showed the eastern chipmunk does not meet criteria for listing as a State-Threatened species.

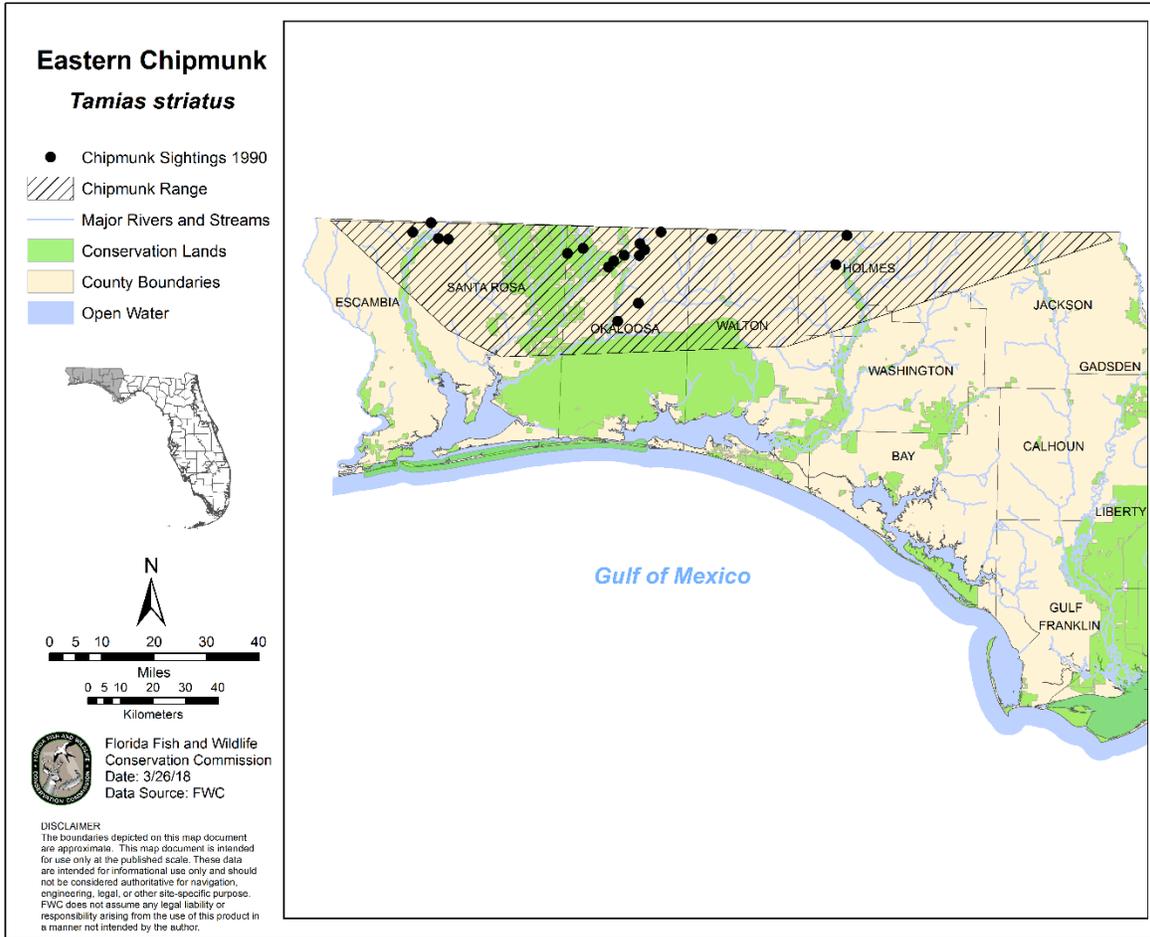


Figure 3. Estimated geographic range, or extent of occurrence (EOO), of the eastern chipmunk in Florida. This EOO is based on data from Winchester and Gore (2015).

CONSERVATION GOALS AND OBJECTIVES

Goal

The conservation status of the eastern chipmunk is maintained or improved so that the species will not again need to be listed on the Florida Endangered and Threatened Species List.

Objectives

I. Ensure the statewide population of the eastern chipmunk is stable or increasing.

Rationale

Estimates of the eastern chipmunk's population size in Florida by Winchester and Gore (2015) were based on occupancy data and extrapolations of published minimum densities of chipmunks. To achieve the conservation goal for this species, it is important to prevent further fragmentation of available chipmunk habitat, and maintain or increase the statewide population. While local abundance may fluctuate, the statewide population should be monitored to detect potential threats and to inform management in local areas. Reliable and effective management techniques combined with development of improved population estimation tools will make it possible to ensure the statewide population is stable, even if localized declines occur in some areas.

II. Develop a more complete understanding of the specific habitat requirements of the eastern chipmunk in Florida and incorporate this information into habitat management guidelines for public conservation lands.

Rationale

In Florida, most suitable habitat for the chipmunk is categorized as oak-dominated hardwood hammock or mixed hardwood-pine forests (Gore 1990, Winchester and Gore 2015). The eastern chipmunk in Florida may have more specialized microhabitat needs than their northern counterparts as much of the potentially suitable habitat is unoccupied within the EOO (Gore 1990, Winchester and Gore 2015). A better understanding of factors affecting habitat use by the eastern chipmunk at finer spatial scales will enable biologists to accurately determine which sites will be occupied by chipmunks. Information on habitat use will also improve management actions to benefit chipmunks.

III. Determine the significant factors that affect chipmunk population persistence in Florida.

Rationale

There are questions about the extent to which immigration of individuals from Alabama affects the distribution, abundance, and persistence of chipmunks on sites where they occur in Florida. To address those questions, a long-term study is necessary. The effects of patch size, habitat quality, habitat fragmentation, and rates of predation also should be examined. Further, climate change may impact persistence through changes in forest structure and the distributions of trees and other plants (Greller 1980, Crumpacker et al. 2001).

CONSERVATION ACTIONS

The following sections describe the conservation actions that will make the greatest contribution toward achieving the conservation objectives. Actions are grouped by category (e.g., Habitat Conservation and Management, Population Management). The Conservation action table ([Table 1](#)) provides information on action priority, urgency, identified partners, and leads for implementation.

Habitat Conservation and Management

The eastern chipmunk inhabits both natural and developed habitats. In Florida, optimal habitats for the chipmunk include oak-dominated hardwood hammock or mixed hardwood-pine forests, often in association with mixed wetland forests along or near streams and rivers (Gore 1990, Winchester and Gore 2015). Developed habitats occupied by chipmunks include urbanized lands such as residential areas where refuge sites are abundant and there are sufficient food resources, including mast-producing trees occur (Ryan and Larson 1976, Winchester and Gore 2015).

Winchester and Gore (2015) found that presence of hardwood hammock habitat is one of the most significant factors determining chipmunk occurrence in Florida. They also found stream length important to determining chipmunk presence. But they believed chipmunks were selecting hardwood forests, which occur along streams, rather than selecting streams. Chipmunks may be more locally abundant in patches of upland hardwood forest that occur in close proximity to mixed wetland forest along streams and rivers (Winchester and Gore 2015). Both total area of upland hardwood forest habitat and the connectivity of those suitable habitat patches are important for long-term persistence (Rosenblatt et al. 1999).

The following actions are identified based on known habitat needs of the chipmunk, and they address the threats of habitat loss and remaining information gaps. Implementing these actions is important to maintain or improve the conservation status of the chipmunk.

Habitat Conservation

Action 1 Identify priority conservation areas (Species Focal Areas) throughout the chipmunk’s Florida range to ensure protection of habitats with the greatest potential to benefit the species.

Action 2 Maintain, enhance, and encourage habitat connectivity to promote movement of individuals among patches of suitable habitat.

The BSR identifies habitat loss and fragmentation as primary threats to the chipmunk (FWC 2015). Identifying Species Focal Areas for the eastern chipmunk will help ensure habitat management and restoration are focused on key areas considered essential for the species’ survival in Florida. Maintaining high-quality areas of habitat will reduce the threat of habitat loss and help secure long-term population viability. Providing necessary connectivity of key habitats throughout the chipmunk’s Florida range will further enhance conservation of the species. Given potential climate-related environmental changes, habitat restoration and long-term management should encourage natural colonization of unoccupied habitats and include areas that provide connectivity and long-term stability. Long-term management should incorporate existing habitat conservation programs and incentive programs ([Actions 11](#) and [13](#)) whenever possible.

Habitat Management

Action 3 Develop habitat management guidelines and monitoring recommendations for public land managers and private landowners.

Land managers need to have a clear understanding of appropriate habitat management strategies for chipmunks. Managers can make adaptive management decisions with information attained through monitoring. On public or private lands managed for conservation, management plans should incorporate objectives for hardwood hammock and mixed pine-hardwood forest habitats into management plans. Management plans should also incorporate strategies to prevent prescribed burns from encroaching into upland hardwood hammock and mixed hardwood-pine forest areas, especially where upland hardwood forest occurs near mixed wetland-forest along streams and rivers. Identifying areas where upland hardwood forest can be restored or re-established as habitat or corridor areas for chipmunks is also important. Additional information on the impact of forest management on naturally occurring hardwood forest may be required.

Many of Florida's imperiled species evolved within habitats that historically burned on a regular basis by lightning-caused wildfire or people. In the absence of fire, habitat structure and plant communities change, resulting in a change in the wildlife species using the area. As such, proper use of prescribed fire can be key to managing some of Florida's imperiled species. Along with numerous partners and stakeholders, FWC promotes the use of prescribed fire on public and private lands. However, for chipmunks, fire suppression is important to maintain the quality of existing hardwood hammock forest and to create additional habitat by promoting the growth of fire-intolerant broadleaf trees. These considerations should be addressed with public and private land managers so that areas may be managed to meet multiple conservation objectives without conflict.

Population Management

No specific actions have been identified for population management. Predation is not believed to limit population size or density, so predator control would not be recommended unless a problem is identified. Most predation is expected to be opportunistic. Predators include raptors (e.g., red-shouldered hawks [*Buteo lineatus*] and barred owls [*Strix varia georgica*]), bobcats (*Lynx rufus*), coyotes (*Canis latrans*), foxes (*Vulpes* spp.), and, in urbanized areas, domestic cats.

Monitoring and Research

The study by Winchester and Gore (2015) addressed known data gaps, however ongoing monitoring at regular intervals is needed to ensure the chipmunk population in Florida remains stable over time. Population persistence also needs examination to understand factors affecting trends over time. Given that latitude is the best predictor of chipmunk occurrence (Winchester and Gore 2015), it is important to document latitudinal changes in chipmunk distribution over time, should they occur. Further, incorporating new landcover data as they become available (e.g., Florida Cooperative Land Cover, Version 3.2 (FWC-FNAI 2016) will improve understanding of how habitat management and land-use changes affect occupancy and occurrence. The following actions are designed to refine information on chipmunk population status, distribution, and potential habitat changes.

Action 4 Generate additional information on factors limiting chipmunk range in Florida.

Action 5 Assess factors that affect the long-term persistence of chipmunks in the areas where they occur.

Action 6 Evaluate the effects of forest management and development on chipmunk habitat over time.

Winchester and Gore (2015) documented latitude, longitude, streams, and hardwood hammock land-cover as important predictors of chipmunk occurrence, but only latitude and hardwood hammock parameters were statistically significant. Correlations with latitude and longitude indicate chipmunks are more abundant farther west and farther north in the panhandle. Also, trap camera data showed a positive relationship between the amount of mixed wetland-forest within 250 m (820 ft) of a camera and detection probability. To identify additional factors affecting chipmunk occurrence, site attribute data on forest structure and composition, soil properties and hydrology would likely be required (Winchester and Gore 2015). Well-drained burrow sites may be important for food storage, and access to secure refuge sites may minimize predation (Rosenblatt et al. 1999). Access to elevated sites (e.g., downed logs) that provide a view of the surrounding area (Snyder 1982) may also be important determinants of habitat quality.

To better understand the factors that determine persistence of chipmunks on sites where they occur in Florida, a long-term study is necessary. The effects of patch size, habitat quality, habitat fragmentation, and rates of predation should also be studied. Further, it is important to understand whether Florida's chipmunk population is dependent upon immigration of individuals from Alabama. To accurately determine the extent to which immigration from Alabama may affect the distribution and abundance of chipmunks in Florida, long-term data is required.

Action 7 Monitor chipmunks in a subset of geographic areas at regular intervals to assess population status and trends.

It will be important to determine whether the statewide chipmunk population is stable or increasing over time. Because it is difficult to precisely estimate the abundance of chipmunks due to their secretive nature (Gore 1990, Winchester and Gore 2015), total population size can be estimated using occupancy data. Therefore, range-wide monitoring is not necessary to evaluate population status.

Rule and Permitting Intent

This section identifies the current regulations addressing conservation of the eastern chipmunk and discusses some of the potential issues with protections and the development of appropriate permitting guidelines.

Current Protections and Regulations

Because chipmunks can be rare in Florida, the loss of individuals may impact the viability of local groups of individuals. Upon removal from listing under Rule 68A 27.005(2)(d), F.A.C., (Designation of Species of Special Concern; Prohibitions; Permits), the eastern chipmunk retained protections specified in Rule 68A-4.001, F.A.C. (General Prohibitions). This rule states

that “no wildlife or freshwater fish or their nests, eggs, young, homes or dens shall be taken, transported, stored, served, bought, sold, or possessed in any manner or quantity at any time except as specifically permitted by these rules nor shall anyone take, poison, store, buy, sell, possess or wantonly or willfully waste the same except as specifically permitted by these rules.” Permits are issued through Rule 68A-9.002, F.A.C. for “scientific, educational, exhibition, propagation, management or other justifiable purposes.”

Protections and Permitting Considerations

The BSR (FWC 2015) concludes that the chipmunk does not meet any criteria for listing, and staff recommended that the species be removed from the Florida Endangered and Threatened Species List. However, the chipmunk still faces threats from habitat loss, habitat degradation, and fragmentation. To meet the goal of this plan, some protections are still needed. Chipmunks are not classified as a game species, and maintaining their non-game status may contribute to achieving the goal of this plan. Additionally, personal possession should be restricted to a level that does not conflict with the conservation goal; allowing no more than 1 individual to be kept as a personal pet may help to prevent commercial exploitation. Taxidermy is prohibited for non-game wildlife, including for the chipmunk.

Action 8 Implement appropriate levels of protection needed to achieve conservation goals for the eastern chipmunk and revise rules as needed to achieve those protections.

As stated above, some protections are still needed to maintain or improve the status of the statewide chipmunk population. Protections should be implemented to protect chipmunks and their habitat from known threats that may impact population trend.

Action 9 Improve conditions included with any FWC-issued scientific collecting permits for chipmunks.

The FWC may issue permits authorizing direct and intentional take of the eastern chipmunk, including for scientific collecting. Permit conditions should be clarified to include the reporting of specific information to FWC, including date, location (including global positioning system [GPS] coordinates if possible), and habitat type information. Permit conditions also could require that if incidental mortality occurs, chipmunk specimens be provided for further study and deposit in the Florida Museum of Natural History. This would allow FWC to gather additional data on distribution and habitat use. Scientific collecting permits may also be issued for activities that produce educational benefits to better inform the public and thus benefit species conservation.

Law Enforcement

FWC’s Division of Law Enforcement and law enforcement partners from other agencies are responsible for enforcing Florida’s wildlife and fisheries laws. Law enforcement is an essential component of the protections that are integral to achieving the goals and objectives of this plan (and other imperiled species’ plans).

Action 10 Implement a training program to provide information to FWC and other law enforcement officers on identification of and protections relevant to the eastern chipmunk.

Coordination with the FWC's Division of Law Enforcement is necessary so officers are aware of the status and rules regarding chipmunks. Officers on the ground not only ensure the enforcement of conservation laws, but also educate the public on how to identify and report violations. Biological staff, species experts, and land managers, in coordination with other partners, can provide appropriate information to law enforcement officers. The [Species Conservation Measures and Permitting Guidelines for the Eastern Chipmunk](#) (FWC 2018) will expand awareness of current rules and permitting recommendations, and also explain the biological context of current protections. In addition to training, law enforcement input may be needed to improve awareness and compliance with F.A.C. rules.

Incentives and Influencing

Action 11 Develop or enhance existing incentive programs to benefit the chipmunk on public and private lands.

An essential component of effective chipmunk conservation will be to encourage managers of conservation lands within the range of the chipmunk to account for the chipmunk when developing and implementing land management plans. Habitat management that emphasizes maintaining or improving habitat quality for the chipmunk on public and private conservation lands is essential to keep this species off the Florida Endangered and Threatened Species List. Efforts to inform land managers about the habitat needs of the chipmunk are important. Encouraging management that supports a stable or increasing population of chipmunks in Florida will help to achieve the goal of this plan.

More than 80% of potential chipmunk habitat is on private lands (Winchester and Gore 2015). Encouraging appropriate habitat management on these lands through technical assistance, development and dissemination of habitat management guidelines, and financial support will help ensure the long-term survival of this species. The FWC's Landowner Assistance Program and other state and federal programs provide technical and financial assistance to private landowners who conduct wildlife management practices on their lands.

Education and Outreach

Education and outreach to public agencies and the private sector is important to meet the goal of this plan. Citizens who are well informed regarding needs of and potential benefits of wildlife species and their habitats are more likely to support these efforts. Public observations on chipmunk occurrence and human-related mortality are important to achieving the actions in this plan.

Action 12 Update and distribute information on chipmunk range, natural history, and threats.

To increase awareness of wildlife and their habitats in Florida, information on basic biology and habitat needs should be kept current and made available. The FWC maintains a species profile for the eastern chipmunk online, and the Species Action Plan Summary (a single-page overview published in Florida's Imperiled Species Management Plan) contains important information as well. Additionally, the Species Conservation Measures and Permitting Guidelines provide information on the actions that can benefit the species and how to avoid or minimize impacts.

Chipmunks are associated with hardwood hammock forests in northwest Florida, especially in areas near rivers and streams; resources that guide management of these natural communities should also be maintained.

Action 13 Support inclusion of the chipmunk in the FWC iNaturalist site to solicit and record public-generated eastern chipmunk sightings in Florida.

Citizen scientist involvement has been beneficial for monitoring and documenting potential shifts in the chipmunk distribution in Florida (Winchester and Gore 2015). Once the public learns of the need for observation records and understands how to provide that information, they can begin contributing data. Citizen-scientist data can be a resource to improve conservation efforts and add to our knowledge of this species.

A citizen science program for the eastern chipmunk should include:

- Training on how to access the website and submit data on the project page.
- Photographs of eastern chipmunks and a description of identifying characteristics and behavioral traits.
- Descriptions of high-quality habitat for chipmunks and habitat management recommendations to develop and maintain that habitat.

Action 14 Develop and disseminate basic education materials to the public with information on the impacts to wildlife from outdoor or free-ranging cats.

This action is intended to engage the public in practices and behaviors that will benefit the health and safety of both people and wildlife.

Coordination with Other Entities

No specific actions have been identified for this section; however, many actions in this plan will require coordination between multiple agencies, universities, and other organizations.

Continued communication among staff within FWC and with external land management partners can support improved conditions for chipmunks in Florida. Management on private lands may be crucial for successful conservation of this species. The FWC's Land Owner Assistance Program and Land Use Planning process can provide technical assistance and management guidelines. Coordination with other permitting agencies will help to avoid or minimize loss by providing them with recommended management guidelines and habitat conditions to help minimize and mitigate negative impacts on chipmunks that may arise through land use conversion and loss.

Local governments maintain public lands within their jurisdictions that may contain habitat for the eastern chipmunk. These protected areas, managed or unmanaged, may provide valuable habitat for chipmunks. Ensuring these lands are accessible for monitoring and research activities will also produce valuable information for conservation of the eastern chipmunk.

Table 1. Eastern chipmunk conservation action table.

NOTE: An explanation of acronyms used is below the table.

Objective(s) Addressed	Team Assigned Priority Level	Action Number	Action	Conservation Action Category	Status	Implementation leads: FWC divisions or sections	External partners	Likely Effectiveness	Feasibility	Urgency: Is the action immediately critical to the species' survival?
I, II, III	2	1	Identify priority conservation areas (Species Focal Areas) throughout the chipmunk's Florida range to ensure protection of habitats with the greatest potential to benefit the species.	Habitat Conservation & Mgmt	NEW	FWRI, HSC	TNC, FFS, FPS, WMDs	High - Identifying SFAs for the eastern chipmunk will help ensure habitat management and restoration are focused.	Moderate - depends on interests and coordination among partners to rank areas as SFAs.	No - no evidence of dire threats to chipmunk populations.
I, II, III	2	2	Maintain, enhance, and encourage habitat connectivity to promote movement of individuals among patches of suitable habitat.	Habitat Conservation & Mgmt	NEW	WHM, CPS, SCP	TNC, FFS, FPS, WMDs	High- Providing necessary connectivity of key habitats throughout the range of the chipmunk will further enhance conservation of the species.	Moderate- This action requires coordination among partners to maintain, enhance, and encourage habitat connectivity. Feasibility of coordination increases when areas are prioritized (Action 1).	No - no evidence of dire threats to chipmunk populations.
I, II, III	2	3	Develop habitat management guidelines and monitoring recommendations for public land managers and private landowners.	Habitat Conservation & Mgmt	NEW	WHM, CPS, SCP	TNC, FFS, FPS, WMDs	High - Management guidelines and monitoring recommendations implemented on public and private lands will help to effectively conserve chipmunk habitat.	High - will depend on interest and coordination among partners to develop guidelines and recommendations	No - no evidence of dire threats to chipmunk populations.
I, II, III	3	4	Generate additional information on factors limiting chipmunk range in Florida.	Monitoring & Research	NEW	FWRI, HSC	University of Florida or other research institutes	High - Understanding factors that determine chipmunk presence will help to effectively conserve chipmunks and facilitate improved management guidelines.	Moderate - depends on interest and funding	No - no evidence of dire threats to chipmunk populations.
I, II, III	3	5	Assess factors that affect the long-term persistence of chipmunks in the areas where they occur.	Monitoring & Research	NEW	FWRI, HSC	University of Florida or other research institutes	High - Monitoring will help aid in the persistence of these populations.	Moderate - Camera stations can be effective in mentoring EACH, but require extensive effort for data management and analysis. Depends on interest and coordination among staff.	No - no evidence of dire threats to chipmunk populations.

Table 1. Eastern chipmunk conservation action table.

Objective(s) Addressed	Team Assigned Priority Level	Action Number	Action	Conservation Action Category	Status	Implementation leads: FWC divisions or sections	External partners	Likely Effectiveness	Feasibility	Urgency: Is the action immediately critical to the species' survival?
I, II, III	3	6	Evaluate the effects of forest management and development on chipmunk habitat over time.	Monitoring & Research	NEW	WHM, CPS, SCP	TNC, FFS, FPS, WMDs	High - Understanding factors that determine chipmunk presence will aid in improving management.	Moderate - depends on funding and coordination among partners	No - no evidence of dire threats to chipmunk populations.
I, II, III	1	7	Monitor a subset of known chipmunk populations as regular intervals to assess population status and trends.	Monitoring & Research	NEW	FWRI, HSC	University of Florida or other research institutes	High - Understanding local trends will help inform population status. Secondary information such as habitat or management associations that impact a population subset can help increase the success of management and conservation of this species.	Moderate - Use of cameras within a subset of the population for monitoring at regular intervals requires minimal effort in the field. However, data processing and analysis is much more intensive and will depend on interest and staff resources. This information could provide rapid information on the presence/absence of EACH in target areas.	No - no evidence of dire threats to chipmunk populations.
I, II, III	1	8	Implement appropriate levels of protection needed to achieve conservation goals for the eastern chipmunk and revise rules as needed to achieve those protections.	Protections & Permitting	NEW	HSC, SCP		Moderate - permitting will help prevent intention take or exploitation. Information gained from scientific collection permits can increase knowledge.	High - Pending approval by FWC Commissioners	No - no evidence of dire threats to chipmunk populations.
I, II, III	2	9	Improve conditions included with any FWC-issued scientific collecting permits for chipmunks.	Protections & Permitting	NEW	HSC, SCP		Moderate - permitting will help prevent intention take or exploitation. Information gained from scientific collection permits can increase knowledge.	Moderate - The development and maintenance of a database to record locations will depend on interest and staff resources.	No - no evidence of dire threats to chipmunk populations.

Table 1. Eastern chipmunk conservation action table.

Objective(s) Addressed	Team Assigned Priority Level	Action Number	Action	Conservation Action Category	Status	Implementation leads: FWC divisions or sections	External partners	Likely Effectiveness	Feasibility	Urgency: Is the action immediately critical to the species' survival?
I, II, III	4	10	Implement a training program to provide information to FWC and other law enforcement officers on identification of and protections relevant to the eastern chipmunk.	Law Enforcement	NEW	HSC, LE		Moderate - increase awareness and understanding of the species to implement legal protections and educate the public.	Moderate - depends on interest and coordination among FWC staff	No - no evidence of dire threats to chipmunk populations.
I, II, III	3	11	Develop or enhance existing incentive programs to benefit the chipmunk on public and private lands.	Incentives & Influencing	NEW	WHM, CPS, SCP	TNC, FFS, FPS, WMDs	High - Incentives to manage habitat for EACH increases the amount of habitat restored or conserved.	Moderate - Resources and partnerships exist that will help facilitate this action, but will depend on interest and coordination among partners	No - no evidence of dire threats to chipmunk populations.
I, II, III	3	12	Update and distribute information on chipmunk range, natural history, and threats.	Education & Outreach	NEW	HSC, SCP	TNC, FFS, FPS, WMDs	Moderate - well informed citizens are more likely to support conservation efforts such as habitat conservation	High - FWC resources are available (i.e. Species Profile on the FWC website), but depends on interest and coordination among partners	No - no evidence of dire threats to chipmunk populations.
I, II, III	3	13	Support inclusion of the chipmunk in the FWC iNaturalist site to solicit and record public-generated eastern chipmunk sightings in Florida.	Education & Outreach	NEW	HSC, SCP		Moderate - Reporting sightings increases awareness of the species and provides FWC with improved understanding of current distribution and population status.	Moderate - Resources are available though FWC social media and public website to promote this action, but will depend on interest and coordination among FWC staff and partners to develop and maintain the information and data.	No - no evidence of dire threats to chipmunk populations.
I, II, III	3	14	Develop and disseminate basic education materials to the public with information on the impacts to wildlife from outdoor or free-ranging cats.	Education & Outreach	NEW	HSC, SCP	TNC, FFS, FPS, WMDs	Moderate - well informed citizens are more likely to support conservation efforts such as habitat conservation and management	Moderate - FWC resources are available (i.e. Species Profile), but depends on interest and coordination among partners	No - no evidence of dire threats to chipmunk populations.
I, II, III		Complete	Locate sites occupied by the eastern chipmunk to determine the habitat types and features of sites occupied in Florida.	Monitoring & Research	COMPLETE	FWRI, LE, HSC, WHM, SCP, CPS	NFWWMD, FFS, landowners	High likelihood of locating sites occupied by chipmunks and recording nearby habitat associations.	Action is achievable and practical. Relationships with public land managers exist. Relationships with private land owners have and will continue to be established.	NO. No evidence of dire threats to chipmunk populations exist. However, current status is unknown, as are potential threats. The proposed action is aimed at gaining information on the status of chipmunk populations.

Table 1. Eastern chipmunk conservation action table.

Objective(s) Addressed	Team Assigned Priority Level	Action Number	Action	Conservation Action Category	Status	Implementation leads: FWC divisions or sections	External partners	Likely Effectiveness	Feasibility	Urgency: Is the action immediately critical to the species' survival?
I, II, III		Complete	Measure variables that may influence eastern chipmunk occupancy, and compare measured variables at occupied and unoccupied sites.	Monitoring & Research	COMPLETE	FWRI,LE,HSC,WHM, SCP,CPS	NWFWMD, FFS, landowners	High likelihood of measuring habitat variables associated with occupied and unoccupied sites.	Summarizing habitat associated with occupied and unoccupied sites is achievable and practical.	NO. No evidence of dire threats to chipmunk populations exist. Current status is unknown, as are potential threats. The proposed action is aimed at gaining information on the status of chipmunk habitat and identifying potential threats.
I, II, III		Complete	Determine the current extent of occurrence of the eastern chipmunk in Florida based upon locations where FWC staff and the public report seeing chipmunks. Verify presence of chipmunks at a subset of reported locations within the known range and at most locations reported from outside the known range.	Monitoring & Research	COMPLETE	FWRI, LE, HSC, WHM, SCP, CPS	NWFWMD, FFS, landowners	High likelihood of determining the range of chipmunks in Florida.	Action is achievable and practical. Relationships with public land managers exist. Relationships with private land owners have and will continue to be established.	NO. No evidence of dire threats to chipmunk populations exist. However, current status is unknown, as are potential threats. The proposed action is aimed at gaining information on the status of chipmunk populations.
I, II, III		Complete	Use reported and verified locations to develop a map of the current extent of occurrence of the eastern chipmunk in Florida.	Monitoring & Research	COMPLETE	FWRI, LE, HSC, WHM, SCP, CPS	NWFWMD, FFS, landowners	High likelihood of developing a range map. A GIS can be used to manage chipmunk reports and observations and produce a map delineating extent of occurrence.	Action is achievable and practical. Relationships with public land managers exist. Relationships with private land owners have and will continue to be established.	NO. No evidence of dire threats to chipmunk populations exist. However, current status is unknown, as are potential threats. The proposed action is aimed at gaining information on the status of chipmunk populations.
I, II, III		Complete	Determine where the species is present within its current extent of occurrence in Florida and use information to determine the proportion of the area occupied.	Monitoring & Research	COMPLETE	FWRI, LE, HSC, WHM, SCP, CPS	NWFWMD, FFS, landowners	High likelihood of estimating chipmunk occupancy within range.	Action is achievable and practical. Relationships with public land managers exist. Relationships with private land owners have and will continue to be established.	NO. No evidence of dire threats to chipmunk populations exist. However, current status is unknown, as are potential threats. The proposed action is aimed at gaining information on the status of chipmunk populations.

Acronyms used in this table:

- CPS: Conservation Planning Services, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation.
- DEP: Florida Department of Environmental Protection
- DOACS: Florida Department of Agricultural and Consumer Services
- FFM: Freshwater Fisheries Management, a Division of the Fish and Wildlife Research Institute.
- FFS: Florida Forest Service
- FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission.
- HCSS: Habitat Conser
- HSC: Habitat and Species Conservation, a Division of Florida Fish and Wildlife Conservation Commission.
- IUCN: International Union for Conservation of Nature
- LE: Law enforcement
- NWFWMD: Northwest Florida Water Management District
- SCP: Species Conservation Planning, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation.
- WHM: Wildlife and Habitat Management, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation.

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