

**A Species Action Plan for the
Florida Bonneted Bat**
Eumops floridanus

Final Draft
November 1, 2013



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EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) created this plan based on the determination of the Biological Review Group that the Florida bonneted bat (*Eumops floridanus*) should remain listed as Threatened in the State of Florida. The U.S. Fish and Wildlife Service proposed to list the Florida bonneted bat in 2012, and the listing was accepted in 2013, adding the Florida bonneted bat to the list of Endangered Species under the Endangered Species Act of 1973. Critical habitat was not designated with the listing, but is expected to be proposed by 2014.

The goal of this plan is to improve the conservation status of the Florida bonneted bat so the species is secure within its historical range. The objective of the plan is to initiate research to fill data gaps in current knowledge of the Florida bonneted bat. Since the range of the Florida bonneted bat is limited to southern Florida, some factors related to extent of occurrence or area of occupancy may always meet the listing criteria. The primary actions of this plan focus on collecting information to inform management and collaborating with other entities conducting research on Florida bonneted bats. Because little is known about this species, achieving the objective and completing the actions will require substantial research and monitoring efforts by FWC and other entities on both public and private lands.

This plan details the actions necessary to improve the conservation status of the Florida bonneted bat. A summary of this plan will be included in the Imperiled Species Management Plan (ISMP), in satisfaction of the management plan requirements in Chapter 68A-27, Florida Administrative Code, Rules Relating to Endangered or Threatened Species. The ISMP will address comprehensive management needs for 60 of Florida's imperiled species and will include an implementation plan; rule recommendations; permitting standards and exempt activities; anticipated economic, ecological, and social impacts; projected costs of implementation and identification of funding sources; and a revision schedule. The imperiled species management planning process relies heavily on stakeholder input and partner support. This level of involvement and support is also critical to the successful implementation of the ISMP. Any significant changes to this plan will be made with the continued involvement of stakeholders.

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GLOSSARY OF TERMS AND ACRONYMS

Acoustic surveys: Monitoring technique that uses specialized equipment and software to detect the presence of bats based upon their echolocation calls.

Area of Occupancy: 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 International Union for Conservation of Nature [IUCN]).

BRG: Biological Review Group, a group of taxa experts convened to assess the biological status of taxa using criteria specified in Rule 68A-27.001, Florida Administrative Code, and following the protocols in the Guidelines for Application of the IUCN Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List 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 Rule 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 and Threatened Species List. In addition, FWC staff may provide within the report a biologically justified opinion that differs from the criteria-based finding.

BWWMA: Fred C. Babcock/Cecil M. Webb Wildlife Management Area

DOACS: Florida Department of Agriculture and Consumer Services

ESA: Endangered Species Act of 1973

Exclusion: Legally required method for removing unwanted bats from a structure. Exclusion involves the use of a 1-way device that allows the bats to leave the structure but prevents them from returning. Holes are sealed after the bats are gone and the device is removed. Exclusions are prohibited between 15 April and 15 August because that is when young are likely to be present and remain in the roost while adults forage for food.

Extent of Occurrence: 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 Rule 120, Florida Statutes, the Administrative Procedures Act. Rules are published in the Florida Administrative Code.

GLOSSARY OF TERMS AND ACRONYMS

FBC: [The Florida Bat Conservancy](#), a private, non-profit organization established to protect and preserve Florida's bats through education, conservation projects, consultation and bat rescue.

Forage: To search for, acquire, and ingest food.

F.S.: Florida Statutes

Fragmentation: A process of environmental change, commonly caused by human-related land conversion, where once-connected habitats become divided into separate fragments.

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

Habitat: The area used for any part of the life cycle of a species (including foraging, breeding, and sheltering).

Hibernation: A state of inactivity and metabolic depression to conserve energy during periods when food is unavailable.

Incidental Take: Incidental Take (as defined in Rule 68A-27.001(5), F.A.C.): Any taking otherwise prohibited, if such taking is incidental to, and not the purpose of the carrying out of an otherwise lawful activity.

ISMP: 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.

NWCO: Nuisance Wildlife Control Operators, individuals licensed by the Florida Department of Agriculture and Consumer Services to address nuisance wildlife concerns according to state rules and regulations.

PIT Tags: Passive Integrated Transponders, small devices inserted under the skin with a unique identification number that can be read using an external scanning device.

Polyestrous: Having more than 1 season each year in which reproduction can occur.

Roost: Artificial or natural structure used by bats for shelter. Roosts can be temporary or permanent.

GLOSSARY OF TERMS AND ACRONYMS

Scientific Collection Permit: A permit issued for activities that include salvage, voucher, bird banding, wildlife possession, or special purpose. Applications must demonstrate a scientific or educational benefit for the species, and must identify the purpose, scope, objective, methodology, location, and duration of the project.

SWG: State Wildlife Grant

Take: As defined in Chapter 68A-27.001(4), F.A.C. "To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct."

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

USFWS: United States Fish and Wildlife Service, the federal agency mandated to protect and manage the nation's native wildlife and freshwater fish resources.

WMA: Wildlife Management Area

INTRODUCTION

Biological Background

The Florida bonneted bat (*Eumops floridanus*) is found only in Florida and is the largest bat in the state (Timm and Genoways 2004, McDonough et al. 2008). Wagner's bonneted, or mastiff, bat (*E. glaucinus*) is a closely related, but more widespread species found in Central and South America. Until recently, bonneted bats in Florida were considered to be a subspecies of *E. glaucinus* and known as *E. g. floridanus*. *E. floridanus* is distinguished from *E. glaucinus* by having a significantly larger body size as well as unique morphological features of the face, mouth, and ears (Timm and Genoways 2004). Other common names for the Florida bonneted bat have included Florida mastiff bat, mastiff bat, and Wagner's mastiff bat (Belwood 1981, 1992; United States Fish and Wildlife Service [USFWS] 2012).

Life History

Relatively little is known about the life history, behavior, and biology of the Florida bonneted bat. Individuals are seldom encountered and most historical and current information is based on collected specimens, a small number of observations of roosting, bats and rangewide acoustic surveys that detect the presence of bats based upon their echolocation calls. Florida bonneted bats have a distinctive echolocation call that is a lower frequency than other bat species in Florida (Marks and Marks 2012).

Bats roost in a variety of structures, both natural and artificial. Tree cavities, caves, rock crevices, and foliage are examples of natural roosts. Buildings, bridges, and bat houses constructed specifically to attract roosting bats are examples of artificial roosts (Kunz and Lumsden 2003). Roosts provide bats with a resting place protected from predators and the elements (Marks and Marks 2006). Roosts also provide shelter for bats to socialize, mate, and rear their young (Kunz and Lumsden 2003). Bats may occupy a roost for only a short period of time, or they may establish a permanent colony within a roost (Marks and Marks 2006).

While habitat associations and natural roost site preferences of Florida bonneted bats are poorly understood, Florida bonneted bats have been documented in several roost types. In 1979, a colony of 7 females and 1 male were found roosting in an enlarged red-cockaded woodpecker (*Picoides borealis*) cavity in a longleaf pine (*Pinus palustris*) near Punta Gorda (Belwood 1981).



Figure 1. Florida bonneted bat house at Fred C. Babcock/Cecil M. Webb Wildlife Management Area. Photograph by Jennifer Myers, FWC.

Florida bonneted bats have been found in the shafts of palm fronds in Coral Gables, as well as under Spanish-style barrel tiles on roofs in Coral Gables and Miami. A roosting colony was found in a fissure in a limestone outcropping in Coral Gables (Belwood 1992, Timm and Genoways 2004, USFWS 2012). Detailed information on documented or suspected roosts is provided in the Habitat, Use of Forests and Other Natural Areas, Use of Parks, Residential, and Other Urban Areas sections of the Proposed Endangered Species Status for the Florida Bonneted Bat (USFWS 2012). The only current known Florida bonneted bat roosts are in bat houses located on Fred C. Babcock/Cecil M. Webb Wildlife Management Area (BWWMA) ([Figure 1](#)) and in bat houses at a private residence in North Fort Myers (USFWS 2012). Florida bonneted bats are consistently present in 1 bat house on BWWMA and the houses at the private residence. Use of the remaining bat houses on BWWMA fluctuates throughout the year (J. Myers, Florida Fish and Wildlife Conservation Commission [FWC], personal communication).

Florida bonneted bats do not hibernate or typically experience periods of torpor. They are active year-round, as are most bats in Florida, although during extended cold weather events, many bats, including bonneted bats, will become torpid (Marks and Marks 2006, USFWS 2012). Florida bonneted bats feed strictly on insects and they use echolocation to detect and capture their prey year-round. They forage in flight and at night, typically returning to the roost periodically during the night (Marks and Marks 2008a). Fecal droppings from the roost in a longleaf pine tree in Punta Gorda primarily contained flying insects from orders Coleoptera, Diptera, and Hemiptera (Belwood 1981, 1992). Florida bonneted bats are fast flyers and have been observed flying at heights of 10 m (33 ft) or more over open areas (Marks and Marks 2008a).

Females give birth to a single pup, and pregnant females and pups have been documented from June through September. Unlike most bats in Florida, Florida bonneted bats may be polyestrous (i.e., they have more than 1 period in which they may reproduce) with the first breeding season occurring June through July and a second occurring later in the year (Marks and Marks 2006, 2008a; Timm and Genoways 2004). Mating behaviors, gestation period, age at weaning, and other reproductive behaviors are poorly understood.

Description

The Florida bonneted bat is the largest bat species in Florida. Total length for adults typically ranges from 126 to 165 mm (4.96 to 6.5 in), forearm length ranges between 61 and 66 mm (2.4 to 2.6 in), and body weight ranges from 30 to 47 grams (1.1 to 1.7 oz) with a pregnant female documented weighing 55 g (2 oz) (Belwood 1981, 1992; Timm and Genoways 2004, Marks and Marks 2006). Fur color varies from dark gray to brown on the dorsal (back) side of the bat, with lighter, grayish fur underneath. Individual hairs are bicolored and lighter at the base. Ears are large and broad and slant forward over the eyes, and, unlike in some similar species found in Florida, the bases of the ears are joined at the midline of the head (Marks and Marks 2006; [Figure 2](#)).

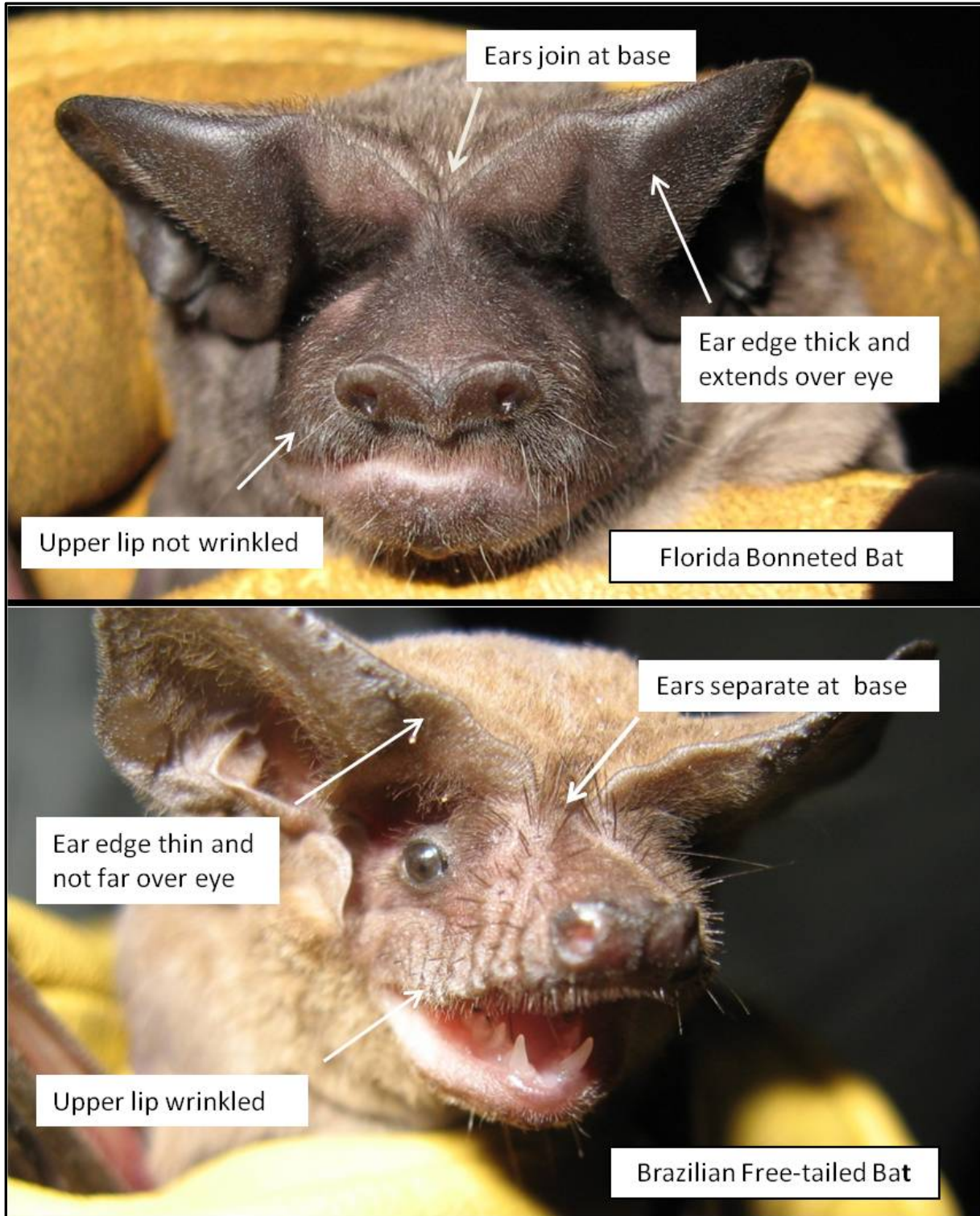


Figure 2. Facial features that distinguish the Florida bonneted bat (top) from the Brazilian free-tailed bat (bottom). Photographs by Kathleen Smith, FWC.

The Florida bonneted bat is among a family of bats often known as free-tailed bats because, unlike most bats, their tails extend well free of the tail membrane that stretches between their legs. Two other free-tailed bats occur in Florida, the Brazilian free-tailed bat (*Tadarida brasiliensis*) and Pallas' mastiff bat (*Molossus molossus*), but Florida bonneted bats are much larger than the other free-tailed bats in Florida (Marks and Marks 2006).

[Figure 3](#) illustrates the relative difference in size between an adult Florida bonneted bat and an adult Brazilian free-tailed bat. The Florida bonneted bat is easily distinguished from any other species in Florida by its free tail, large size, and ears that join at the base.



Figure 3. Florida bonneted bat and Brazilian free-tailed bat, illustrating the size difference between the species. Photograph by Chris Burney, FWC.

Geographic Range and Distribution

A survey conducted by the Florida Bat Conservancy (FBC) in 2006 and 2007 estimated the Florida bonneted bat range ([Figure 4](#)). A follow-up FBC survey in 2011 and 2012 focused on the

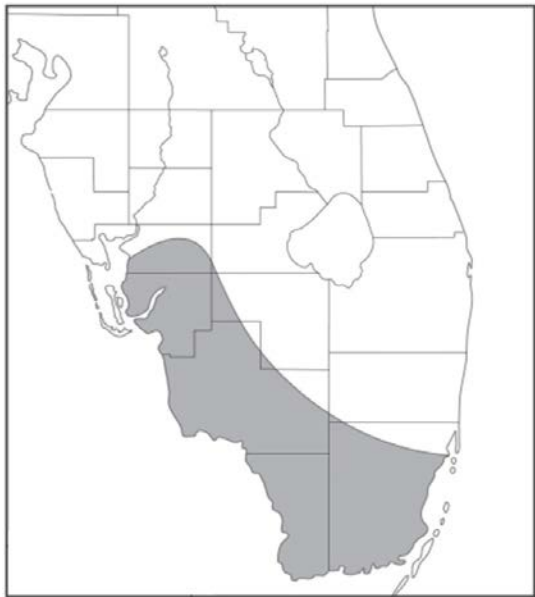


Figure 4. Suspected range (extent of occurrence) of the Florida bonneted bat. The species likely occupies only a portion of the delineated range. Source: Marks and Marks 2012.

northern and southern extents of the range, but did not result in a significant change to the range map (Marks and Marks 2012, USFWS 2012). The current range includes Charlotte, Collier, Lee, Miami-Dade, and Monroe counties (Timm and Genoways 2004, Marks and Marks 2012). The area occupied within these counties is unknown, but likely is much smaller than the total area encompassed by county boundaries (Marks and Marks 2012, USFWS 2012). Fossil remains suggest the range historically included Brevard, Broward, and Indian River counties (Belwood 1992, Timm and Genoways 2004, USFWS 2012), in addition to the previously listed counties included in the current range. Acoustic surveys documented Florida bonneted bat calls at 2 locations along the Kissimmee River in Polk and Okeechobee counties in 2008 (Marks and Marks 2008b). The occurrence of the species in these counties remains uncertain (Marks and Marks 2012); however, subsequent surveys through 2013 have recorded them intermittently.

Conservation History

In 1992, the Florida Game and Fresh Water Fish Commission (predecessor to the FWC) listed the Florida mastiff bat (since re-classified as the Florida bonneted bat; see [Biological Background](#)) as Endangered. In 2010, the FWC adopted a revised listing classification that combined the Endangered and Threatened categories into a single Threatened status. As a result of the Biological Review Group (BRG) status review and the revised listing classification, the Florida bonneted bat became a Threatened species on the Florida Endangered and Threatened Species List. The change to Threatened status represents a change in the classification system, and not a change in the conservation status for the species.

In 1985, the USFWS included the Florida mastiff bat as a category 2 candidate species, since listing might be warranted, but data were limited. Subsequent reviews continued to consider the species as a candidate, but it was removed from the candidate list in 1996 because the taxon was considered a subspecies of *E. glaucinus*, was deemed more abundant than previously known, and was not in danger of identifiable threats (USFWS 2012). In 2009, after the taxonomy was reevaluated and *E.g. floridanus* was elevated to *E. floridanus*, the USFWS recognized the Florida bonneted bat as a federal candidate species in its annual Candidate Notice or Review with a Listing Priority Number of 2 (threats high in magnitude and imminent). At that time federal listing was warranted but was precluded by other higher priority listing actions. In October 2012, the USFWS proposed to list the Florida bonneted bat as a federally Endangered species under the Endangered Species Act of 1973 (ESA); this listing was accepted in 2013, extending the ESA's protections to this species (USFWS 2012).

The FWC species-ranking database gave a score of 33.3 to the Florida bonneted bat (scores based on Millsap et al. 1990). A species ranking above 27 is considered potentially at risk of extinction and warrants biological status review (Rule 68A-27.0012(2)(c)1a, Florida Administrative Code [F.A.C.]). In addition, the Florida Committee on Rare and Endangered Plants and Animals included the Florida bonneted bat in the 1978 and 1992 editions of Rare and Endangered Biota of Florida (Belwood 1992). The Florida's Natural Area Inventory considers the Florida bonneted bat to have a global status of G1 (critically imperiled), due to habitat loss and restricted range (Florida Natural Areas Inventory 2012). Florida's State Wildlife Action Plan recognizes the Florida bonneted bat as a Species of Greatest Conservation Need (FWC 2011), and the International Union for the Conservation of Nature (IUCN) currently lists the Florida bonneted bat as Critically Endangered due to small population size, very small subpopulations, and apparent continuing population decline (Timm and Arroyo-Cabrales 2008).

Land acquisition specifically to protect Florida bonneted bats has not been initiated. Florida bonneted bat roosting and foraging habitat requirements are poorly understood, making it difficult to assess the amount or type of habitat that should be protected, or if currently protected lands are those most valuable for Florida bonneted bat conservation. The USFWS is expected to designate critical habitat for this species in 2014.

During the FBC's 2006 through 2007 rangewide surveys, Florida bonneted bats were documented near BWWMA. In response, FWC contracted with FBC to conduct surveys on BWWMA and installed bat houses in 2007 and 2008. Surveys were conducted over 3 nights and included recording bat calls while driving slowly across the wildlife management area (WMA),

as well as stationary recording sites. Florida bonneted bat calls were recorded at 3 sites on BWWMA during these surveys (Marks and Marks 2008c). FWC staff at BWWMA installed 15 bat houses, comprising 8 roosts, on the WMA. Each roost consists of 1 to 2 bat houses mounted on a utility pole ([Figure 1](#)). To date, 5 roosts have been occupied by Florida bonneted bats. In 2012, FWC staff installed 5 additional roosts near existing roosts to provide additional habitat for Florida bonneted bats. The new roosts are not yet occupied. Monitoring of these bat houses is ongoing (J. Myers, personal communication).

The longest-monitored colony of Florida bonneted bats is located on private property in Lee County. In the backyard of a private residence, the homeowner has 3 bat houses that are used by Florida bonneted bats. This is an example of cooperative efforts between a private landowner, conservation group, and wildlife agency.

In 2012, the Florida Bonneted Bat Working Group was formed to address the conservation needs of this species across its range. Members include the FWC, USFWS, National Park Service, Zoo Miami, FBC, and several other private and public entities. Many members are also stakeholders referenced in this plan. Members of this working group are involved in conservation activities such as acoustical surveys, bat house monitoring, species education and outreach activities, as well as ongoing research projects.

Threats and Recommended Listing Status

In 2010, the FWC directed staff to evaluate the status of all species listed as Threatened or Species of Special Concern that had not undergone a status review in the past decade. To address this charge, staff conducted a literature review and solicited information from the public on the status of the Florida bonneted bat. The FWC convened a BRG of experts on the Florida bonneted bat to assess the biological status of the species using criteria specified in Rule 68A-27.001, F.A.C., following the protocols in the Guidelines for Application of the IUCN Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1). FWC staff developed an initial draft of a Biological Status Review (BSR) report, which included the BRG's findings and a preliminary listing recommendation from staff. FWC distributed the draft for peer review, and the reviewers' input was incorporated into a [final report](#).

Threats

The BRG identified the following threats to the Florida bonneted bat: 1) small population size and restricted extent of occurrence, which increases vulnerability; 2) continued loss of forested habitat; 3) potential limited roost availability; and 4) pesticides from mosquito-control operations. Additional threats identified by the BRG include low fecundity (females produce only 1 pup per year), human disturbance (persecution and removal of roosting bats in trees, buildings, or other manmade structures), prolonged or repeated episodes of cold temperature, disease, and wind farms.

Recommended Listing Status

The Florida bonneted bat BRG concluded from the biological assessment that the Florida bonneted bat met criteria necessary to warrant its continued listing as Threatened on the Florida Endangered and Threatened Species List.

The Florida bonneted bat met the following criteria for listing:

- Criterion B, Geographic Range: the extent of occurrence <20,000 km² (7,722 mi²) and the population may exist in fewer than 10 locations; a continuing decline is inferred in the extent of occurrence, as well as area, extent, or quality of habitat;
- Criterion D, Population Very Small or Restricted: the current population size in Florida is estimated to be fewer than 1,000 mature individuals and the population has a very restricted area of occupancy and number of locations.

Other threats include stochastic events such as hurricanes, which may destroy old trees with roosting cavities (Timm and Genoways 2004, NatureServe 2010). For more information on potential threats, including climate change and disease, see the Summary of Factors Affecting the Species section of USFWS (2012).

CONSERVATION GOALS AND OBJECTIVES

The BRG found that the Florida bonneted bat met the criteria for listing as a Threatened species on the Florida Endangered and Threatened Species List. As such, the conservation goal and objective for the Florida bonneted bat are:

Goal

Conservation status of the Florida bonneted bat is improved such to a point that the species is secure within its historical range.

Objective

Initiate research to fill data gaps in current knowledge of the Florida bonneted bat and use existing information and results to promote Florida bonneted bat conservation.

Rationale

Many aspects of Florida bonneted bat ecology are unknown or poorly understood. The BRG identified several threats to the species, but the extent to which these threats impact Florida bonneted bats is not well understood given the lack of scientific information available for this species. The objective of this plan is to identify opportunities to fill in the gaps of what is known about Florida bonneted bats. Effective conservation of the Florida bonneted bat will depend on the support and involvement of partners and stakeholders. Developing conservation recommendations for land management or permitting guidance without a good understanding of the biology of the Florida bonneted bat is not likely to improve the status of the species, and may limit future involvement of partners. Data gathered as a result of actions outlined in this plan will be used to develop and implement conservation strategies to improve the status of the species.

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](#)) identifies action priority, urgency, potential funding sources, likely effectiveness, identified partners and leads for implementation. The conservation actions are intended to conserve and expand the existing population and increase what is known about the species' range, distribution, habitat requirements, and population size. Several actions also attempt to better our understanding of Florida bonneted bat life history and ecology in order to improve conservation of the species. Completing these actions will allow us to measure progress toward the conservation goal and objective for the Florida bonneted bat.

Habitat Conservation and Management

General habitat management recommendations for bats include maintaining and protecting open freshwater and wetland habitat as foraging habitat (Marks and Marks 2008c). Habitat management recommendations specific to Florida bonneted bats are not currently available. [Action 3](#) identifies the need to determine the habitat requirements of Florida bonneted bats in order to address impacts of landscape-scale changes across their range. [Action 8](#) describes research to identify Florida bonneted bat habitat types, and [Action 9](#) describes the need to identify what types of roosts are available, and how they are used by Florida bonneted bats. Species-specific habitat management recommendations should be developed based on the outcome of these research actions.

Florida bonneted bats are known to roost in both natural and artificial structures, including tree cavities, rock outcroppings, buildings, and bat houses (see [Life History](#)) (Marks and Marks 2008a), though the only currently known roosts are in bat houses. Florida bonneted bats have been documented in urban, rural, and native landscapes. Both natural and artificial roosts could be impacted by land-management activities and stochastic events, as well as human presence and the loss of habitat due to development. Colony-roosting species like the Florida bonneted bat roost in relatively permanent and uncommon roosts (i.e., tree cavities and bat houses). They typically remain faithful to their roosts and are unlikely to switch to new roosts (Humphrey 1975, Lewis 1995). If Florida bonneted bats depend on relatively few roosts as suspected, and given their small population size and the uncertainty about availability of suitable roosts, they may well have difficulty finding and occupying new roosts. Therefore, protecting existing roosts is very important to conserving the species. The following section identifies potential threats to roosts and provides recommendations for roost protection.

Roost Threats

The potential impact of land-management activities such as timber management and prescribed fire on roosts is poorly understood. Timber-management activities (i.e., thinning and removal of old or live trees with cavities) may benefit bats by reducing clutter and increasing the sustainability of pine stands for foraging and commuting (Loeb and Waldrop 2008) or increasing the basal diameter of surrounding trees. However, thinning may also reduce the number of roosts available to bats.

Presumably, many bat species in the southeastern United States have evolved in ecosystems dominated by fire, and their roosting strategies may limit their vulnerability to fire (Carter et al. 2000). The effects of fire on bats can depend on a variety of characteristics such as seasonality of the burn, fire intensity, residence time (the length of time it takes flame to move over the ground), and overstory mortality (Carter et al. 2000). Fire can create snags, which can eventually become suitable for use by tree-roosting bats (Carter et al. 2000). Fire during the season when most vegetation is dormant may impact the survival of tree- or foliage-roosting bats during colder temperatures and during periods of torpor for certain species, including the Florida bonneted bat. Growing-season burns may impact the survival of non-volant (flightless) young (Carter et al. 2000). Florida bonneted bats may be polyestrous (Marks and Marks 2008a), and flightless young could be affected by fire during either the dormant or growing season. Regardless of fire season, smoke and heat from fire could impact the microclimate of the bat box. On BWWMA, prescribed burning is conducted near Florida bonneted bat houses on a 2-year rotation, on average, with no observed negative effects (J. Birchfield, FWC, personal communication); however, this determination is based on observations, not on systematic assessment. To our knowledge, no research on the Florida bonneted bat's response to prescribed fire exists, though other species' responses have been studied. Studies showed that prescribed burning may initially reduce insect availability (Lacki et al. 2009) but may increase long-term prey availability (Dickinson et al. 2009). Additionally, fire was shown to reduce canopy clutter (Boyles and Aubrey 2006, Dickinson et al. 2009) and create or restore available roost trees or snags (Boyles and Aubrey 2006, Dickinson et al. 2009, Lacki et al. 2009).

Any information gained from future research on fire effects to natural and artificial roosts of the Florida bonneted bat ([Action 9](#)) should be incorporated into roost protection guidelines.

Urban development can also impact Florida bonneted bat roosts. This species has been suspected of roosting in man-made structures such as the shingles of Spanish-style barrel tile roofs in Miami and Coral Gables (Belwood 1992), attics, fireplaces, and brick chimneys (NatureServe 2010). Florida bonneted bats may be killed or injured when dwellings are demolished (Robson 1989) or when they take up residence in structures where they are not wanted. Pest control companies unaware of or non-compliant with the regulations (Rule 68A-9.010, F.A.C.) that apply to bats have been known to remove them through methods other than legal exclusions (see [Rule and Permitting Intent](#), information on Florida Administrative Code number Rule 68A-4.001, F.A.C., General Prohibitions, and Rule 68A-9.010, F.A.C., Taking Nuisance Wildlife, and [Roost-Protection Guidelines](#)).

Across the southern United States, bats roost in an estimated 3,600 highway structures such as bridges and overpasses (Keeley and Tuttle 1999). Repair and maintenance of these structures can be detrimental to roosting bats, as can road construction such as road-widening projects. Other *Eumops* species (i.e., *E. underwoodi* and *E. perotis*) are not known to roost in bridges or overpasses (Keeley and Tuttle 1999). Florida bonneted bats have not been documented roosting in highway structures, though their presence has been documented near bridges and overpasses that could be suitable roost sites (Keeley and Tuttle 1999, USFWS 2012; C. Marks, FBC, personal communication) and their potential use of highway structures cannot be ruled out given the few documented occurrences of the species across its range.

Action 1 Develop recommendations for protecting the roosts of Florida bonneted bats.

Although more research should be conducted to determine which specific land-management activities can create or preserve Florida bonneted bat roosts ([Action 9](#)), the following list of recommendations should be incorporated into land management and nuisance bat technical assistance ([Action 1](#)). This list should be revisited as results of research become available.

Roost-Protection Guidelines:

- Old trees and snags with hollows and cavities should be retained in natural areas such as Everglades National Park, Big Cypress National Preserve, Fakahatchee Strand Preserve State Park, and BWWMA (Belwood 1992). If dead or old trees must be felled, they should be examined for bat roosts and occupation by other imperiled species prior to felling (Marks and Marks 2008b), especially since no locations of natural Florida bonneted bat roost sites or roost selection preferences are currently known. If bats are found, managers are encouraged to consult with the FWC to accurately identify the species and discuss an appropriate course of action.
- Nuisance wildlife control operators (NWCs), biologists, and law enforcement personnel within the range of the Florida bonneted bat should be informed that the breeding season of the Florida bonneted bat is uncertain, and that the bats may have young in the roost outside of the typical maternity season. Until more information on the breeding season is obtained and the exclusion rule modified ([Actions 15](#) and [16](#)), we recommend consultation with FWC before excluding Florida bonneted bats from a roost at any time of the year.
- Increase public land acquisition within the range of the Florida bonneted bat. Land acquisition can assist with protecting roosts, breeding, and foraging areas. Publically managed lands allow for more oversight of land management activities through the required development of state-approved management plans and provide general protections from development. Increase conservation easements and other voluntary conservation efforts on private lands.
- Educate pest control companies, NWCs, homeowners and homeowners associations, and local government staff to minimize injury and fatality of Florida bonneted bats in urban areas ([Actions 17](#) and [19](#)). This applies to bats that are roosting in buildings or vegetation such as palm trees that may be managed as landscaping.
- Take steps to prevent vandalism at known roosts. Vandalism can be a threat to roost cavities and artificial roosts of Florida bonneted bats. At this time, it has not been a main concern at BWWMA, but adequate law enforcement presence and frequent roost checks by biological staff on publically managed lands may deter vandals.

Action 2 Develop and implement guidelines for building, installing, and monitoring bat houses for Florida bonneted bats.

Bat houses can be useful tools in the conservation and promotion of bats on public and private land because they provide roosting habitat that may otherwise be lacking. Florida bonneted bats are among the species that use bat houses (Marks and Marks 2006). At BWWMA, Florida bonneted bats inhabit single-chamber and triple-chambered bat houses (J. Birchfield, personal communication). More research on the role of bat houses in Florida bonneted bat conservation

should be conducted ([Action 9](#)). Specific recommendations regarding Florida bonneted bat houses are not available, though species experts provide general suggestions to consider when installing bat houses within the Florida bonneted bat's range. These general recommendations should be evaluated to ensure they address the needs of Florida bonneted bats roosting in bat houses. New recommendations should incorporate research results on natural and artificial roosts ([Action 9](#)). Until further research is conducted on the role of bat houses for Florida bonneted bats, general recommendations for building and installing bat houses can be found in the Bat Conservation International's [Criteria for Successful Bat Houses](#), [Appendices 1](#) and [2](#) (Marks and Marks 2006).

FWC bat house monitoring protocols should be followed for bat houses installed within the Florida bonneted bat range ([Appendix 3](#) and [Actions 3, 5, 9, 17, and 18](#)). If Florida bonneted bats are suspected in an occupied bat house, managers are encouraged to coordinate with FWC.

Action 3 Develop landscape-level recommendations for the conservation of the Florida bonneted bat using information from research on rate of habitat loss, conversion, and alteration.

Habitat loss and reduction of forested areas are serious threats to the Florida bonneted bat's survival, according to the [BSR](#). Florida's human population is predicted to increase to 36 million by 2060 and about 28,300 km² (11,000 mi²) of land may be converted from rural and natural to urban uses (Zwick and Carr 2006, [Figure 5](#)). The projected loss and fragmentation of natural

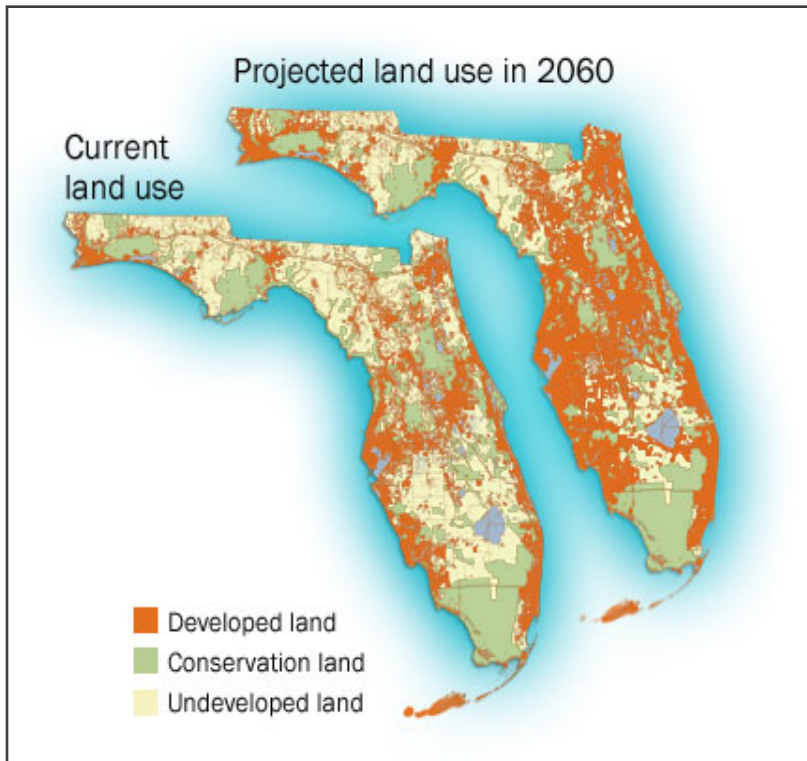


Figure 5. Projected increase in area of developed land in Florida. Source: Zwick and Carr 2006.

habitat may adversely affect Florida bonneted bats; however, this species occurs in urban areas and uses structures such as chimneys and roofs for roosting (Belwood 1992). Because the survival and productivity rates of Florida bonneted bats in urban areas are unknown, it is not possible to accurately predict the impact of increasing urbanization on Florida bonneted bat populations. One adverse impact of more urban roosts is increasing human interaction and associated increase in exclusions. Expanded bat education programs ([Action 7](#)) and installation of alternate roosts may help offset adverse impacts.

The Florida bonneted bat population may number less than a few hundred individuals (Marks and Marks 2008a). Restricted range and low fecundity may make it vulnerable to extinction due to inbreeding depression, random environmental changes, or genetic drift (USFWS 2012). Almost 50% of the 12 known occurrences of the Florida bonneted bat are on private property (Marks and Marks 2008a, 2008d). Florida bonneted bat use of private or public lands are not well understood and it would be imprudent to make management recommendations to address these threats at this time. The [Monitoring and Research](#) section describes actions that, when implemented, will aid in identifying species-specific management recommendations. Increased urbanization also increases the Florida bonneted bat's risk for removal, exclusion, or persecution due to human-wildlife conflict as discussed in [Action 1](#).

Establishment of wind turbines is a concern in some areas because they obstruct existing bat flight corridors and can be sources of bat mortality (Kunz et al. 2007). Some research suggests that bats may even be attracted to the wind turbines out of curiosity, misperception, or as potential feeding, roosting, flocking, and mating opportunities (Cryan and Barclay 2009). Wind farms have been proposed in southern Florida near Loxahatchee National Wildlife Refuge and on the west side of Lake Okeechobee near Fisheating Creek (Melissa Tucker, FWC, personal communication). Adherence to the USFWS [Land-Based Wind Energy Guidelines](#) for siting wind farms, along with consultation with FWC, is recommended to wind farm developers, as is more research to determine impacts of these installations on Florida bonneted bat populations.

Habitat changes and landscape alterations will occur, but how they will affect the Florida bonneted bat is unknown, as we do not yet know what habitat components and landscape features Florida bonneted bats require. More research should be conducted to determine the rate of loss, conversion, and alteration of the habitat of Florida bonneted bats. Specific research that would assist with these findings are habitat preferences ([Action 8](#)), population size and distribution ([Action 11](#)), and roost selection characteristics ([Action 9](#)). Results of this research can be incorporated in habitat management recommendations for public and private lands ([Action 3](#)).

Population Management

Action 4 Assess the need for potential management actions for Florida bonneted bats roosting in bat houses during extreme weather events, such as hurricanes or freezes, and develop guidelines if appropriate.

Severe weather events may affect the survival of the small, fragmented population of Florida bonneted bats. On BWWMA, all occupied Florida bonneted bat houses are located within 16 km (10 mi) of each other. The occupied bat houses in North Fort Myers are within 26 km (16 mi) of BWWMA (J. Myers, personal communication). If a hurricane significantly impacted Charlotte or Lee counties, the occupied bat houses would likely be damaged.

Bats in the family Molossidae, including Florida bonneted bats, appear to be physiologically intermediate between temperate- and tropical-zone bats (Arlettaz et al. 2000). They can tolerate moderately cold temperatures but may die following prolonged exposure to cold. During a severe freeze throughout much of southern Florida in 2010, at least 8 Florida bonneted bats died in a bat

house in North Fort Myers (S. Trokey, private land owner, personal communication). Natural roosts may be better insulated than bat houses and thus provide better shelter and survival during cold temperatures, but this is merely speculation. [Action 4](#) relates specifically to determining whether bats roosting in bat houses need additional protection during extremely cold weather.

Appropriate response to potential severe weather events should be determined. Short-term relocation of individuals from bat houses may prevent their immediate demise, but long-term effects to the bats are unknown. Management guidelines for bat houses should be developed based on current knowledge. Guidelines may change following results of research proposed in [Monitoring and Research](#).

Interventions such as insulating or heating a bat house during severe cold weather, or physically bringing bats indoors need to be studied further to determine if they are necessary or if they could be detrimental ([Action 9](#)). Factors that may initiate intervention (duration of cold weather, low-temperature threshold) need to be further studied before guidelines can be developed. If Florida bonneted bats are using a bat house, we recommend consultation with FWC before taking action in advance of a severe weather event or if dead or cold-stunned bats are found below the bat house.

Monitoring and Research

As noted in the [BSR](#) and a recent federal assessment, information on population size and geographic range of Florida bonneted bats is quite limited (USFWS 2012). The available information was sufficient to determine that the Florida bonneted bat warrants the highest level of imperiled status in Florida (listing as Threatened on the Florida Endangered and Threatened Species List), but more specific and local information is needed. Several conservation actions listed here will generate needed information on geographic range, habitat use, population size, productivity and survival, and roost use. This information will greatly increase our understanding of the Florida bonneted bat and thereby improve our ability to conserve the species.

Action 5 Develop a database of occurrence information and research findings.

Because the Florida bonneted bat is rare and difficult to detect, information about the species has come from incidental sightings or irregular monitoring and is not readily available. Compiling occurrence and location information into a database would help researchers know what data is available; but just as importantly, it helps identify what data need to be collected. In particular, a data repository for information about roost sites would be useful in determining the types of roosts used and their location ([Action 9](#)). Currently, incidental observations of roosts are largely unavailable to most biologists. Results from long-term monitoring of roost use or large-scale acoustic surveys could be compiled in a central location and made available for subsequent analysis or review by anyone interested in conservation of Florida bonneted bats (see [Coordination with Other Entities](#)). Having a central repository might also help in setting standards or examples of the types of data that need to be collected ([Action 6](#)). A functional and useful central database for Florida bonneted bats will require planning to determine what information needs to be included, the types of assistance from partners who can provide information ([Action 18](#)), and the level of commitment from database managers to keep the database current and readily accessible.

Action 6 Develop standard methods for detecting presence of Florida bonneted bats.

Action 7 Determine the current geographic range (i.e., extent of occurrence and area of occupancy) for Florida bonneted bats.

Action 8 Identify Florida bonneted bat roosting and foraging habitat.

Florida bonneted bats range over a small area of southern Florida, but that area includes a wide variety of habitats, and their distribution across those habitats is poorly known (USFWS 2012). Recent acoustic surveys have detected Florida bonneted bats repeatedly in only 4 counties and infrequently at a few sites in 3 other counties ([Geographic Range and Distribution](#); Marks and Marks 2012). Because monitoring has been restricted to areas accessible by roads and relatively few bats have been detected, the distribution of the Florida bonneted bats and their use of different habitat types both for roosting and foraging remains poorly known (Marks and Marks 2012, USFWS 2012). As a consequence, the extent of occurrence of the Florida bonneted bat remains only coarsely known (extrapolated to counties) and the area occupied is largely undetermined. Better defining the geographic range of the Florida bonneted bat and identifying habitat types used for roosting and foraging are important steps in conserving this species in Florida ([Action 7](#) and this action).

Acoustic monitoring of the echolocation calls of Florida bonneted bats is the most efficient means of detecting these fast, high-flying animals. Before extensive monitoring is implemented, research is needed to determine how detection probability is affected by the survey methods, including type of monitoring equipment and the height and orientation of detectors. Survey methods should also be developed in conjunction with statisticians and species experts prior to implementing an acoustic monitoring program ([Action 6](#)). An acoustic monitoring program could be implemented to determine the geographic range and foraging habitats of the Florida bonneted bat by identifying areas where bats are present ([Action 7](#)). Analysis of data from the acoustic monitoring, particularly a multiple-scale approach using occupancy modeling, could provide useful information on the landscape features and habitat types used most often by Florida bonneted bats ([Action 8](#)). It is important to not only identify specific habitat components that are used by Florida bonneted bats for roosting and foraging on a local scale, but to also identify which factors influence selection of habitat on a landscape scale. On areas where land-management information is readily available, it should be incorporated into analyses to assess potential impacts of activities such as prescribed fire or mechanical vegetation treatments on Florida bonneted bats ([Actions 1, 2, and 3](#)). This information would be useful in helping to better map and monitor Florida bonneted bat distribution and to manage habitats for the species.

In 2012, FWC awarded a grant to researchers at the University of Florida titled “Closing Data Gaps for the Florida Bonneted Bat (*Eumops floridanus*).” Funding came from Florida’s State Wildlife Grants (SWG) Program. The objectives included in this grant are: 1) to develop a protocol that can be used for monitoring bonneted bats to determine population trends; 2) to determine habitat associations of the bonneted bat for foraging and roosting, surveying a minimum of 7 habitat types and 10 locations in southern Florida; and 3) to provide recommendations for additional conservation measures for bonneted bats. This grant was funded and work began in July 2013. Funding of the SWG grant, implementation of projects to meet the

grant objectives, and results from data collected will begin the implementation of [Actions 6, 7, 8,](#) and [9](#).

Action 9 Determine what kinds of roost sites are available and how they are used.

Florida bonneted bats use natural roost sites in cavities of trees, but they also utilize artificial structures including buildings and bat houses ([Life History](#); Belwood 1981, 1992; USFWS 2012). Because Florida bonneted bats roost in small colonies, their roosts are typically small in size and difficult to detect. Currently, the only known roosts are in a few bat houses in Charlotte and Lee counties ([Conservation History](#); USFWS 2012). The availability of roosts and disturbance of roosts are important factors in the conservation of colonial bats, but little is known about the availability of potential natural roost sites for Florida bonneted bats or how frequently roosts are disturbed (e.g., by humans, predators, storms, or fire) (USFWS 2012). We know that Florida bonneted bats will use bat houses, but we do not know to what extent the presence of bat houses may impact their use of natural roosts, or if their use of bat houses indicates that natural roost sites may be lacking. We also know little about how many roosts Florida bonneted bats typically use, how often they switch among roosts, whether certain habitats are preferred for roosting, or the characteristics that make a tree or other structure suitable as a roost. All this information would help managers most effectively and efficiently provide and protect suitable roosts for Florida bonneted bats ([Actions 1](#) and [2](#)) and should be addressed in future research.

Artificial Roosts

We do not know how important bat houses are to the conservation of Florida bonneted bats. Research should aid in identifying the appropriate style, number, density, and placement of bat houses that may be beneficial ([Action 2](#)).

Occupied bat houses on BWWMA could be used to study roost switching, seasonal use of roosts, and preferences between artificial and natural roosts. They could also be used to evaluate potential effects of land-management practices such as prescribed fire and tree thinning ([Action 1](#)). Information gained from regular observations of the occupied houses and records of the number of bats present before and after land-management treatments will be useful. Even more useful information could be obtained if individual bats were marked with passive integrated transponder (PIT) tags and houses were fitted with PIT readers. In this way, detailed information about roost use could be collected for many individuals, and use of different styles or locations of bat house could be identified. Regardless of the method used to collect data on use of bat houses, it is critically important that research questions, study objectives, details of methods, and analysis techniques all be determined prior to collecting data and in conjunction with species experts and statisticians. Otherwise, it may be difficult to gain useful information from the data collected. Any research at bat houses on BWWMA will be supervised by the FWC, and will require a scientific collection permit ([Rule and Permitting Intent](#)) to ensure protection of the roosts. Researchers may also require permits from the USFWS.

Natural Roosts

Natural roost sites are most efficiently located by tracking bats back to roosts, typically by following bats that have been captured, fitted with a radio transmitter, and released. Unfortunately, Florida bonneted bats are difficult to capture and the few that have been fitted

with radios have not tolerated the devices (J. Gore, personal communication). A first step in finding roosts and learning more about them will be determining how to keep radio transmitters attached without harming the bats. Trials could be conducted using bats occupying bat houses at BWWMA; any research at those sites will be supervised by the FWC and require a scientific collection permit ([Rule and Permitting Intent](#)) to ensure protection of the roosts.

Action 10 Assess genetic diversity across the population.

Most aspects of Florida bonneted bat genetics are unknown (Timm and Genoways 2004). Because the population is believed to be quite small and may have gone through genetic bottlenecks following hurricanes or other environmental perturbations, genetic diversity may be low and be limiting population viability (USFWS 2012). Furthermore, it is not known whether subpopulations exist across the species' range and whether these are genetically isolated. For example, if the absence of records of Florida bonneted bats in the open expanses of the Everglades (Marks and Marks 2012) is more than a sampling limitation, then Florida bonneted bat populations in southeastern Florida are reproductively isolated and may be genetically distinct from those in southwestern Florida. It is important to assess genetic diversity across the population so that steps can be taken to improve diversity, especially if associated effects upon population viability are identified.

Action 11 Develop and implement range-wide surveys to estimate population size.

Because bats are highly mobile and difficult to detect, counting individuals and accurately assessing population size is very difficult (Kunz 2003). Most population estimates have been for species that roost in colonies where individuals can be counted consistently over time. Unfortunately, Florida bonneted bats roost only in relatively small colonies, few of which are known (Timm and Genoways 2004); therefore, population estimates are limited to small portions of the total populations. Although it may not be possible to accurately estimate population size, occupancy modeling ([Action 8](#)), analysis of genetic diversity ([Action 10](#)), or other approaches may provide useful information about population size. These methods and others should be evaluated with a goal of developing surveys to estimate population size.

If numerous roosts are identified ([Action 9](#)), the number of bats using the roosts could be monitored and a trend of bat numbers (colony size) potentially could be used as an indicator of a correlated trend in the size of the overall population (Kunz 2003). This information would be useful in assessing changes in population size and would be especially useful if it closely correlated with any observed change in geographic range ([Action 7](#)). However, accurately estimating population size may not be practical or possible, and completing [Actions 7, 8, 9, and 10](#) are of higher priority.

Action 12 Determine Florida bonneted bat breeding biology, productivity, and survival rates.

Action 13 Determine specifically what Florida bonneted bats eat and how their diet varies across their range and over time.

Action 14 Determine effects of environmental toxins, including pesticides, on Florida bonneted bats.

Little is known about Florida bonneted bat reproduction and diet. The breeding season remains poorly determined, except that pregnant females have been found in July, August, and September, and young have been found in all seasons (Belwood 1992, Timm and Genoways 2004). It is possible that females are polyestrous and may form breeding harems in small colonies with a dominant male (Belwood 1981). Females are known to produce a single young, but gestation period, age at reproduction, number of young produced, and survival rates are not known. Knowing this basic information ([Action 12](#)) would allow managers to make better decisions about the timing of management activities near roost sites ([Action 1](#)) and would allow biologists to make better estimates of population viability.

Florida bonneted bats are insectivorous but specific components of their diet are not well understood, and current knowledge is based on a single study with a small sample size (see [Life History](#)) (Belwood 1981, 1992). Presumably, they feed primarily upon flying insects, but, unlike most bats, they can take off readily from the ground, so it is possible that they also feed upon ground-dwelling invertebrates or even small vertebrates. Analysis of fecal droppings from known roosts, particularly advanced analysis of genetic material in feces, should provide a clear picture of the diet of Florida bonneted bats ([Action 13](#)). However, fecal collection at occupied bat houses can be difficult. On BWWMA, occupied bat houses are in areas that are inundated seasonally with water and almost daily rains during the summer and early fall make fecal collection very difficult. Collecting viable samples can be time consuming and requires daily visits to occupied bat houses (J. Myers, personal communication).

Much of the range of the Florida bonneted bat is along urban or agricultural areas where the bats might be exposed to environmental toxins (particularly pesticides) which could adversely affect their health (Clark 1988). The effect of environmental toxins on Florida bonneted bats could be determined by measuring contaminant levels in bats or their insect prey and identifying any association between those levels and productivity and survival of bats ([Action 14](#)). If adverse effects are identified, managers could take steps to curtail the exposure of the bats.

Rule and Permitting Intent

The Florida bonneted bat is to be retained as a Threatened species in Florida, using the currently accepted scientific name (*Eumops floridanus*) and common name (Florida bonneted bat). [Action 15](#) provides recommendations to incorporate research into protective measures specifically for the Florida bonneted bat.

Action 15 Use results of research on Florida bonneted bat life history to develop needed protections.

Existing Regulations

It is illegal to take bats in Florida in accordance with the general prohibitions in Rule 68A-4.001, F.A.C., but enforcement of this rule is challenging. Colonial-roosting bats that occupy manmade structures are at increased risk of roost destruction and are particularly vulnerable during the maternity season, when bats gather to give birth and raise young. To address these risks, Rule

68A-9.010, F.A.C., provides protections for bats when they take up temporary or permanent residence in dwellings or other manmade structures, such as bridges and overpasses, where human-wildlife conflict may occur. These protections regulate how and when bats may be removed from structures. Exclusion devices (physical barriers that allow bats to exit a structure but not re-enter) are the only legal means of removing bats; the rule requires the use of an exclusion device prior to building repairs if bats are present, and describes the appropriate methods for the use of the exclusion device during the timeframe outside of the maternity season. The FWC provides information and technical assistance on excluding bats [online](#) and through regional Wildlife Assistance Biologists.

As a Threatened species, the Florida bonneted bat is also protected under Chapter 68A-27, F.A.C., Rules Relating to Endangered or Threatened Species, specifically Rule 68A-27.003(2)(a), F.A.C., for state-designated Threatened species. This rule states that:

- No person shall take, possess, or sell any of the Endangered or Threatened species included in this subsection, or parts thereof or their nests or eggs except as allowed by specific federal or state permit or authorization.
- Permit requirements for intentional take and incidental take are currently defined in Rule 68A-27.007(2), F.A.C., and are applicable to the Florida bonneted bat. The intent of protections should include protection of roosting sites, which are different from nesting sites as described in current rule, and should be in accordance with the objectives outlined in this action plan or other recovery plans. These additional considerations are discussed in detail in the [Additional Protection Needed](#) section.
- Permit requirements for intentional take and incidental take are currently defined in Rule 68A-27.007(2), F.A.C., and are applicable to the Florida bonneted bat.

Any research that requires handling Florida bonneted bats will require a scientific collection permit. On BWWMA, individuals who want to collect data on the occupied bat houses without disturbing occupied bat houses or handling bats have been granted access to the WMA through a Special Use Permit issued by FWC. This permit allows for access to closed areas on WMAs and provides conditions for conducting activities. Due to increasing requests for access specifically to collect echolocation calls at occupied bat houses, and in anticipation of future research projects that may result in an increase in requests for access with the potential for cumulative disturbance impacts to Florida bonneted bats, a scientific collection permit will now be required to collect Florida bonneted bat data on BWWMA, unless such work is done in conjunction with ongoing FWC activities or FWC staff.

The [application](#) for the scientific collection permit is available online. Applications are reviewed by FWC's Mammal Taxa Coordinator, Biologists in the Species Conservation Planning Section, internal species experts, and regional and local staff. Anyone conducting research on the Florida bonneted bat should be aware that additional permits for research activities that involve handling bonneted bats may be needed from the USFWS or from the agencies that manage properties accessed for research (e.g., Water Management Districts, National Park Service).

The U.S. Fish and Wildlife Service proposed to list the Florida bonneted bat in 2012, and the listing was accepted in 2013, adding the Florida bonneted bat to the list of Endangered Species protected under the Endangered Species Act of 1973.

Additional Protections Needed

As discussed in the [Introduction](#) and [Actions 1](#) and [12](#), Florida bonneted bats are suspected to have 2 breeding seasons each year. [Action 12](#) describes research needs regarding Florida bonneted bat reproduction. If this research indicates that Florida bonneted bats have a different maternity season than other bat species in Florida, additional protections will be needed ([Action 15](#)). Current protective measures contained in Rule 68A-9.010, F.A.C., prevent bat exclusions from taking place between 15 April and 15 August. However, these measures do not require individuals conducting an exclusion to first determine what bat species or group of species would be affected by the exclusion. If a bat roost includes Florida bonneted bats and exclusion is conducted pursuant to the current guidelines, it could still result in take by death of young remaining in the roost after the exclusion, if Florida bonneted bats are found to have a maternity season that falls in the window for allowed exclusions.

To prevent take of Florida bonneted bats during exclusions, the following additional protections need to be addressed:

1. Identification of bat species roosting in structures. Visual inspections may be possible in some cases, but roosts are often located in inaccessible areas of a structure (e.g., behind walls, under tiles, or above soffits). Acoustic surveys may be another method to identify what species or group of species are using the roost prior to exclusion ([Action 15](#)).
2. Identification of the breeding and maternity seasons for the Florida bonneted bat. This may require reducing the season in which exclusions may be conducted within the range of the Florida bonneted bat.

The FWC recommends using only qualified and experienced NWCOs to exclude bats, and provides technical assistance for dealing with bats when they create human–wildlife conflicts. While very few violations of Rule 68A-9.010, F.A.C., are reported to FWC, it is not clear how often exclusions occur that are inconsistent with regulations. It is also not known if most individuals conducting nuisance wildlife work can distinguish between Florida bonneted bats and other bat species. Despite the protections provided to bats in general and to Florida bonneted bats via Rule 68A-9.010 and Chapter 68A-27, F.A.C., there is still concern that Florida bonneted bats may be excluded during sensitive time periods or are being removed from roosts using prohibited methods (C. Marks, personal communication).

An additional issue to consider in roost protection during exclusions is that removal of pest species “in, on, or under” a structure is regulated by the Structural Pest Control Act (Chapter 482, Florida Statutes [F.S.] and Rule 5E-14, F.A.C.) through the Florida Department of Agriculture and Consumer Services (DOACS). This act primarily focuses on the regulation of pesticide use; however, many NWCOs that remove animals from attics or crawl spaces are also regulated by this act. Full licensing as a pest-control operator requires extensive knowledge of pesticides, and this requirement is not applicable to most NWCOs. To address this, DOACS amended Chapter 482, F.S., to include a limited certification for commercial wildlife management personnel (s. 482.157, F.S.), which is required for anyone removing rats and mice, but is encouraged for those removing other species from buildings. DOACS training materials do not include specific recommendations for Florida bonneted bats, and are not adequate to assure conservation of bats in general. [Action 19](#) addresses these concerns through coordination with DOACS.

To improve conservation of bats roosting in structures, we recommend implementing [Actions 15, 16, 17, and 19](#) to improve compliance with existing rules and knowledge about the Florida bonneted bat.

Threats to the Florida bonneted bat were identified by the BRG, but research is needed to understand how these threats may be impacting populations. New regulations or permitting related to habitat loss and roost protection in natural areas are not recommended at this time because of the lack of information about the life history of the Florida bonneted bat. As research actions are implemented and new information is acquired, additional protections or permitting requirements may be suggested in the future ([Action 15](#)).

Law Enforcement

Action 16 Develop and implement an FWC Law Enforcement training module for Florida bonneted bats.

In conjunction with federal, state, and local partners, the FWC’s Division of Law Enforcement is responsible for enforcing Florida’s wildlife and fisheries laws. FWC biologists and other bat experts can educate law enforcement officers through the development, circulation, and interpretation of identification tools, distribution maps, handling, and other approved methods for dealing with unwanted bats ([Action 16](#)). Since the Florida bonneted bat can be mistaken for other bat species, proper identification tools will be important for documenting violations of Florida’s wildlife laws. In turn, an important component of the enforcement strategy is ensuring compliance through public education ([Action 17](#)). FWC law enforcement officers understand the importance of explaining wildlife laws to the public to avoid unintentional violations.

However, FWC law enforcement officers actively pursue and recommend prosecution for those who intentionally violate wildlife laws. FWC law enforcement officers also educate the public on how to identify and report violations. The Division of Law Enforcement administers the Wildlife Alert program, which receives information via a toll-free number (1-888-404-3922) answered 24 hours a day, 7 days a week.

Incentives and Influencing

Influencing

The [BSR](#) and this plan identify the threats to the Florida bonneted bat that have warranted state listing, as well as regulatory recommendations that may afford them protection from take. The FWC is working to develop recommendations for protecting Florida bonneted bat roosts ([Action 1](#)) and landscape-level recommendations for the conservation of the Florida bonneted bat ([Action 3](#)). Existing efforts to influence county and city governments, private landowners, and other state and private entities should incorporate these recommendations wherever possible.

Incentive Programs

The FWC’s Landowner Assistance Program advances species conservation objectives through public-private conservation partnerships. FWC also takes advantage of several programs that promote conservation by providing technical and financial assistance to private landowners.

FWC partners with other state and federal agencies to administer the Forest Stewardship Program, Wildlife Habitat Incentives Program, Wetlands Reserve Program, Environmental Quality Incentives Program, Partners for Fish and Wildlife Program, and the Cooperative Conservation Blueprint. Florida also provides tax incentives, including property tax exemptions for landowners that put a perpetual conservation easement on their land. Additional incentives may include exemption from permits for activities that enhance wildlife activities such as mowing, roller-chopping, and tree stand thinning, as long as they are not a precursor to development or negatively impacting imperiled species. Any number of these incentive programs may be applicable for working with private landowners to identify, protect, and manage existing and potential habitat for the Florida bonneted bat.

Education and Outreach

Bats are often misunderstood by the public. Misinformation can often lead to persecution of bats. Because the Florida bonneted bat is so rare, most people are not aware of the existence of this species. Education and outreach is critical to develop awareness of the needs of Florida bonneted bats ([Action 17](#)), and all bat species. Within FWC, education for staff responding to public requests for assistance with bats within the range of the Florida bonneted bat is also critical. Support from stakeholders and conservation partners will be an important component in implementation of conservation actions listed in this plan ([Action 18](#)).

Action 17 Develop and implement an education and outreach program on the Florida bonneted bat, including development of a Florida bonneted bat webpage for public use.

Target audiences for this program include, but are not limited to:

- Land managers
- Conservation planners
- City and county governments
- Pesticide applicators
- Licensed NWCs
- Homeowners and homeowners associations
- Developers and environmental consultants

Educational materials will have greater impact if tailored to the target audience. The following key messages should be included:

- The Florida bonneted bat is listed by the FWC as a Threatened species, and is also listed by USFWS as Endangered; they are therefore protected by state and federal regulations.
- Bats in general are beneficial to have in nature, and the presence of this rare species in south Florida contributes to the uniqueness of that region of the state.
- Bats in buildings or in other situations where they could create human–wildlife conflicts are still protected, and resources are available to help address any potential problems.
- Because Florida bonneted bats are so rare, actions taken to conserve the species and learn more about their natural history are very important.
- Bat houses have the potential to be an important conservation tool for Florida bonneted bats ([Action 2](#)).
- Roost protection guidelines and general habitat management guidelines will be provided if they become available.

Coordination with Other Entities

A number of partners, including other state agencies, federal and county governments, universities, research and consulting groups, and private individuals take an interest in the conservation of Florida bonneted bats. Research and monitoring are high-priority actions for Florida bonneted bats, and many other entities are currently pursuing projects involving this species across its range. In addition to the information outlined in the plan, the Conservation Action Table ([Table 1](#)) identifies priorities for research actions, and suggests specific information that should be included in ongoing and future Florida bonneted bat research.

[Action 5](#) recommends development of a database of research and occurrence information, which will require coordination with other entities to complete. This should include coordinating with the Department of Health to ensure that agency is aware of FWC’s interest in any bat specimen that may be a Florida bonneted bat. FWC maintains a bat mortality database for reporting sick or dead bats. Anyone who finds a bat that appears sick, is acting in an unusual manner, or is dead is encouraged to report that information by calling FWC’s Wildlife Alert phone number (1-888-404-3922) or completing the FWC’s [form for reporting sick, unusually behaving, or dead bats](#). [Action 18](#) describes an opportunity for continued coordination among conservation partners.

Action 18 Maintain FWC involvement in the Florida Bonneted Bat Working Group.

In 2012, the Florida Bonneted Bat Working Group formed to address the conservation needs of this species across its range. Members include the FWC, USFWS, National Park Service, Zoo Miami, FBC, and several other private and public entities. Many members are also stakeholders referenced in this plan. Continuation of this working group will aid in communication among conservation partners for Florida bonneted bats and will aid in implementation of many conservations actions outlined in this plan.

Action 19 Work with DOACS to improve educational materials provided to NWCOs through the limited commercial wildlife management certification.

The limited certification for commercial wildlife control operators requires that an applicant pass a test that includes acceptable methods for removal of wildlife from structures. The current set of [documents](#) that serve as study material does not provide any information about the Florida bonneted bat and provides a very limited set of guidelines for conducting exclusions. Incorporating the expertise of bat biologists and partners to improve the study material will benefit the Florida bonneted bat and bats in general ([Action 19](#)). The module developed in [Action 16](#) could be an appropriate model for the information to include in reference material for DOACS.

Table 1. Florida Bonneted Bat (*Eumops floridanus*) Conservation Action Table

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

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgency
Based on answers to Likely Effectiveness, Feasibility & Urgency Scale = 1 to 5 (1 = highest priority)					ONGOING = activity is currently being done EXPANDED = do more than what is currently being done NEW = activity is NOT currently being done	YES indicates that FWC has authority to implement an action and NO indicates that other entities need to be consulted/influenced to fully realize implementation	Can we divert existing resources to complete the action (YES / NO)?	Estimated \$ to implement action; May be TBD (to be determined)	Where will needed \$ come from? (Trust fund, Grant, Legislature, Existing budget, Unknown, etc.)	FWC divisions, programs or sections working together and with external partners to accomplish the action	Agencies, local governments, organizations, universities, landowners working together with FWC to accomplish the action.	Likelihood of achieving the desired result and ultimately contributing to the conservation or knowledge of the species.	Can it be done? Practical? Relationships already exist? Consider answers to other columns to the left.	Consider how dire the threats are to species and if the proposed action is critical to the immediate survival of the species? (YES/NO and explain WHY?)
1	2	1	Develop recommendations for protecting Florida bonneted bat roosts.	Habitat Conservation & Mgmt, Protections & Permitting	NEW	YES	YES	TBD	Existing budget, grant, or unknown	WHM, FWRI, SCP	Florida Bonneted Bat Working Group Members	High - if roosts are identified, this action would contribute to the conservation of the species.	Feasible - relationships already exist, can be done but will depend on implementation/completion of other actions that help identify FBB roosting habitat.	Yes - critical to immediate survival of FBB because loss of roosting habitat is a likely contributing factor to overall population decline.
1	1	2	Develop and implement guidelines for building, installing, and monitoring bat houses for Florida bonneted bats.	Habitat Conservation & Mgmt, Monitoring & Research, Education & Outreach	EXPANDED	YES	YES	TBD	Existing budget, grant, or unknown	WHM, FWRI, SCP	Florida Bonneted Bat Working Group Members	High - as interest grows for putting out FBB bat houses, this Action would be highly effective in aiding in conservation and increasing knowledge of FBBs.	Feasible - relationships already exist, can be done, FWC general bat house monitoring protocol already developed and being tested.	Yes - as more people become interested in putting out bat houses, direction is needed on best methods, etc., to do this effectively.
1	2	3	Use information from research on rate of habitat loss, conversion, and alteration to develop landscape level recommendations for the conservation of the Florida bonneted bat.	Habitat Conservation & Mgmt, Monitoring & Research	NEW	YES	YES	TBD	Existing budget, grant, or unknown	WHM, FWRI, SCP	Florida Bonneted Bat Working Group Members	Unknown/High - need to know what habitat components and landscape features are required by FBB but detection difficulties may limit development of landscape level recommendations.	Possible - Relationships already exist. Without known FBB natural roost locations it may be difficult to develop specific recommendations. Acoustic survey data could be used.	Yes - Habitat changes and landscape alterations are ongoing. Need to develop guidelines ASAP to preserve remaining FBB habitat.
1	2	4	Assess the need for potential management actions for Florida bonneted bats roosting in bat houses during extreme weather events, such as hurricanes or freezes, and develop guidelines if appropriate.	Population Mgmt, Monitoring & Research	NEW	YES	YES	TBD	Existing budget, grant, or unknown	WHM, FWRI, SCP	Florida Bonneted Bat Working Group Members	Unknown - research on population size and distribution would put the importance of this action into perspective. Potential to lose occupied bat houses in a hurricane is high, likely less so for cold weather.	Possible - relationships already exist. Feasibility and practicality unknown at this time.	Unknown - this could be critical to the immediate survival of the species given how few known roosts occur but it is not known if potential actions are warranted.
1	1	5	Develop a database of research and occurrence information.	Monitoring & Research, Coordination with Other Entities	NEW	NO	YES	TBD	Existing budget, grant, or unknown	WHM, FWRI, SCP	Florida Bonneted Bat Working Group Members	High - compiling info into a database would help to know what info is available and also what still needs to be collected. This may also help in setting standards for data collection.	Feasible - relationships already exist, can be done, Bonneted Bat Working Group has been formed and is facilitating communication among individuals/entities working with FBB.	Yes - a readily accessible database on FBB research and monitoring would identify data gaps and facilitate information sharing among conservation partners.
1	1	6	Develop standard methods for detecting presence of bonneted bats.	Monitoring & Research	NEW	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, SCP, WHM	Florida Bonneted Bat Working Group Members	High- standard methods would be beneficial as there are many entities besides FWC surveying for FBB. Would contribute to the knowledge of the species.	Possible/Feasible - relationships already exist, probably can be done.	Yes - better data collection would increase knowledge about FBB and may aid in accomplishing other actions relating to roost protection and habitat recommendations.

Table 1. Florida Bonneted Bat (*Eumops floridanus*) Conservation Action Table

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgency
	Based on answers to Likely Effectiveness, Feasibility & Urgency Scale = 1 to 5 (1 = highest priority)				ONGOING = activity is currently being done EXPANDED = do more than what is currently being done NEW = activity is NOT currently being done	YES indicates that FWC has authority to implement an action and NO indicates that other entities need to be consulted/influenced to fully realize implementation	Can we divert existing resources to complete the action (YES / NO)?	Estimated \$ to implement action; May be TBD (to be determined)	Where will needed \$ come from? (Trust fund, Grant, Legislature, Existing budget, Unknown, etc.)	FWC divisions, programs or sections working together and with external partners to accomplish the action	Agencies, local governments, organizations, universities, landowners working together with FWC to accomplish the action.	Likelihood of achieving the desired result and ultimately contributing to the conservation or knowledge of the species.	Can it be done? Practical? Relationships already exist? Consider answers to other columns to the left.	Consider how dire the threats are to species and if the proposed action is critical to the immediate survival of the species? (YES/NO and explain WHY?)
1	1	7	Determine the current geographic range (i.e., extent of occurrence and area of occupancy).	Monitoring & Research	EXPANDED	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, SCP, WHM	Florida Bonneted Bat Working Group Members	High - current range is limited to counties in which the species occurs, this action would contribute to both conservation and knowledge of FBBs.	Feasible - relationships already exist, practical, would require significant manpower and resources.	Yes - necessary to understand where the species occurs in order to best protect it and meet Conservation Goal.
1	2	8	Identify Florida bonneted bat roosting and foraging habitat.	Monitoring & Research	EXPANDED	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, WHM, SCP	Florida Bonneted Bat Working Group Members	Moderate/High - completion of this action would increase the effectiveness of Actions 1-3.	Possible/Feasible - relationships already exist, probably can be done.	Yes - in order to protect habitat specifically for FBB we need to know what its habitat preferences are.
1	1	9	Determine what kinds of roost sites are available and how they are used.	Monitoring & Research	EXPANDED	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, WHM, SCP	Florida Bonneted Bat Working Group Members	Moderate - no effective methods for locating natural roosts are currently available, completion of this action would increase the effectiveness of Actions 1-3.	Possible - relationships already exist but until a natural roost is located this action will be difficult to accomplish.	Yes - identifying roosting habitat is arguably the most critical component of FBB conservation right now.
1	3	10	Assess genetic diversity across the population.	Monitoring & Research	NEW	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, SCP, WHM	Florida Bonneted Bat Working Group Members	High/Moderate - if animals can be captured. Would inform potential population management needs	Possible and feasible - if FBB's can be caught across the range.	No - identifying roosting ecology is more urgent in the short term for conservation.
1	3	11	Develop and implement range-wide surveys to estimate population size.	Monitoring & Research	NEW	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, SCP, WHM	Florida Bonneted Bat Working Group Members	Unknown - accurately assessing population size in bats is difficult.	Unknown - FBB roost in small colonies and only a few are known. May not be possible to accurately estimate population size.	Yes - understanding the population size relates to the conservation of the species and achieving Conservation Goal and Objective.
1	1	12	Determine Florida bonneted bat breeding biology, productivity, and survival rates.	Monitoring & Research	NEW	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, SCP, WHM	Florida Bonneted Bat Working Group Members	High - this action would contribute to conservation and knowledge of the species and would help inform other actions.	Possible - relationships already exist.	Yes - FBBs may have a longer breeding season than other bats in Florida, until that is better understood, FBBs may not be adequately protected during its breeding season.
1	2	13	Determine specifically what Florida bonneted bats eat and how their diet varies across their range and over time.	Monitoring & Research	NEW	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, SCP, WHM	Florida Bonneted Bat Working Group Members	Moderate - this action would contribute to conservation and knowledge of the species.	Feasible - Practical, though time consuming. Can be done, relationships exist.	Yes - understanding the FBB's diet would aid in enhancing prey availability as a management action.
1	3	14	Determine effects of environmental toxins, including pesticides, on Florida bonneted bats.	Monitoring & Research	NEW	YES	NO	TBD	Existing budget, grant, or unknown	FWRI, SCP, WHM	Florida Bonneted Bat Working Group Members	Moderate - this action would contribute to conservation and knowledge of the species.	Feasible - Practical, could relate to Action 14, can be done, relationships exist.	Yes - much of the range includes urban or agricultural areas where the FBB could be exposed to toxins, especially pesticides.

Table 1. Florida Bonneted Bat (*Eumops floridanus*) Conservation Action Table

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgency
	Based on answers to Likely Effectiveness, Feasibility & Urgency Scale = 1 to 5 (1 = highest priority)				ONGOING = activity is currently being done EXPANDED = do more than what is currently being done NEW = activity is NOT currently being done	YES indicates that FWC has authority to implement an action and NO indicates that other entities need to be consulted/influenced to fully realize implementation	Can we divert existing resources to complete the action (YES / NO)?	Estimated \$ to implement action; May be TBD (to be determined)	Where will needed \$ come from? (Trust fund, Grant, Legislature, Existing budget, Unknown, etc.)	FWC divisions, programs or sections working together and with external partners to accomplish the action	Agencies, local governments, organizations, universities, landowners working together with FWC to accomplish the action.	Likelihood of achieving the desired result and ultimately contributing to the conservation or knowledge of the species.	Can it be done? Practical? Relationships already exist? Consider answers to other columns to the left.	Consider how dire the threats are to species and if the proposed action is critical to the immediate survival of the species? (YES/NO and explain WHY?)
1	1	15	Use results of research on Florida bonneted bat life history to develop needed protections.	Protections & Permitting	NEW	YES	YES	TBD	Action will not require funding	SCP, WHM, FWRI, LE, FWC's Legal Department	DOACS, NWCOs, Bonneted Bat Working Group Members	High - adequately protecting FBB during their maternity season would contribute to the conservation of the species.	Feasible - completion depends on other actions relating to roosting and breeding biology.	Yes - FBBs may have a longer breeding season than other bats in Florida, until that is better understood, FBBs may not be adequately protected during its breeding season.
1	2	16	Develop and implement an FWC Law Enforcement training module for Florida bonneted bats.	Law Enforcement	NEW	YES	YES	TBD	Unknown	SCP, WHM, LE	Florida Bonneted Bat Working Group Members	High - as a Threatened species, it is LE's responsibility to recognize FBBs and enforce the F.A.C. as it pertains to FBBs.	Feasible - requires coordination and communication with LE.	Yes - protection of FBBs and their roosts is essential to the conservation of the species.
1	2	17	Develop and implement education and outreach program on the Florida bonneted bat, including development of a Florida bonneted bat webpage for public use.	Education & Outreach	NEW	YES	YES	TBD	Grant, Unknown	WHM, OCR, SCP	Florida Bonneted Bat Working Group Members	High/Moderate - developing educational materials will be important in educating the public, land managers, LE, and other entities about FBB identification, roost protection, and how they can aid in the conservation of FBBs.	Feasible - can be done, practical, relationships already exist.	Yes - involvement from the public and other entities is vital to conservation this species as it's range expands beyond protected areas.
1	1	18	Maintain FWC involvement in the Florida Bonneted Bat Working Group.	Coordination with Other Entities	ONGOING	YES	YES	TBD	Existing budget	WHM, FWRI, SCP	Florida Bonneted Bat Working Group Members	High - developing and maintaining a working relationship with other entities involved in FBB conservation will contribute to both conservation and knowledge of the species.	Feasible/Ongoing - FWC staff initiated the working group and have developed a relationship that should be maintained.	Yes - a coordinated effort will be necessary to accomplish all actions in this plan and to meet the Conservation Goal and Objective.
1	2	19	Work with DOACS to improve educational materials provided to NWCO's through the limited commercial wildlife management certification.	Coordination with Other Entities	ONGOING	YES	YES	TBD	Existing budget, unknown	SCP	DOACS, NWCOs, Bonneted Bat Working Group Members	High - current educational materials lacking in regards to bats in general and specifically FBB. Increasing effectiveness of NWCOs dealing with nuisance bats could contribute to FBB conservation.	Feasible/Practical - relationships already exist.	Yes - improving educational materials for NWCOs should improve how they deal with FBBs and reduce negative effects.

Acronyms used in this table:

- ASAP: As soon as possible
- DOACS: Florida Department of Agricultural and Consumer Services
- F.A.C. Florida Administrative Code
- FBB: Florida Bonneted bat
- FWC: Florida Fish and Wildlife Conservation Commission
- FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission
- LE: Law enforcement
- NWCO: Nuisance Wildlife Control Officer
- OCR: The Florida Fish and Wildlife Conservation Commission's Office of Community Relations
- 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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APPENDICES

Appendix 1. Instructions for building a single-chambered bat house. (These are general plans for a single-chambered bat house but this design has not been tested for use by Florida bonneted bats.)

<http://www.batcon.org/pdfs/bathouses/SingleChamberBHPlans.pdf>



BAT CONSERVATION
INTERNATIONAL
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Single-chamber Bat House (wall mounted)

Materials (makes one house)

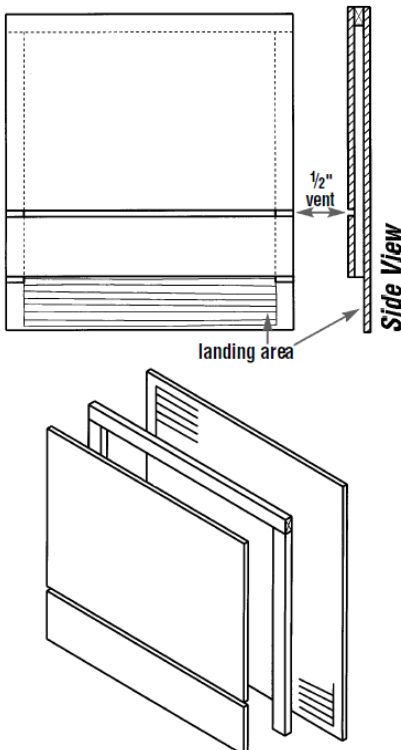
- ¼ sheet (2' x 4') ½" AC, BC or T1-11 (outdoor grade) plywood
- One piece 1" x 2" (¾" x 1½" finished) x 8' pine (furring strip)
- 20 to 30 exterior-grade screws, 1"
- One pint dark, water-based stain, exterior grade
- One pint water-based primer, exterior grade
- One quart flat, water-based paint or stain, exterior grade
- One tube paintable latex caulk
- 1" x 4" x 28" board for roof (optional, but highly recommended)
- Black asphalt shingles or galvanized metal (optional)
- 6 to 10 roofing nails, ¾" (if using shingles or metal roofing)

Recommended tools

Table saw or handsaw	Caulking gun
Variable-speed reversing drill	Paintbrushes
Screwdriver bit for drill	Hammer (optional)
Tape measure or yardstick	Tin snips (optional)

Construction

1. Measure and cut plywood into three pieces:
26½" x 24" 16½" x 24" 5" x 24"
2. Roughen inside of backboard and landing area by cutting horizontal grooves with sharp object or saw. Space grooves ¼" to ½" apart, cutting ½" to ⅝" deep.
3. Apply two coats of dark, water-based stain to interior surfaces. Do not use paint, as it will fill grooves.
4. Cut furring strip into one 24" and two 20½" pieces.
5. Attach furring strips to back, caulking first. Start with 24" piece at top. Roost chamber spacing is ⅜".
6. Attach front to furring strips, top piece first (caulk first). Leave ½" vent space between top and bottom front pieces.
7. Caulk all outside joints to further seal roost chamber.
8. Attach a 1" x 4" x 28" board to the top as a roof (optional, but highly recommended).
9. Apply three coats of paint or stain to the exterior (use primer for first coat).
10. Cover roof with shingles or galvanized metal (optional).
11. Mount on building (south or east sides usually best).



More bat-house plans and additional information can be found in BCI's *Bat House Builder's Handbook*, available at www.batcatalog.com.

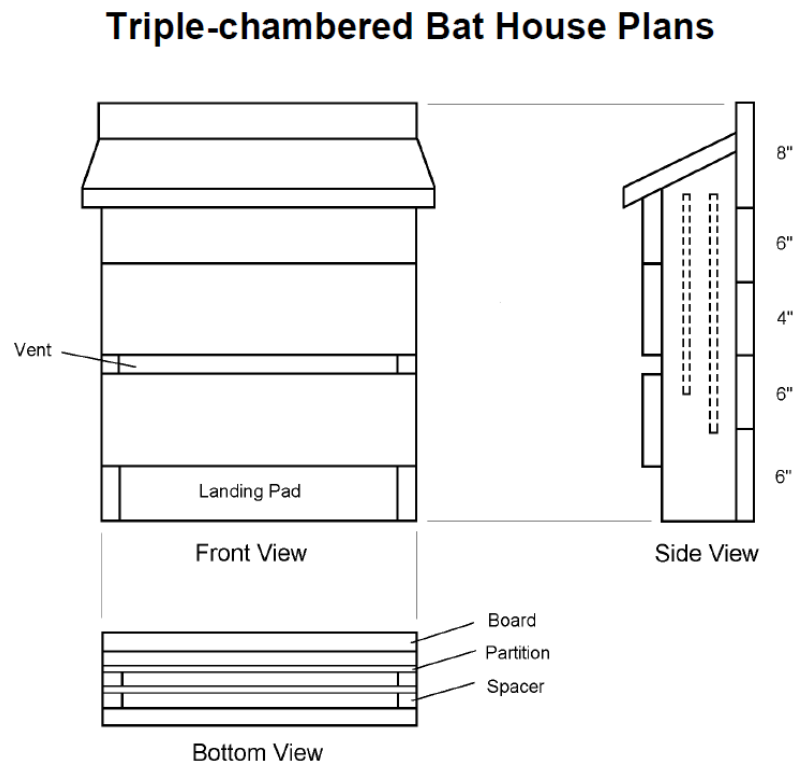
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Optional modifications to the single-chamber bat house

1. Wider bat houses can be built for larger colonies. Be sure to adjust dimensions for back and front pieces and ceiling strip. A ⅜" support spacer may be needed in the center of the roosting chamber for bat houses over 24" wide to prevent warping.
2. To make a taller version for additional temperature diversity, use these modifications: From a 2' x 8' piece of plywood, cut three pieces: 51" x 24", 33" x 24" and 12" x 24". Cut two 8' furring strips into one 24" and two 44" pieces. Follow assembly procedure above.
3. Two bat houses can be placed back-to-back, mounted between two poles, to create a three-chamber nursery house. Before assembly, cut a horizontal ⅜" slot in the back of each house about 9" from the bottom edge of the back piece to permit movement of bats between houses. Two pieces of wood, 1" x 4" x 4¼", screwed horizontally to each side, will join the two boxes. Leave a ⅜" space between the two houses, and roughen the wood surfaces or cover the back of each with plastic mesh (see item 5 below). Do not cover the rear exit slots with mesh. One 1" x 4" x 34" vertical piece, attached to each side over the horizontal pieces, blocks light but allows bats and air to enter. A galvanized metal roof, covering both houses, protects the center roosting area from rain. Eaves should be about 3" in southern areas and about 1½" in the north.
4. Ventilation may not be necessary in cold climates. In this case, the front should be a single piece 23" long. Smaller bat houses like this one will be less successful in cool climates. However, those mounted on buildings maintain thermal stability better and are more likely to attract bats.
5. Durable plastic mesh can be substituted to provide footholds for bats. Attach one 20" x 24½" piece to backboard after staining interior, but prior to assembly.

Appendix 2. Instructions for building a triple-chambered bat house.

http://www.floridabats.org/ImagesBHs/Bat_House_Plans.pdf

**MATERIALS**

One 3' foot long 1" X 8" (7/4")
 One 8' foot long 1" X 6" (5 1/2")
 One 6' foot long 1" X 4" (3 1/2")
 Two 3' foot long 1" X 1" (3/4")

One 2' X 2' sheet of T-111 exterior siding or rough sided plywood.
 One 4' by 4' sheet 1/4" plastic mesh (Optional).
 46 - 1 5/8" #8 galvanized wood screws.

*Plastic mesh is only necessary if the interior of the bat house is constructed with smooth-sided wood. A better approach is to use T-111 siding for the partitions and rough-sided lumber for the back wall. If smooth-sided wood or plywood is used, it can be grooved at 1/2" intervals to provide a rough surface for the bats to grasp onto. See also the note at bottom of page 2.

INSTRUCTIONS

- Step 1. From the 1X6, cut six 14" sections for the front and back panels of the bat house.
 From the 1X8, cut one 16" section for the roof and one 14" section for the back.
 From the 1X1's cut four 17" sections. These will be used as spacers to secure the partitions.
 From the 1X4, cut one additional 14" section for the back. From the remaining piece of the 1X4 cut two sections for the sides. One end of each piece will be cut at a 30-degree angle for the roof. This can be done by cutting each piece with a front length of 21 1/2" and a back length of 23 1/2".

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Appendix 2 continued.

- Step 2. From the T-111 or plywood sheet, cut a 17"X12" section for the back partition, and a 16"X12" section for the front partition. Note: If a larger piece of plywood is available, these two pieces can be cut 12½" in width to provide a flush fit at either side.
- Step 3. Bevel the back of the 16" roof section at 30 degrees. The roof will look best if the top (widest side) is made 6½" wide when the bevel is cut. Bevel one of the 14" X 6" pieces at 30 degrees. This piece will be used at the top of the front and the bevel is necessary to match the roof.
- Step 4. Begin assembly of the bat house by placing the two side pieces on a table with the long sides up and 14" apart (outside to outside). It is recommended that glue or caulking be used as the bat house is assembled to strengthen and weatherproof it. Place one of the 14" X 6" pieces on top and align it with the bottom of the two side pieces. Fasten it with two 1-5/8" wood screws on each side. Drilling 3/32" pilot holes for all screws will help prevent the wood from splitting. Repeat the process with a 6", 4", 6" and 8" piece, in that order. This will place the 8" piece at the top of the bat house. Now turn the bat house over so it is laying on its back. Drill one 5/16" hole at the top, and one 5/16" hole bottom. These will be used for mounting the bat house to a post or building. The holes should be located in the center and 2" from the edge.
- Step 5. If plastic mesh is being used, cut two sections of plastic mesh the same dimensions as the plywood partitions. Staple the mesh to the plywood using vertical rows of staples about 2-3" apart. The side with the mesh will face the front of the bat house. Cut a section of plastic mesh 12" wide and 23" long and place it on the back wall of the bat house. Fasten the mesh with vertical rows of staples about 2-3" apart.
- Step 6. Position the 1X1's in the left and right-hand corners with the bottom ends located 4½" from the bottom of the bat house. This will create a 4½" landing pad. Place the 17" partition with the rough or mesh covered side up on top of the two 1X1's already in position. Use three 1-5/8" wood screws in each; one in the center and the other two about ¾" from each end. Make sure the top wood screw securely attaches the 1X1 to the 8" board on the back wall. This will add strength to the bat house.
- Step 7. Position the remaining two 1X1's on each side of the partition directly above the previous two. Place the 16" partition on top (rough or mesh side up); allowing 1" of the previous 1X1's to show at the bottom. This open space makes it easier for bats to crawl into the forward crevices. Now fasten the plywood section and 1X1's using two 1-5/8" screws on each side. Locate them about 1½" from the top and bottom of the plywood partition to avoid the screws underneath.
- Step 8. Place the beveled 14" X 6" board at the top of the front, aligning the beveled edge with the 30 degree angle of the two side pieces. Fasten it using two 1-5/8" screws on each side. Repeat using a second 14" X 6" board. Locate the third and final 14" X 6" board about ½" down from the previous one to form a ½" gap for the vent.
- Step 9. Center the roof section such that there is equal overhang on each side. Fasten it to the side pieces using two 1-5/8" screws on each side. The roof should be caulked where it meets the back wall. Adding roofing material and painting the bat house will greatly extend its life. A light brown color works well in Florida.
- Step 10. The bat house can be mounted on a 4"X4" post or the side of a building using the holes drilled in step 4 and three-inch long, 5/16" lag bolts. A large galvanized or stainless steel washer (fender washer) is recommended to protect the wood. Mounting on trees is not recommended because they have proven to be the least successful location for bat houses. Bat houses should be located at least ten feet above ground. Experience indicates the higher the bat house is mounted the more likely it will get bats.

Note 1: There are photographs of this bat house during various stages of construction on the web at: <http://www.floridabats.org/BatHousePlanPhotos.htm>.

Note 2: If you choose to use ¼" plastic mesh please contact the Florida Bat Conservancy since it is not readily available from local suppliers. We can mail you the required amount of mesh for this bat house design for the cost of the material and shipping.

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Appendix 3. FWC bat house occupancy assessment protocol.

Protocol current as of May 2013.



Bat House Occupancy Assessment

Bat houses provide roosting sites for several species of bats in Florida and can be an important tool in bat conservation. Better information is needed on where and when bats are using bat houses on conservation lands, and if land management activities have the potential to impact bat house use. Participating in bat house occupancy assessments will lead to better recommendations on bat house siting, and over many years may provide trend information on bat house use.

Assessment Objective - Estimate number of bats and seasonality of use of bat houses in Florida.

- ◇ Bat houses should be checked *THREE times every year*. Checks should be conducted once during each of the following time periods:

May-July
September-November 15th
December-February

- ◇ If staff resources allow, information is also needed relative to land management activities. These optional visits should be conducted *within a week before and after* land management activities within 100 ft of houses. Land management activities include prescribed burning, extensive timber removal, or other activities that *substantially* alter the immediate environment.
- ◇ Bat house checks fall into two categories: daytime checks and evening emergence counts.
 - Daytime Checks are completed to determine if bat houses are occupied and to estimate number of bats for each house according to the instructions below.
 - Evening Emergence Counts are **optional** and are best conducted at occupied houses in which number of bats cannot be estimated (ie. large condo houses, reduced visibility).

Daytime Checks - Visit each house during the day and look for signs that bats are using the house. For occupied houses, estimate number of bats, if possible.

- ◇ Bat sign includes:
 - Staining near the opening of the house chambers.
 - Small pellets scattered on the ground at the base of the house. Bat guano is a similar size to mouse or rat droppings, but is composed primarily of insect parts and can be easily crumbled. Pellets are also rather shiny in appearance.
 - Sounds of bats (chirping, chattering)
- ◇ Binoculars, mirrors, and flashlights can be used to look into house chambers for bats.
- ◇ Record date, presence/absence, type of bat sign, and **estimated number of bats** on datasheet.
 - **Estimated number of bats** – Count or estimate the number of bats in the bat house, if possible. In most cases bats cannot be individually counted, but an estimate of the

Appendix 3 continued.

proportion of space within each house that is filled by resting bats may be possible, using increments of 25% (ie. 0-25%, 26-50%, 51-75%, 76-100%). If *neither* a count nor estimate of proportion of space can be confidently determined, simply indicate whether the house is occupied.

- ♦ If conducting the daytime visit as part of a land management activity, please include the type of land management and the date of the activity in the data sheet. Multiple visits can be included on a single data sheet.

Evening Emergence Count - Conduct at houses known or suspected to be occupied and in which number of bats cannot be accurately determined. Technical and staff assistance can be provided if needed.

- ◇ Count should take place on a clear evening when the temperature is warmer than 45° F.
- ◇ Arrive at least 15 minutes prior to sunset; choose a location at least 25 feet from the house, with a clear view of the opening. Limit disturbance (noise, lights) that could prevent emergence.
- ◇ Bats should emerge shortly after sunset. The observer should remain at the house for at least 30 minutes after civil twilight, or until no more bats emerge from the house. If bonneted bats are suspected, the observer should remain at the house for at least 45 minutes after civil twilight.
- ◇ For sunset and civil twilight times, see http://aa.usno.navy.mil/data/docs/RS_OneDay.php
- ◇ Record date, number of bats, and other observations on datasheet.
- ◇ Near-infrared equipment can be used to record an emergence and can be particularly useful at large bat condos.

Reporting Data

- ◇ Fill out Bat House Information form *only once* for each bat house.
- ◇ Record all data from Daytime Checks and Evening Emergence Counts using the Bat House Occupancy Datasheet below.
- ◇ Send all forms to Melissa.Tucker@myfwc.com

FWC's Mammal Taxa Coordinator

Appendix 3 continued.



Bat House Information

Send forms to Melissa.Tucker@myfwc.com
 FWC's Mammal Taxa Coordinator

Please complete one form for each bat house on WMA/WEA.

General Information

WMA/WEA: _____
 Contact Name: _____
 Contact Phone Number: _____
 Total Number of Bat Houses: _____

Bat House Information

Bat House Name: _____
 (Name is for WMA/WEA staff reference only. Choose a name that uniquely identifies the bat house for staff purposes. Ex: Check station house, pond house, Burn Unit 12 house, etc.)

Latitude: _____ Longitude: _____
 (Decimal degrees preferred)

Installation Date (estimated month/year): _____

Bat House Size: Single ___ Double ___ Triple ___ Condo ___
 Estimated number of bats when full (if known): _____
 If size is unknown, estimated dimensions: _____

Bat House Mount Setup _____ Estimated Height of House (from ground) _____
 (Ex. Attached to tree, pole, 4x4, building)

Photo provided? (Y / N)
 If possible, please attach a photo of this house, labeled with Bat House Name.

Brief description of habitat within sight of bat house:

Other comments regarding bat house:

Appendix 3 continued.



Bat House Occupancy Datasheet

WMA/WEA

Observers

Send forms to [Melissa Tucker@myfwc.com](mailto:Melissa.Tucker@myfwc.com)

FWC's Mammal Taxa Coordinator

Bat House Name	Date	Survey Type (DC or EEC)	Bat Sign Observed (B = bats observed, G = Guano, S = Staining, C = chirping/chattering, N=none; Put all that apply.)	# of Bats or Proportion of Space with Bats (0-25%, 26-50%, 41-75%, 76-100%)	Check is Part of Land Mgmt Activity (Y or N)	Date of land management activity and description (if applicable; Ex: June 13 - prescribed fire in block containing bat house)
Comments:						