DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2012–0078; 4500030113]

RIN 1018–AY15

Endangered and Threatened Wildlife and Plants; Proposed Endangered Species Status for the Florida Bonneted Bat

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; request for public comments.

SUMMARY: We, the U.S. Fish and Wildlife Service, propose to list the Florida bonneted bat (*Eumops floridanus*), as an endangered species under the Endangered Species Act of 1973, as amended (Act). This proposed rule, if made final, would extend the Act's protections to this species. We have found that critical habitat is prudent but not determinable at this time due to lack of knowledge of which physical and biological features are essential to the conservation of the species. The Service seeks data and comments from the public on this proposed listing rule and on the biological needs of the species that will enable the Service to define critical habitat for this species.

DATES: We will accept comments received or postmarked on or before December 3, 2012. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES** section, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by November 19, 2012.

ADDRESSES: You may submit comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal: *http://www.regulations.gov.* In the Search box, enter FWS–R4–ES–2012–0078, which is the docket number for this rulemaking. You may submit a comment by clicking on ''Comment Now!''

(2) *By hard copy:* Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2012–0078; Division of Policy and Directives Management; U.S. Fish and Wildlife Service; 4401 N. Fairfax Drive, MS 2042–PDM; Arlington, VA 22203.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov.* This generally means that we will post any personal information you provide us (see the Information Requested section below for more information).

FOR FURTHER INFORMATION CONTACT: Larry Williams, Field Supervisor, U.S. Fish and Wildlife Service, South Florida Ecological Services Office, 1339 20th Street, Vero Beach, Florida 32960–3559, by telephone 772–562–3909, ext. 285, by facsimile 772–562–4288. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION: This document consists of: (1) A proposed rule to list the Florida bonneted bat as an endangered species; (2) a finding that designation of critical habitat for the species is prudent; and (3) a finding that critical habitat is not determinable at this time because the biological needs of the species are not sufficiently well known to permit identification of areas as critical habitat.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from the public, other concerned governmental agencies, Native American tribes, the scientific community, industry, or any other interested parties concerning this proposed rule. We particularly seek comments concerning:

(1) Additional information concerning the historical and current status, range, distribution, and population size of this species, including the locations of any additional populations or colonies of this species.

(2) Any information on the biological or ecological requirements of the species, especially life history information and habitat needs (e.g., preferred roosting and foraging habitat, nightly and seasonal movements, dispersal capabilities, diet, and seasonal changes in diet), and ongoing conservation measures for the species and its habitat.

(3) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to this species and regulations that may be addressing those threats.

(4) Current or planned land use activities in the areas occupied by the species and possible impacts of these activities on this species.

(5) Additional information regarding the threats under the five listing factors:

(a) The present or threatened destruction, modification, or curtailment of its habitat or range;

(b) Overutilization for commercial, recreational, scientific, or educational purposes;

(c) Disease or predation;

(d) The inadequacy of existing regulatory mechanisms; and

(e) Other natural or manmade factors affecting its continued existence.

We are particularly interested in information regarding threats from disease; predation; climate change; impacts to prey base, including insect abundance and availability; impacts from wind energy and other land use projects; inadvertent or purposeful removal or displacement of Florida bonneted bats; use of bat exclusion devices at inappropriate times; and regulations or conservation measures that may be addressing these threats.

(6) What physical or biological features (e.g., space, food, water, cover or shelter, sites for breeding and rearing of offspring, protected habitats) are essential to the conservation of the species.

(7) The reasons why we should or should not designate habitat as ''critical habitat'' under section 4 of the Act (16 U.S.C. 1531 *et seq.*), including the benefits of or possible risks of designation, including any possible adverse effects to Florida bonneted bats or roosts once their locations are published (e.g., targeted actions to discourage the use of roosts, intentional or excessive disturbance to roosts, removal of individuals from roosts, use of exclusion devices at inappropriate times, other persecution directed at the species), and any other risks associated with publication of maps designating any area on which the species may be located, now or in the future, as critical habitat.

(8) Specific information on:

(a) The amount and distribution of habitat for the Florida bonneted bat;

(b) What areas, which are occupied at the time of listing (or are currently occupied) contain features essential to the conservation of the species, should be included in a designation and why;

(c) Special management considerations or protection that may be needed in critical habitat areas, including managing for the potential effects of climate change; and

(d) What areas not occupied at the time of listing are essential for the conservation of the species and why.

(9) Information on the projected and reasonably likely impacts of climate

change on the Florida bonneted bat and its habitat.

Please note that submissions merely stating support for or opposition to the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is a threatened or endangered species must be made ''solely on the basis of the best scientific and commercial data available.''

You may submit your comments and materials concerning this proposed rule by one of the methods listed in the **ADDRESSES** section. We request that you send comments only by the methods described in the **ADDRESSES** section.

If you submit information via *http://www.regulations.gov,* your entire submission—including any personal identifying information—will be posted on the Web site. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov.* Please include sufficient information with your comments to allow us to verify any scientific or commercial information you include.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov,* or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Executive Summary

This document consists of: (1) A proposed rule to list the Florida bonneted bat (*Eumops floridanus*) as an endangered species; (2) a finding that designation of critical habitat for the species is prudent; and (3) a finding that critical habitat is not determinable at this time due to our current lack of understanding of the physical and biological habitat features essential to the conservation of the species.

Why we need to publish a rule. Under the Act, a species or subspecies may warrant protection through listing if it is an endangered or threatened species throughout all or a significant portion of its range. The Florida bonneted bat is currently a candidate species known to exist only in south Florida. The species has a small estimated population size and faces numerous and immediate threats throughout its very restricted range and, therefore, qualifies for listing. Protections under the Act can only be accomplished through issuing proposed and final rules. This document proposes the protection of the species and is based upon our careful review of the status of the species and the threats it faces, using the best available information. Additionally, we seek data and comments from peer reviewers, government agencies and Tribes, stakeholders, and the public on this proposed listing rule and on possible critical habitat for the species.

The basis for our action. Under the Act, a species may be determined to be an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence. Based on our analysis below, we have determined that the Florida bonneted bat qualifies for listing as an endangered species due to three of these five factors (Factors A, D, and E).

Peer review of our methods. We will obtain review and opinions from knowledgeable individuals with scientific expertise on our technical assumptions, analysis, adherence to regulations, and whether or not we used the best available information in developing this proposed rule. Their review will be requested during the public comment period.

Acronyms and Abbreviations Used in This Document

We use many acronyms and abbreviations throughout this proposed rule. To assist the reader, we provide a list of these here for easy reference:

Babcock-Webb WMA = Fred C. Babcock/Cecil M. Webb Wildlife Management Area
BCNP = Big Cypress National Preserve
CCSP = U.S. Climate Change Science Program
ENP = Everglades National Park
FBC = Florida Bat Conservancy
FBWG = Florida Bat Working Group
FDACS = Florida Department of Agriculture and Consumer Services
FDEP = Florida Department of Environmental Protection
FFS = Florida Forest Service
FNAI = Florida Natural Areas Inventory
FPL = Florida Power and Light
FR = Federal Register
FSPSP = Fakahatchee Strand Preserve State Park
FTBG = Fairchild Tropical Botanic Garden
FWC = Florida Fish and Wildlife Conservation Commission
IPCC = Intergovernmental Panel on Climate Change
NPS = National Park Service
OC = Organochlorine
OP = Organophospate
PSSF = Picayune Strand State Forest
SFWMD = South Florida Water Management District
WMA = Wildlife Management Area
WNS = White-nose syndrome

Previous Federal Actions

The Florida bonneted bat (*Eumops floridanus*) was previously known as the Florida mastiff bat (*Eumops glaucinus floridanus*).

On September 18, 1985, we published a Review of Vertebrate Wildlife for Listing as Endangered or Threatened Species (50 FR 37958), which included the Florida mastiff bat as a category 2 candidate species for possible future listing as an endangered or threatened species. Category 2 candidates were those taxa for which information contained in our files indicated that listing may be appropriate, but for which additional data were needed to support a listing proposal. In a January 6, 1989, Animal Notice of Review (54 FR 554), the Florida mastiff bat continued as a category 2 candidate. On November 21, 1991, the Florida mastiff bat was upgraded from a category 2 to a category 1 species in an Animal Candidate Review for Listing as Endangered or Threatened Species (56 FR 58804), characterized as having a declining trend (indicating decreasing numbers or increasing threats or both). It remained a category 1 candidate (declining trend) in the 1994 review (59 FR 58982). In 1996, the Florida mastiff bat was removed from the candidate list (61 FR 7596) because the taxon was deemed to be more abundant or widespread than previously believed or not subject to any identifiable threat.

On November 9, 2009, we recognized the Florida bonneted bat (*Eumops floridanus*) as a Federal candidate species in our annual Candidate Notice of Review (74 FR 57804) with a Listing Priority Number of 2 (threats high in magnitude and imminent). This action constituted a 12-month finding for the species in which it was determined that listing the species was warranted but precluded by other higher priority listing actions.

On January 29, 2010, we received a petition from Wild South to list the Florida bonneted bat as an endangered species and to designate critical habitat pursuant to the Act (O'Malley 2010). The petition heavily relied upon the Service's 2009 species assessment, but did not provide any new substantial

information. On February 17, 2010, we responded to the petitioner, indicating that we had previously determined that the listing of the species was warranted but precluded and that, through the Candidate Notice of Review process, we annually determine whether listing remains warranted but precluded.

On May 10, 2011, the Service announced a work plan to restore biological priorities and certainty to the Service's listing process. As part of an agreement with one of the agency's most frequent plaintiffs, the Service filed a work plan with the U.S. District Court for the District of Columbia. The work plan will enable the agency to, over a period of 6 years, systematically review and address the needs of more than 250 species listed within the 2010 Candidate Notice of Review, including the Florida bonneted bat, to determine if this species should be added to the Federal Lists of Endangered and Threatened Wildlife and Plants. This work plan will enable the Service to again prioritize its workload based on the needs of candidate species, while also providing State wildlife agencies, stakeholders, and other partners clarity and certainty about when listing determinations will be made. On July 12, 2011, the Service reached an agreement with a frequent plaintiff group and further strengthened the work plan, which will allow the agency to focus its resources on the species most in need of protection under the Act. These agreements were approved on September 9, 2011. The timing of this proposed listing is, in part, therefore, an outcome of the work plan.

The Service's decision to propose listing of the Florida bonneted bat resulted from our careful review of the status of the species and the threats it faces.

Endangered Species Status for the Florida Bonneted Bat

Background

The Florida bonneted bat is a member of the Molossidae (free-tailed bats) family within the order Chiroptera. The species is approximately 130 to 165 millimeters (mm) (5.1 to 6.5 inches [in]) in length (Timm and Genoways 2004, p. 857) and the largest bat in Florida (Owre 1978, p. 43; Belwood 1992, p. 216; Florida Bat Conservancy [FBC] 2005, p. 1). The length of the tail ranges from 46 to 57 mm (1.8 to 2.2 in), hind foot 11 to 15 mm (0.4 to 0.6 in), ear 20 to 30 mm (0.8 to 1.2 in), and forearm 60.8 to 66.0 mm (2.39 to 2.60 in) (Timm and Genoways 2004, p. 857). Masses average 39.7 grams (g) (1.4 ounces [oz]) and range from 30.2 to 46.6 grams (1.1 to 1.6 oz) (Owre 1978, p. 43; Belwood 1981, p. 412; Belwood 1992, p. 216; Timm and Genoways 2004, p. 857). A pregnant female with a single fetus weighed 55.4 g (2.0 oz) (Belwood 1981, p. 412). Males and females are not significantly different in size (Timm and Genoways 2004, p. 857). Timm and Genoways (2004, p. 857) found no pattern of size-related geographic variation in this species.

Members of the genus *Eumops* have large, rounded pinnae (ears), arising from a single point or joined medially on the forehead (Best *et al.* 1997, p. 1). The common name of ''bonneted bat'' originates from characteristic large broad ears, which project forward over the eyes (FBC 2005, p. 1). Ears are joined at the midline of the head. This feature, along with its large size, distinguish the Florida bonneted bat from the smaller Brazilian (=Mexican) free-tailed bat (*Tadarida brasiliensis*), the only other molossid to occur in Florida (Belwood 1992, p. 216).

Wings of the members of the genus *Eumops* are among the narrowest of all molossids (Freeman 1981, as cited in Best *et al.* 1997, p. 3) and are well-adapted for rapid, prolonged flight (Vaughan 1959 as cited in Best *et al.* 1997, p. 3). This wing structure is conducive to high-speed flight in open areas (Findley *et al.* 1972 as cited in Best *et al.* 1997, p. 3).

The Florida bonneted bat's fur is short and glossy, with hairs sharply bicolored with a white base (Belwood 1992, p. 216; Timm and Genoways 2004, p. 857). Like other molossids, color is highly variable; color varies from black to brown to brownish-gray or cinnamon brown with ventral pelage paler than dorsal (Owre 1978, p. 43; Belwood 1992, p. 216; Timm and Genoways 2004, p. 857). The basisphenoid pits (paired depressions in the basisphenoid bone) of the skull are ovoid (egg-shaped) and moderately deep (Timm and Genoways 2004, p. 857). The tail projects beyond the interfemoral membrane (skin that stretches between the legs) (Owre 1978, p. 43; Belwood 1992, p. 216).

Taxonomy

Allen (1932, pp. 256–259) first described a new genus and species of Pleistocene free-tailed bat, *Molossides floridanus,* from a jaw of a single specimen. Ray *et al.* (1963, pp. 373, 377–381) transferred *Molossides floridanus* to the genus *Eumops.* The genus *Eumops* was later revised (Koopman 1971, pp. 1–6; Eger 1977, pp. 1–69; Timm and Genoways 2004, p. 859). Koopman (1971, pp. 1–6) found specimens of *Eumops* from Florida that have been identified as *E. glaucinus* to be markedly larger than tropical American specimens of that species and regarded *floridanus* as a well-marked subspecies of *E. glaucinus.* Until recently, two subspecies of *E. glaucinus* had been recognized: *E. glaucinus floridanus,* which occurs in Florida, and *E. glaucinus glaucinus,* which occurs from central Mexico to southeastern Brazil and northwestern Argentina, and Cuba and Jamaica in the Greater Antilles (Eger 1977, pp. 39–43).

Timm and Genoways (2004, p. 852) reviewed and reassessed the taxonomic status of bats of the genus *Eumops.* They found considerable geographic variation among specimens of bonneted bats (then named *E. glaucinus*) and determined that *E. glaucinus* is in fact a species-group consisting of more than one species. Timm and Genoways (2004, pp. 852, 855, 859) determined that bonneted bats in Florida are significantly larger than those in all other populations and have other distinguishing skeletal morphology, including the following: proportionally shorter and deeper basisphenoid pits (bony cavities inside the nose), glenoid fossa (mandibular fossa or depression in the skull) that are broadly triangular with rounded apices (tips), and differences in shape of the baculum (penis bone) and palate. Given these differences, Timm and Genoways (2004, pp. 852, 856) indicated that the correct name for both Pleistocene and Recent Florida bonneted bats is *Eumops floridanus.* Recent studies show that morphologically, *E. floridanus* is distinct from all other populations in the *E. glaucinus* complex (R. Timm, University of Kansas, pers. comm. 2008a; McDonough *et al.* 2008, pp. 1306, 1311). Based upon their most recent work, McDonough *et al.* (2008, p. 1306) concluded that there are four species in the *E. glaucinus* complex—*E. glaucinus* (in South America east of the Andes), *E. ferox* (in the Caribbean, Mexico, and Central America), an unnamed taxon in western Ecuador (subsequently described as *E. wilsoni* (Baker *et al.* 2009, pp. 1–13)), and *E. floridanus* in south Florida.

E. floridanus is extremely similar in both the mitochondrial and nuclear genes to the populations on Cuba and Jamaica and is clearly derived from those populations (R. Timm, pers. comm. 2008a; McDonough *et al.* 2008, pp. 1309–1313). Specimens of *E. floridanus* are morphologically distinct from *E. glaucinus,* but cannot be distinguished by cytochrome-b or amplified fragment length polymorphism (AFLP) DNA data (McDonough *et al.* 2008, pp. 1312–1313). McDonough *et al.* (2008, p. 1313) suggested that morphological

distinction in *E. floridanus* has preceded establishment of either mitochondrial or nuclear distinction through their examination of mtDNA (mitochondrial DNA), nuclear AFLP, karyotypic, and morphological data within the *E. glaucinus* complex. According to McDonough (2008, p. 1313), the *floridanus-glaucinus* complex presented a unique opportunity to study the process of speciation using new techniques from the emerging field of genomics, and the use of multiple character sets (mtDNA, nuclear, and morphological) will become more prevalent in the future. McDonough *et al.* (2008, p. 1313) stated that while adherence to the genetic species concept would relegate *E. floridanus* to conspecific status (of or belonging to the same species) with *E. glaucinus,* morphological and ecological concepts clearly call for the recognition of *E. floridanus* as a distinct species.

The Florida bonneted bat (*E. floridanus*) was previously known as Florida mastiff bat, Wagner's mastiff bat, and mastiff bat (*E. glaucinus floridanus*) (Owre 1978, p. 43; Belwood 1992, p. 216; Best *et al.* 1997, p. 1). While earlier literature found the Florida bonneted bat distinct at the subspecies level (see Timm and Genoways 2004, pp. 852, 856; McDonough *et al.* 2008, p. 1307), the most current scientific information confirms that *E. floridanus* is a full species and this taxonomic change has been accepted by the scientific community (Timm and Genoways 2004, p. 861; McDonough *et al.* 2008, pp. 1306–1315; R. Timm, pers. comm. 2008b, 2009; Baker *et al.* 2009, pp. 9–10). The International Union for Conservation of Nature and Natural Resources (Timm and Arroyo-Cabrales 2008, p. 1) and the Florida Natural Areas Inventory (FNAI) (FNAI 2012, p. 24) use the name *E. floridanus.* The Florida Fish and Wildlife Conservation Commission (FWC) (FWC 2011a, pp. 1–11) also recognizes the species as *E. floridanus,* but their current threatened and endangered list uses both names, Florida bonneted (mastiff) bat, *Eumops (=glaucinus) floridanus* (see also *Factor D* below).

Life History

Relatively little is known about the Florida bonneted bat's life history. Lifespan is not known. Based upon the work of Wilkinson and South (2002, pp. 124–131), Gore *et al.* (2010, p. 1) inferred a lifespan of 10 to 20 years for the Florida bonneted bat, with an average generation time of 5 to 10 years.

The Florida bonneted bat has a fairly extensive breeding season during summer months (Timm and Genoways 2004, p. 859). The maternity season for most bat species in Florida occurs from mid-April through mid-August (Marks and Marks 2008a, p. 8). During the early portion of this period, females give birth and leave young in the roost while they make multiple foraging excursions to support lactation (Marks and Marks 2008a, pp. 8–9). During the latter portion of the season, young and females forage together until the young become sufficiently skilled to forage and survive on their own (Marks and Marks 2008a, p. 9). The Florida bonneted bat is a subtropical species, and pregnant females have been found in June through September (FBC 2005, p. 1; Marks and Marks 2008a, p. 9). Examination of limited data suggests that this species may be polyestrous (having more than one period of estrous in a year), with a second birthing season possibly in January–February (Timm and Genoways 2004, p. 859; FBC 2005, p. 1).

Information on reproduction and demography is sparse. The Florida bonneted bat has low fecundity; litter size is one (FBC 2005, p. 1; Timm and Arroyo-Cabrales 2008, p. 1). The colony studied by Belwood (1981, p. 412) consisted of eight adults and included five post-lactating females, one pregnant female with a single fetus, and one male with enlarged testicles; the other female escaped before examination. The pregnant female captured was the first record of a gestating Florida bonneted bat in September (Belwood 1981, p. 412). However, Belwood (1981, p. 412) noted that this finding is consistent with the reproductive chronology of bonneted bats in Cuba, which are polyestrous. Robson *et al.* (1989, p. 81) found an injured pregnant female in Coral Gables in late August 1988, which aborted its fetus in early September 1988. A landowner with an active colony in North Fort Myers reported that she has seen young bats appear in spring and summer, generally with only one or two births within the colony per year (S. Trokey, pers. comm. 2006a). However, four young were noted in 2004 (S. Trokey, pers. comm. 2006a). A juvenile male caught in a mist net at Picayune Strand State Forest (PSSF) on December 17, 2009, suggested breeding in the area (Smith 2010, p. 1). Age was determined by viewing the epiphyseal-diaphyseal fusion (level of bone growth and formation in the wings) under a magnifying glass and taking a photograph of the fusion, which was independently confirmed by two Florida bat experts (Smith 2010, pp. 1–2). The juvenile weighed 35 g (1.2 oz) and had a left forearm length of 64.5 mm (2.5 in) (Smith 2010, p. 1).

Based upon limited information, the species roosts singly or in colonies consisting of a male and several females (Belwood 1992, p. 221). G.T. Hubbell believed that individuals in Miami roosted singly (Belwood 1992, p. 221). However, Belwood (1981, p. 412) suggested that a colony, consisting of seven females and one male using a longleaf pine cavity as a roost site in Punta Gorda, was a harem group, based on its sex ratio. Belwood (1981, p. 412; 1992, p. 221) suggested that this behavior has been recorded in a few bat species and such social groupings may be facilitated by roosting in tree cavities, which can be defended from other males (Morrison 1979, pp. 11–15).

Information on roosting habits from artificial structures is also limited. The Florida bonneted bat colony using bat houses on private property in Lee County consisted of 8 to 25 individuals, including one albino (S. Trokey, pers. comm. 2006a, 2006b; 2008a, 2008b, 2012). After the prolonged cold temperatures killed and displaced several bats in early 2010, a total of 10 individuals remained by April 2010, with seven occupying one house and three occupying another (S. Trokey, pers. comm. 2010a, 2010b, 2010c). As of February 2012, there are 18 bats using two houses at this location (S. Trokey, pers. comm. 2012). Sex ratio is not known. Some movement between the houses has been observed; the albino individual has been observed to be in one house one day and the other house the next (S. Trokey, pers. comm. 2006a).

At the Fred C. Babcock/Cecil M. Webb Wildlife Management Area (Babcock-Webb WMA), 42 individuals are using 4 separate roosts, consisting of 7 bat houses among 4 sites (J. Myers, pers. comm. 2012a, 2012b; Marks and Marks 2012, pp. 8, 12, A61). These sites each consist of two bat houses on a single pole, with the exception of one site, which has a pole containing only one house. The most recent counts from simultaneous observations at these sites, taken at emergence on April 19, 2012, documented the following: 35 Florida bonneted bats at 2 houses, 5 at 2 houses, 1 at 2 houses, and 1 at 1 house (J. Myers, pers. comm. 2012a; Marks and Marks 2012, pp. 12, 19, A61). It is not known if there is movement between houses or among roost locations or between artificial and unknown natural roosts within Babcock-Webb WMA.

The Florida bonneted bat is active year-round and does not have periods of hibernation or torpor. The species is not migratory, but there might have been seasonal shifts in roosting sites (Timm

and Genoways 2004, p. 860). Belwood (1992, pp. 216–217) reported that, prior to 1967, G.T. Hubbell routinely obtained several individuals per year collected during the winter from people's houses.

Precise foraging and roosting habits and long-term requirements are unknown (Belwood 1992, p. 219). Active year-round, the species is likely dependent upon a constant and sufficient food supply, consisting of insects, to maintain its generally high metabolism. Based upon limited information, Florida bonneted bats feed on flying insects of the following orders: Coleoptera (beetles), Diptera (true flies), and Hemiptera (true bugs) (Belwood 1981, p. 412; Belwood 1992, p. 220; FBC 2005, p. 1). An analysis of bat guano (droppings) from the colony using the pine flatwoods in Punta Gorda indicated that the sample (by volume) contained coleopterans (55 percent), dipterans (15 percent), and hemipterans (10 percent) (Belwood 1981, p. 412; Belwood 1992, p. 220). No other similar analyses have been performed, but researchers are planning to conduct analyses of guano to determine dietary preferences and seasonal changes (Ridgley 2012, pp. 1–4; C. Marks, FBC, pers. comm. 2012; S. Snow, Everglades National Park (ENP), pers. comm. 2012). This species may prey upon larger insects, which may be less abundant than smaller prey items (S. Snow, pers. comm. 2012). Since the species can take flight from the ground like other *Eumops* spp., it may also prey upon ground insect species (Ridgley 2012, pp. 1–2).

Molossids, in general, seem adapted to fast flight in open areas (Vaughan 1966, p. 249). Various morphological characteristics (e.g., narrow wings, high wing-aspect ratios (ratio of wing length to its breadth) make *Eumops* well-adapted for efficient, rapid, and prolonged flight in open areas (Findley *et al.* 1972, pp. 429–444; Freeman 1981, pp. 96–97; Norberg and Rayner 1987, pp. 399–400; Vaughan, 1959 as cited in Best *et al.* 1997, p. 3). Barbour and Davis (1969, p. 234) noted that the species flies faster than smaller bats, but cannot maneuver as well in small spaces. Belwood (1992, p. 221) stated that *E. glaucinus* is ''capable of long, straight, and sustained flight,'' which should allow individuals to travel large distances. Norberg and Rayner (1987, p. 399) attributed long distance flights of Brazilian free-tailed bats to their high wing-aspect ratios, with that species capable of traveling 65 km (40 miles) from its roosting site to its foraging areas (Barbour and Davis 1969, p. 203). Nonetheless, average foraging distances for the Florida bonneted bat are not known (G. Marks, pers. comm. 2012). Although the species can fly long distances, it likely does not travel farther than necessary to acquire food needed for survival (G. Marks, pers. comm. 2012).

Bonneted bats are ''fast hawking'' bats that rely on speed and agility to catch target insects in the absence of background clutter, such as dense vegetation (Simmons *et al.* 1979, pp. 16–21; Belwood 1992, p. 221; Best *et al.* 1997, p. 5). Foraging in open spaces, these bats use echolocation to detect prey at relatively long range, roughly 3 to 5 meters (10 to 16 feet) (Belwood 1992, p. 221). Based upon information from G.T. Hubbell, Belwood (1992, p. 221) indicated that individuals leave roosts to forage after dark, seldom occur below 10 meters (33 feet) in the air, and produce loud, audible calls when flying; calls are easily recognized by some humans (Belwood 1992, p. 221; Best *et al.* 1997, p. 5; Marks and Marks 2008a, p. 5). On the evening of April 19, 2012, Florida bonneted bats using bat houses at Babcock-Webb WMA emerged to forage at dusk; emergence occurred from approximately 8:20 to 8:40 p.m. (J. Myers, pers. comm. 2012; P. Halupa, pers. obs. 2012).

Habitat

Relatively little is known of the ecology of the Florida bonneted bat, and long-term habitat requirements are poorly understood (Robson 1989, p. 2; Robson *et al.* 1989, p. 81; Belwood 1992, p. 219; Timm and Genoways 2004, p. 859). Habitat for the Florida bonneted bat mainly consists of foraging areas and roosting sites, including artificial structures. At present, no active, natural roost sites are known, and only limited information on historical sites is available.

Recent information on foraging habitat has been obtained largely through acoustical surveys, designed to detect and record bat echolocation calls (Marks and Marks 2008a, p. 5). Acoustical methods have generally been selected over mist netting as the primary survey methodology because this species flies and primarily forages at heights of 9 meters (30 feet) or more (Marks and Marks 2008a, p. 3). The Florida bonneted bat has a unique and easily identifiable call. While most North American bats vocalize echolocation calls in the ultrasonic range that are inaudible to humans, the Florida bonneted bat echolocates at the higher end of the audible range, which can be heard by some humans as high-pitched calls (Marks and Marks 2008a, p. 5). Most surveys conducted using acoustical equipment can detect echolocation calls within a range of 30 meters (100 feet); call sequences are analyzed using software that compares calls to a library of signature calls (Marks and Marks 2008a, p. 5). Florida bonneted bat calls are relatively easy to identify because calls are issued at frequencies well below that of other Florida bat species (Marks and Marks 2008a, p. 5).

In general, open, fresh water and wetlands provide prime foraging areas for bats (Marks and Marks 2008c, p. 4). Bats will forage over ponds, streams, and wetlands and drink when flying over open water (Marks and Marks 2008c, p. 4). During dry seasons, bats become more dependent on remaining ponds, streams, and wetland areas for foraging purposes (Marks and Marks 2008c, p. 4). The presence of roosting habitat is critical for day roosts, protection from predators, and the rearing of young (Marks and Marks 2008c, p. 4). For most bats, the availability of suitable roosts is an important, limiting factor (Humphrey 1975, pp. 341–343). Bats in south Florida roost primarily in trees and manmade structures (Marks and Marks 2008a, p. 8).

Available information on roosting sites for the Florida bonneted bat is extremely limited. Roosting and foraging areas appear varied, with the species occurring in forested, suburban, and urban areas (Timm and Arroyo-Cabrales 2008, p. 1). Data from acoustical surveys and other methods suggests that the species uses a wide variety of habitats (see Table 1) (Marks and Marks 2008a, pp. 13–14; 2008b, pp. 2–5; 2008c, pp. 1–28; 2012, pp. 1–22; R. Arwood, Inside-Out Photography, Inc., pers. comm. 2008a, 2008b, 2012; Smith 2010, pp. 1–4; S. Snow, pers. comm. 2011, 2012).

Use of Forests and Other Natural Areas

Bonneted bats are closely associated with forested areas because of their tree-roosting habits (Robson 1989, p. 2; Belwood 1992, p. 220; Eger 1999, p. 132), but specific information is limited. Belwood (1981, p. 412) found a small colony of Florida bonneted bats (seven females and one male, all adults) roosting in a longleaf pine (*Pinus palustris*) in a pine flatwoods community near Punta Gorda in 1979. The bats were roosting in a cavity 4.6 meters (15.1 feet) high, which had been excavated by a red-cockaded woodpecker (*Picoides borealis*) and later enlarged by a pileated woodpecker (*Dryocopus pileatus*) (Belwood 1981, p. 412). Belwood (1981, p. 412) suggested that the bats were permanent residents of the tree due to the considerable accumulation of fecal material,

approximately 1 meter (3.3 feet) in depth. Eger (1999, p. 132) noted that in forested areas, old, mature trees are essential roosting sites for this species. The species also uses foliage of palm trees. Based upon information from G.T. Hubbell, specimens have been found in shafts of royal palms (*Roystonea regia*) (Belwood 1992, p. 219).

Similar roosting habitats have been reported for *E. g. glaucinus* in Cuba. Nine of 19 known roost sites were located in tree cavities, including woodpecker holes and cavities in royal palms, ''dagame'' trees (*Callycophyllum candidissimum*), and mastic trees (*Bursera simaruba*) (Silva-Taboada 1979 as cited in Robson 1989, p. 2 and Belwood 1992, p. 219). Another individual was found roosting in the foliage of the palm *Copernicia vespertilionum* (Silva-Taboada 1979 as cited in Belwood 1992, p. 219). Belwood (1992, pp. 219–220) noted that the majority of the approximately 80 specimens of *E. glaucinus* from Venezuela housed in the U.S. National Museum were collected from tree cavities in heavily forested areas.

More recent acoustical data and other information indicate that the Florida bonneted bat uses forests and a variety of other natural areas. Echolocation calls have been recorded in a wide array of habitat types: pine flatwoods, pine rocklands, cypress, hardwood hammocks, mangroves, wetlands, rivers, lakes, canals, etc. (see Table 1). Table 1 lists locations and habitat types where Florida bonneted bats were recorded or observed (2003 to present) (Marks and Marks 2008a, pp. 13–14; 2008b, pp. 2–5; 2008c, pp. 1–28; 2012, pp. 1–22; R. Arwood, pers. comm. 2008a, 2008b, 2012; Smith 2010, pp. 1–4; S. Snow, pers. comm. 2011, 2012; FNAI 2012, pp. 1–28). Additional details on key sites are provided below Table 1.

TABLE 1—LOCATIONS AND HABITAT TYPES RECORDED OR OBSERVED FOR FLORIDA BONNETED BATS (2003–2012)

Site	Ownership	Counties	Management	Habitat type
Everglades National Park (ENP) (2 backcountry sites along Wilderness Waterway [Darwin's Place, Watson Place]).	public	Monroe	National Park Service (NPS).	earth midden hammocks, mangroves.
ENP (junction of Main Park Road and Long Pine Key).	public	Miami-Dade	NPS	pine rocklands, wetlands.
L–31N Florida Power and Light (FPL) corridor, eastern boundary ENP.	private	Miami-Dade	NPS and FPL	canal, mixed.
Homestead, FL	private	Miami-Dade	None	residential, urban.
Fairchild Tropical Botanic Garden (FTBG)	private	Miami-Dade	FTBG	pine rockland, hardwood hammock, water, tropical garden, residential.
Zoo Miami	private and public	Miami-Dade	Miami-Dade	urban, landscaped; pine rocklands.
Coral Gables (2 sites, including Granada Golf Course).	private	Miami-Dade	None	residential, urban.
Snapper Creek Park	public	Miami-Dade	Miami-Dade County	residential, urban.
Everglades City	private	Collier	None	residential, urban.
Naples	private	Collier	None	residential, urban.
Fakahatchee Strand Preserve State Park (FSPSP) (2 sites, including Ballard Pond, Prairie Canal Bridge).	public	Collier	Florida Department of Environmental Protection (FDEP).	lake and canal near hardwood hammock, and pine flatwoods.
Picayune Strand State Forest (PSSF)	public	Collier	FFS	canal (juvenile male caught above Faka-Union Canal).
Big Cypress National Preserve (multiple sites).	public	Collier	NPS	pine flatwoods, palmetto, cypress, mixed and hardwood hammocks, mangroves, mixed shrubs, wet prairies, river.
North Fort Myers (2 sites, including bat houses).	private	Lee	None; private landowner.	residential, urban; bat houses.
Babcock-Webb Wildlife Management Area (WMA) (3 sites, Tucker Grade east end, B/W west area, and bat houses and near red-cockaded woodpecker clusters).	public	Charlotte	Florida Fish and Wildlife Conservation Commission (FWC).	pinelands (and near red-cockaded woodpecker clusters); bat houses.
Babcock Ranch (Telegraph Swamp)	public, private	Charlotte	Private entities, FWC, FFS, and Lee County.	swamp.
Kicco	public	Polk	FWC and SFWMD	oxbow along Kissimmee River.
Kissimmee River Public Use Area (Platt's Bluff).	public	Okeechobee	FWC and SFWMD	boat ramp along Kissimmee River.

In 2006, the species was found at Babcock-Webb WMA in the general vicinity of the colony found by Belwood (1981, p. 412); this was the first documentation of the Florida bonneted bat at this location since 1979 (Marks and Marks 2008a, pp. 6, 11, 13). Major habitat types at Babcock-Webb WMA include dry prairie, freshwater marsh, wet prairie, and pine flatwoods; all calls were recorded in pinelands (Marks and Marks 2008a, pp. A7, B38–B39; 2012,

pp. 8, A61, B43). The species was also recorded at an adjacent property, Babcock Ranch in 2007; calls were recorded at Telegraph Swamp, but not in the pinelands surveyed (Marks and Marks 2008a, pp. A9, B55–B57).

The species has been found within the Fakahatchee Strand Preserve State Park (FSPSP), using this area throughout the year (D. Giardina, Florida Department of Environmental Protection (FDEP), pers. comm. 2006; C. Marks, pers. comm. 2006a, 2006b, M. Owen, FSPSP, pers. comm. 2012a, 2012b). In 2006, this species was found at a small lake and at a canal adjacent to tropical hardwood hammocks (Ballard Pond and Prairie Canal Bridge) in the FSPSP (Marks and Marks 2008a, pp. 11, A7–A9, B50–B51). Available data and observations indicate that the species was regularly heard at FSPSP from 2000 through 2012 at various locations, primarily in the main strand swamp and near royal palms (M. Owen, pers. comm. 2012a, 2012b; R. Rau, pers. comm. 2012). In November 2007, the species was observed along U.S. 41 at Collier-Seminole State Park in Collier County (S. Braem, FDEP, pers. comm. 2012). The FDEP also suggests that the species may occur at Charlotte Harbor Preserve State Park in Charlotte County and Delnor-Wiggins Pass State Park in Collier County (P. Small, FDEP, pers. comm. 2012).

The Florida bonneted bat has been found in various habitats within Big Cypress National Preserve (BCNP). During surveys conducted in a variety of habitats in 2006–2007, the majority consisting of cypress swamps and wetlands, only one call was recorded in 16 survey nights in 2007 (Marks and Marks 2008a, pp. 11, A12–A14). The call was recorded at Deep Lake along the western edge of BCNP and the eastern side of the FSPSP; the lake was surrounded by cypress and hardwood hammocks similar to the habitat around Ballard Pond in the FSPSP (see above) (R. Arwood, pers. comm. 2008b). The species was recorded again in February 2012 at another location (Cal Stone's camp) in an area of pine and palmetto with cypress domes in the surrounding area (R. Arwood, pers. comm. 2012; Marks and Marks 2012, p. 13). Data derived from recordings taken in 2003 and 2007 by a contractor and provided to the Service (S. Snow, pers. comm. 2012) and available land use covers derived from a geographic information system also suggest that the species uses a wide array of habitats within BCNP.

As noted earlier, FWC biologists and volunteers caught a free-flying juvenile male Florida bonneted bat in 2009 using a mist net in the PSSF in Collier County (Smith 2010, p. 1). Habitat composition of PSSF includes wet prairie, cypress stands, and pine flatwoods in the lowlands and subtropical hardwood hammocks in the uplands, and the individual was captured in the net above the Faka-Union Canal (Smith 2010, p. 1). This was particularly notable because it may have been the first capture of a Florida bonneted bat without a roost site being known (Smith 2010, p. 1).

In 2000, the species was found within mangroves at Dismal Key within the Ten Thousand Islands (Timm and Genoways 2004, p. 861; Marks and Marks 2008a, pp. 6, A9, B53; 2012, p. 14). Subsequent surveys in 2000, 2006, and 2007 did not document any calls at this location (Marks and Marks 2008a, pp. 6, 11, 14). In 2007, the species had been recorded at a backcountry campsite (Watson's Place) within ENP, comprised of mixed hardwoods (S. Snow, pers. comm. 2012). In 2012, the species was found within mangroves and mixed hardwoods at another backcountry campsite (Darwin's Place) along the Wilderness Waterway (Ten Thousand Island area), approximately 4.8 kilometers (km) (3 miles) east-southeast of Watson's Place within ENP (Marks and Marks 2012, pp. 8, 17, A53, B35, B38; C. Marks, pers. comm. 2012; S. Snow, pers. comm. 2012). However, the species was not located in similar habitats during 18 survey nights in 2012 (Marks and Marks 2012, p. 14).

In 2011–2012, the species was found in various natural habitats elsewhere in ENP and vicinity (S. Snow, pers. comm. 2011, 2012; Marks and Marks 2012, pp. 8, 14). It was found in wetlands and pinelands at the junction of the main park road and road to Long Pine Key (S. Snow, pers. comm. 2011, 2012; Marks and Marks 2012, p. 8, 14, 17), and also along the L–31N canal in a rural area, at the eastern boundary of ENP (S. Snow, pers. comm. 2012; Marks and Marks 2012, pp. 8, 14, 17, A59). In March 2012, one suspect (presumed, but not confirmed) call sequence was also recorded on SR 9336 in an area of rural residential and agricultural habitat in Miami-Dade County (S. Snow, pers. comm. 2012). In January 2012, another suspect call was recorded from the suburban streets of the village of Palmetto Bay in Miami-Dade (S. Snow, pers. comm. 2012).

In 2008, the Florida bonneted bat was found at two locations along the Kissimmee River during a survey of public areas contracted by FWC (J. Morse, pers. comm. 2008, 2010; Marks and Marks 2008b, pp. 2–5; 2008c, pp. 1–28). One location was at an oxbow along the Kissimmee River in a pasture in Kicco; the other was at Platt's Bluff boat ramp at a public park on the Kissimmee River (Marks and Marks 2008c, pp. 11, 17). However, despite numerous attempts, no additional calls were detected in the Lake Kissimmee areas or along the Kissimmee River during subsequent surveys designed to more completely define the northern part of its range (C. Marks, pers. comm. 2012a; Marks and Marks 2012, pp. 3, 5, 8, 10) (see *Current Distribution*).

Use of Parks, Residential, and Other Urban Areas

The Florida bonneted bat uses human structures and other nonnatural environments. In Coral Gables (Miami area), specimens have been found in the shafts of royal palm leaves (Belwood 1992, p. 219). Based upon observations from G.T Hubbell, past sightings in Miami suggest that preferred diurnal roosts may be the shingles under Spanish tile roofs (Belwood 1992, p. 219). The species also roosts in buildings (e.g., in attics, rock or brick chimneys of fireplaces, and especially buildings dating from about 1920–1930) (Timm and Arroyo-Cabrales 2008, p. 1). One individual recently reported that a single Florida bonneted bat had come down the chimney and into his residence in Coral Gables in the fall about 5 years ago (D. Pearson, pers. comm. 2012). Belwood (1992, p. 220) suggested that urban bats would appear to benefit from using Spanish tile roofs on dwellings, since the human population in south Florida is growing, and such structures are more common now than in the past. However, it is important to recognize that bats using old or abandoned and new dwellings are at significant risk; bats are removed when structures are demolished or when they are no longer tolerated by humans and eradicated or excluded from dwellings (see *Summary of Factors Affecting the Species, Factor E*).

This species may also roost in rocky crevices and outcrops on the ground, based on the discovery of an adult for which the specimen tag says ''found under rocks when bull-dozing ground'' (Timm and Genoways 2004, p. 860). A colony was found in a limestone outcropping on the north edge of the University of Miami campus in Coral Gables; the limestone contained a large number of flat, horizontal, eroded fissures in which the bats roosted (Timm and Genoways 2004, p. 860). It is not known to what extent such roost sites are suitable.

Recent acoustical surveys (2006, 2008, 2012) confirmed that the species continues to use a golf course in urban Coral Gables (Marks and Marks 2008a,

pp. 6, 11, A4; 2008b, pp. 1–6; 2012, pp. 8, 14, 16, 19, A24, B16). Despite numerous efforts, attempts to locate the roost site have been unsuccessful.

Recordings taken continuously from a balcony from a fifth floor condominium also detected presence in Naples (R. Arwood, pers comm. 2008a). Recordings taken from a house and at a boat dock along the Barron River in Everglades City also detected presence in this area (R. Arwood, pers comm. 2008a).

The species has been documented at Zoo Miami within an urban public park in Miami-Dade County (C. Marks, pers. comm. 2011; Ridgley 2012, p. 1; Marks and Marks 2012, pp. 8, 14, 16, A26). A dead specimen was found on Zoo Miami (then known as Miami Metrozoo) grounds at the Asian Elephant barn in 2004 (Marks and Marks 2008a, p. 6). Miami-Dade County biologists observed seven bats similar in size to Florida bonneted bats and heard chatter at the correct frequency a few years ago, but were unable to obtain definitive recordings (S. Thompson, Miami-Dade Park and Recreation Department, pers. comm. 2010) until a single call was recorded by FBC outside the same enclosure in September 2011 (Ridgley 2012, p. 1; Marks and Marks 2012, pp. 8, 14, 16, A26). Surrounding habitats include natural areas and horticulturally altered landscape, with a variety of manmade structures (Ridgley 2012, p. 1).

In 2011 and 2012, the species was recorded within tropical gardens at Fairchild Tropical Botanic Garden (FTBG) in Miami-Dade County (S. Snow, pers. comm. 2011, 2012; Marks and Marks 2012, pp. 8, 13–14, 17, A35, A37).

Use of Artificial Structures

The Florida bonneted bat can use artificial structures (Marks and Marks 2008a, p. 8; Morse 2008, pp. 1–14; S. Trokey, pers. comm. 2012). In fact, all of the active known roosting sites for the species are bat houses (two at a private landowner's house; four at Babcock-Webb WMA).

The species occupies bat houses on private land in North Fort Myers, Lee County; until recently, this was the only known location of an active colony roost anywhere (S. Trokey, pers. comm. 2006a, 2008b; Marks and Marks 2008a, pp. 7, 15). The Florida bonneted bat has used this property for over 9 years (S. Trokey, pers. comm. 2012). The bat houses are located near a small pond, situated approximately 5 meters (17 feet) above the ground with a south by southwest orientation (S. Trokey, pers. comm. 2012). The relatively high height of the houses may allow the large bats to fall from the roosts before flying (S. Trokey, pers. comm. 2012).

The species also occupies bat houses within pinelands at Babcock-Webb WMA in Punta Gorda, Charlotte County (Marks and Marks 2012, pp. 8, A61). In winter 2008, two colonies were found using bat houses (Morse 2008, p. 8; N. Douglass, FWC, pers. comm. 2009). In 2010, approximately 25 individuals were found at two additional bat houses, bringing the potential total at Babcock-Webb WMA to 58 individuals, occupying four houses (J. Birchfield, FWC, pers. comm. 2010; Marks and Marks 2012, pp. 12, A61). In 2012, 42 individuals were found to use four roost sites, consisting of a total of seven bat houses, situated approximately 5 meters (17 feet) above the ground with north and south orientations (J. Myers, pers. comm. 2012a; Marks and Marks 2012, pp. 12, 19, A61). Roosts at Babcock-Webb WMA are mainly in hydric and mesic pine flatwoods with depression and basin marshes and other mixed habitat in the vicinity (J. Myers, pers. comm. 2012b).

In summary, relatively little is known of the species' habitat requirements. Based upon available data above, it appears that the species can use a wide array of habitat types (see Table 1 above). Available information on roosting sites is extremely limited and particularly problematic, since the availability of suitable roosts is an important, limiting factor for most bat species. Existing roost sites need to be identified so they can be preserved and protected (Marks and Marks 2008a, p. 15). Uncertainty regarding the location of natural and artificial roost sites may contribute to the species' vulnerability (see *Summary of Factors Affecting the Species, Factors A* and *E* below). Since the location of key roost sites is not known, inadvertent impacts to and losses of roosts may be more likely to occur, placing the species at greater risk. If key roost sites are located, actions could be taken to avoid or minimize losses.

Historical Distribution

Records indicating historical range are limited. Morgan (1991, p. 200) indicated that *E. glaucinus* had been identified from four late Pleistocene (approximately 11,700 years ago) and Holocene (time period beginning 10,000 years ago) fossil sites in the southern half of the Florida peninsula. Late Pleistocene remains are known from Melbourne, Brevard County, and Monkey Jungle Hammock in Miami-Dade County (Allen 1932, pp. 256–259; Martin 1977, as cited in Belwood 1981, p. 412 and Timm and Genoways 2004, p. 857; Morgan 1991, p. 188). Holocene remains are known from Vero Beach, Indian River County (Ray 1958, Martin 1977, and Morgan 1985, 2002 as cited in Timm and Genoways 2004, p. 857; Morgan 1991, pp. 187–188, 200), and also Monkey Jungle Hammock (Morgan 1991, p. 188). The largest fossil sample (9 specimens) was reported from the Holocene stratum at Vero Beach (Morgan 1985 as cited in Morgan 1991, p. 200). The fossil records from Brevard County and Indian River County are considerably farther north than where living individuals have typically been recorded (Timm and Genoways 2004, p. 857; Marks and Marks 2008b, p.5).

Timm and Genoways (2004, p. 856) noted that *E. floridanus* is one of the few species of Recent mammals that was described from the Pleistocene fossil record before the discovery of living individuals. The type specimen (first specimen used to describe the species), described by Allen (1932, pp. 256–259) is from Melbourne in Brevard County, Florida (Morgan 1991, pp. 187, 200). The type specimen is dated from the late Rancholabrean Melbourne Bed, in Brevard County (Morgan 1991, pp. 187, 200; Timm and Genoways 2004, pp. 858, 860).

Most of the historical records and sightings for this species are several decades old from the cities of Coral Gables and Miami in extreme southeastern Florida, where the species was once believed to be common (Belwood 1992, pp. 216, 219; Timm and Genoways 2004, p. 857; Timm and Arroyo-Cabrales 2008, p. 1). G.T. Hubbell also reported a female with young from Fort Lauderdale in Broward County; all of his sightings of Florida bonneted bats were near human dwellings (Belwood 1992, p. 219). Prior to 1967, G.T. Hubbell regularly heard loud, distinctive calls at night as the bats foraged above buildings and he routinely obtained several individuals per year that were collected during the winter months from people's houses (Belwood 1992, pp. 216–217). Layne (1974, p. 389) stated, ''This bat has the most restricted range of any Florida mammal, being only known from Miami, Coral Gables, and Coconut Grove, where it inhabits buildings in residential areas with lush vegetative growth'' (Barbour, 1936; Schwartz 1952a; Jennings, 1958).

Other early literature also mentioned Fort Lauderdale as an area where the species occurred (Barbour and Davis 1969, p. 231; Belwood 1992, pp. 218–219). However, in their comprehensive review, none of the specimens examined by Timm and Genoways (2004, pp. 856–857, 864) were from

Broward County. Belwood (1981, p. 412) found a colony in Punta Gorda; however, the longleaf pine in which the bats roosted was felled during highway construction. Recent specimens are only known from extreme southern and southwestern Florida, including Miami-Dade County on the east coast and Charlotte, Collier, and Lee Counties on the Gulf coast (Timm and Genoways 2004, pp. 856–857).

As part of a status survey, Robson (1989, pp. 8–9) examined available specimens from museum collections (University of Miami, Miami-Dade Community College, and Florida Museum of Natural History) dating from 1951–1989. Of the 21 specimens examined, 11 were from Coral Gables, 4 were from Miami, 3 were from North Miami, and 3 were from Punta Gorda (Robson 1989, p. 8). As part of the same study, Robson (1989, p. 9) investigated 44 reports of bats throughout southern Florida in 1989, but did not collect or observe the Florida bonneted bat. Another 25 sites were selected for acoustical sampling as part of this study. Records of bats from the selected sites were generally scant or nonexistent; only one record from Coral Gables was found (Robson 1989, p. 9). Despite considerable effort (1,724 stops during 86.2 hours), no additional evidence of the species was found in this study (Robson 1989, pp. 9, 15).

Current Distribution

Endemic to Florida, the Florida bonneted bat has one of the most restricted distributions of any species of bat in the New World (Belwood 1992, pp. 218–219; Timm and Genoways 2004, pp. 852, 856–858, 861–862). Although numerous acoustical surveys for the Florida bonneted bat have been conducted in the past decade by various parties, the best scientific information indicates that the species exists only within a very restricted range, confined to south Florida (Timm and Genoways 2004, pp. 852, 856–858, 861–862; Marks and Marks 2008a, p. 15; 2012, pp. 10–11).

The majority of information relating to current distribution comes from the following recent studies: (1) Range-wide surveys conducted in 2006–2007, funded by the Service, to determine the status of the Florida bonneted bat following the 2004 hurricane season, and followup surveys in 2008 (Marks and Marks 2008a, pp. 1–16 and appendices; 2008b, pp. 1–6); (2) surveys conducted in 2008 along the Kissimmee River and Lake Wales Ridge, funded by the FWC, as part of bat conservation and land management efforts (Marks and Marks 2008c, pp. 1–28; 2008d, pp. 1–21; Morse 2008, p. 2); (3) surveys conducted within BCNP in 2003 and 2007, funded by the NPS (S. Snow, pers. comm. 2012); (4) surveys conducted in 2011–2012 in ENP by NPS staff (S. Snow, pers. comm. 2012); (5) surveys conducted in 2010–2012, funded by the Service, to fill past gaps and better define the northern and southern extent of the species' range (Marks and Marks 2012, pp. 1–22 and appendices); and (6) recordings taken from proposed wind energy facilities in Glades and Palm Beach Counties (C. Coberly, Merlin Environmental, pers. comm. 2012; C. Newman, Normaneau Associates, Inc, pers. comm. 2012). These survey efforts and results are described in more detail below.

(1) Range-Wide Survey

Results of range-wide acoustical surveys in 2006–2007 documented presence in Charlotte, Lee, Collier, and Miami-Dade Counties (see Table 1; Marks and Marks 2008a, p. 11). As part of this study, all previous known locations for the Florida bonneted bat and other previously unsurveyed areas were surveyed to determine presence (Marks and Marks 2008a, p. 3). In total, 50 survey nights were conducted at select locations in south Florida with 48 areas surveyed (Marks and Marks 2008a, pp. 9–10; 2012, p. 5). Echolocation calls were recorded by researchers at six of the areas surveyed (Marks and Marks 2008a, p. 10). Although Broward County was previously considered part of the species' range (Barbour and Davis 1969, p. 231; Belwood 1992, pp. 218–219; Hipes *et al.* 2001, page not numbered), Marks and Marks (2008a, p. 13) did not record any Florida bonneted bat calls in the Fort Lauderdale or surrounding areas. The species was not recorded on the east coast of Florida north of Coral Gables as part of the 2006–2007 survey (Marks and Marks 2008a, p. 10).

Following this study, Marks and Marks (2008a, p. 10) concluded that ''based on the surveys conducted to date, the full extent of the Florida bonneted bat population exists within a very limited range extending from the Babcock Webb WMA through southwest Florida to south Miami and Homestead.'' More detailed information regarding locations is provided above (see *Habitat* and Table 1 above and *Population/Status* below). Although there was no detection of presence in the Everglades region during the 2006–2007 range-wide survey, additional work within ENP was recommended because this area links the east and west portions of the range (Marks and Marks 2008a, p. 15).

(2) Surveys along the Kissimmee River

Surveys conducted for the FWC in the Lake Wales Ridge and Kissimmee River areas in 2008 indicated presence within Polk and Okeechobee Counties, at two locations along the Kissimmee River (see Table 1; Marks and Marks 2008b, p. 2; 2008c, pp. 1–28). As part of these studies, select areas in the Kissimmee River area (9 nights at 25 locations) and along the Lake Wales Ridge (6 nights at 13 locations) were surveyed for possible presence (Marks and Marks 2008c, pp. 1–28; 2008d, pp. 1–21). Detection of presence along the Kissimmee River was significant as this was the first time the species had been found north of Lake Okeechobee except in fossil records and effectively extended the known range 80 km (50 miles) north (Marks and Marks 2008b, pp. 2, 5; 2008c, pp. 1–28). Calls were recorded at Kicco and Platt's Bluff along the Kissimmee River in Polk and Okeechobee Counties in May 2008 (see Table 1) (Marks and Marks 2008b, p. 2; 2008c, pp. 11, 17). The Platt's Bluff finding is 85 km (53 miles) northeast of the nearest previously recorded location, which was in Telegraph Swamp within the Babcock Ranch (Marks and Marks 2008b, p. 3). Additional surveys to better assess the population in the Kissimmee River area were recommended as a future action (Marks and Marks 2008b, p. 5).

Other stationary and roving acoustical surveys of select public lands in the southwest region of Florida contracted by FWC in 2007–2008 did not produce any additional occurrences (Morse 2008, pp. 1–14). The bat was only found at Babcock-Webb WMA and at two WMAs along the Kissimmee River; however, it was not found at Chassahowitzka, Hilochee, or Hickory Hammock WMAs or during surveys along the Lake Wales Ridge (Morse 2008, pp. 1–14; Marks and Marks 2008b, p. 3). It was not found elsewhere in Highlands, Okeechobee, or Polk Counties (Marks and Marks 2008c, pp. 1–28; 2008d, pp. 1–21).

(3) Surveys in Big Cypress

Acoustical surveys conducted in 2003 and 2007 documented presence within BCNP at numerous locations (see Table 1; S. Snow, pers. comm. 2012). In 2003, positive calls were found at nine locations over 24 nights. In 2007, positive calls were found at 15 locations over 22 nights.

(4) Surveys in the Everglades Region

Acoustical surveys conducted on 41 nights in the Everglades region from October 2011 to May 2012 by Skip Snow (pers. comm. 2012) documented presence at several locations within

ENP and surrounding locations (see Table 1). These findings are significant since the importance of the Everglades region to the Florida bonneted bat had been previously in question. In addition, some findings (e.g., FTBG, L–31N canal) represented new occurrences within the species' known range.

(5) Surveys To Examine Extent of Range

Surveys conducted in 2010–2012 designed to specifically examine past gaps and better define the northern and southern extent of the species' range improved understanding of the species' geographic extent (Marks and Marks 2012, pp. 1–22 and appendices). As part of this study, 48 locations were surveyed, including 15 nights in the area surrounding Lake Kissimmee or along the Kissimmee River (Marks and Marks 2012, pp. 5, 9). Results of this study and additional work by researchers did not suggest presence north of Punta Gorda or east of Babcock Ranch in Charlotte County (Marks and Marks 2012, p. 10). In addition, Florida bonneted bat calls were not recorded between Lake Okeechobee and the east coast of Florida, which supports previous work indicating no evidence of the species on the east coast north of Miami (Marks and Marks 2012, p. 10). Although new findings in the southern portion of the established range were confirmed (e.g., FTBG, L–31N canal, Long Pine Key in ENP, Zoo Miami, and Darwin's place), presence was not detected in other areas (e.g., Key Largo or Card Sound Road) (Marks and Marks 2012, pp. 8–10). Consequently, researchers concluded that the proposed range map from 2008 should remain unchanged, as the previous recordings in the Kissimmee River area were unexplained outliers (Marks and Marks 2008a, p. 11; 2012, pp. 10–11). In their view, the species' range encompasses Charlotte, Lee, Collier, Monroe, and Miami-Dade Counties, with only fractions of Glades, Hendry, and Broward Counties included (Marks and Marks 2012, p. 11).

(6) Recordings at Proposed Wind Energy Sites

In 2011, possible Florida bonneted bat calls were reported in Glades County near a proposed wind farm project, located in mixed habitat types, west of Lake Okeechobee (D. Torcolacci, HurricaneWind, Ridgeline Energy, pers. comm. 2012; C. Coberly, pers. comm. 2012). At this time, recordings (from 7 nights) are considered unconfirmed due to current disagreement between experts and are best classified as ''possible'' Florida bonneted bat calls (C. Coberly, pers. comm. 2012). If present, this would be a significant finding, as the species was not previously documented in Glades County. Recordings from another proposed wind energy facility in Palm Beach County did not confirm presence (C. Newman, pers. comm. 2012). Of 175,802 bat calls analyzed over 12 months at 4 locations at the project site in Palm Beach County, no Florida bonneted bat calls have been identified (C. Newman, pers. comm. 2012).

In summary, the Florida bonneted bat appears to be restricted to south and southwest Florida. The core range may primarily consist of habitat within Charlotte, Lee, Collier, Monroe, and Miami-Dade Counties. Recent data also suggest use of portions of Okeechobee and Polk counties and possible use of areas within Glades County. However, given available data, it is not clear to what extent areas outside of the core range may be used. It is possible that areas outside of the south and southwest Florida are used only seasonally or sporadically. Alternatively, these areas may be used consistently, but the species was not regularly detected due to the limitations of available data, survey methods, and search efforts.

Population Estimates and Status

Little information exists on historical population levels. The Florida bonneted bat was considered common in the Miami–Coral Gables area because of regular collection of specimens from 1951 to 1965 (Robson 1989, p. 2; Belwood 1992, p. 216). Jennings (1958, p. 102) indicated that the species was not abundant, noting that a total of 20 individuals had been taken from 1936 to 1958. Prior to 1967, G.T. Hubbell regularly heard loud, distinctive calls at night as the bats foraged above buildings in the Miami area, and he routinely obtained several individuals per year that were collected from people's houses (Belwood 1992, pp. 216–217). Barbour and Davis (1969, p. 234) indicated that, on average, about two individuals per year are brought to the Crandon Park Zoo in Miami, due to injuries, but no time period was specified.

Unpublished data from a survey of 100 pest control companies in 1982 on the southeastern coast of Florida showed that requests to remove ''nuisance'' bats from this area all but ceased beginning in the 1960s (Belwood 1992, p. 217), indicating a sharp decline in bats in general. Timm and Genoways (2004, p. 861) found only three records of Florida bonneted bats in the greater Miami area after 1965. The colony found near Punta Gorda in 1979 appeared to be the only recorded occurrence since 1967 (Belwood 1981, p. 412). A 6-week field trip in 1980 to locate other occurrences was unsuccessful and led to the belief that this species was ''probably extinct in Florida'' (Belwood 1992, p. 217). No new evidence of this species was found from 1979 until 1988 when Robson *et al.* (1989, p. 81) found a pregnant female in Coral Gables (Robson 1989, p. 2).

Timm and Genoways (2004, p. 861) surmised that the Florida bonneted bat may have been uncommon for several decades, based upon the work of previous researchers (Barbour 1945 as cited in Timm and Genoways 2004, p. 861; Jennings 1958, p. 102; Layne 1974, pp. 389–390), who noted the scarcity of bats in southern Florida. Owre (1978, p. 43) observed fewer than a dozen individuals in roughly 25 years and noted that few mammalogists had success in finding the species. Robson (1989, p. 5) indicated that the decline of specimens and sightings in the mid-1960s is reflected in the museum record and noted that the 1950s and 1960s was a period of rapid growth in the Miami area. Robson (1989, pp. 5–9) suggested that the resulting disturbance and destruction of native habitat may have flushed a large number of specimens out of established roosts, resulting in a high collection rate. A status survey conducted in 1989, encompassing 25 sites within natural areas within a nine-county area, found no new evidence of this species (Robson 1989, pp. 1, 3–5, 8).

Population Size Estimates

Based upon available data and information, the Florida bonneted bat occurs within a restricted range and in low abundance (Marks and Marks 2008a, p. 15; 2012, pp. 9–15; Timm and Arroyo-Cabrales 2008, p. 1; FWC 2011a, pp. 3–4; FWC 2011b, pp. 3, 6; R. Timm, pers. comm. 2012). Actual population size is not known, and no population viability analyses are available (FWC 2011a, p. 4). However, population size is thought to be less than that needed for optimum viability (Timm and Arroyo-Cabrales 2008, p. 1). As part of their evaluation of listing criteria for the species, Gore *et al.* (2010, p. 2) found that the extent of occurrence appears to have declined on the east coast, but trends on the west coast could not be inferred due to limited information.

In his independent review of the FWC's biological status report, Ted Fleming, Emeritus Professor of biology at University of Miami, noted that anecdotal evidence from the 1950s and 1960s suggests that this species was more common along Florida's southeast coast compared with the present (FWC 2011b, p. 3). Fleming stated that, ''There

can be no doubt that *E. floridanus* is an uncommon bat throughout its very small range. Its audible echolocation calls are distinctive and easily recognized, making it relatively easy to survey in the field'' (FWC 2011b, p. 3). He also stated that he does not doubt that the total State population numbers ''in the hundreds or low thousands'' (FWC 2011b, p. 3).

Similarly, in response to a request for information as part of the Service's annual Candidate Notice of Review, Robert Timm (pers. comm. 2012), Curator of Mammals at Department of Ecology and Evolutionary Biology and Biodiversity Institute at the University of Kansas, indicated that numbers are low, in his view, as documented by survey attempts. ''*Eumops* are very obvious bats where they occur because of their large size and distinctive calls. Given the efforts to locate them throughout southern Florida, if they were there in any significant numbers, they would have been located'' (R. Timm, pers. comm. 2012).

Results of the 2006–2007 range-wide survey (see *Range-wide survey* above) suggested that the Florida bonneted bat is a rare species with limited range and low abundance (Marks and Marks 2008a, p. 15). Based upon results of both the range-wide study and survey of select public lands, the species was found at 12 locations (Marks and Marks 2008b, p. 4), but the number and status of the bat at each location are unknown. Based upon the small number of locations where calls were recorded, the low numbers of calls recorded at each location, and the fact that the species forms small colonies, Marks and Marks (2008a, p. 15) stated that it is possible that the entire population of Florida bonneted bats may number less than a few hundred individuals.

Results of the 2010–2012 surveys (see *Surveys to examine extent of range*) and additional surveys by other researchers identified new occurrences within the established range (i.e., within Miami area, areas of ENP and BCNP) (S. Snow, pers. comm. 2011, 2012; R. Arwood, pers. comm. 2012; Marks and Marks 2012, p. 8), however, not in sufficient numbers to alter previous population estimates. In their 2012 report on the status of the species, Marks and Marks (2012, p. 12) provided an updated estimation of population size, based upon 120 nights of surveys at 96 locations within peninsular Florida, results of other known surveys, and personal communications with others involved in Florida bonneted bat work. Based upon an average colony size of 11 and an estimated 26 colonies within the species' range, researchers estimated the total Florida bonneted bat population at 286 bats (Marks and Marks 2012, pp. 12–15).

Similarly, the 2011 International Union for Conservation of Nature Red List of Threatened Species lists the species as ''critically endangered'' because ''its population size is estimated to number fewer than 250 mature individuals, with no subpopulation greater than 50 individuals, and it is experiencing a continuing decline'' (Timm and Arroyo-Cabrales 2008, p. 1). The FNAI (2012, pp. 24, 28) also considers the global element rank of the Florida bonneted bat to be G1, meaning it is critically imperiled globally because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or manmade factor.

Acoustical Survey Efforts as Indicators of Rarity

Results of the original 2006–2007 acoustical range-wide survey (see *Range-wide survey* above) indicated that of 4,938 calls recorded and analyzed, only 37 (0.75 percent) were from Florida bonneted bats (Marks and Marks 2008a, acoustical data). Of these, 13 were from the FSPSP, 11 from Babcock Ranch, 6 near the bat houses in Lee County, 3 from Babcock-Webb WMA, 3 from Coral Gables, and 1 from the Homestead area (Marks and Marks 2008a, p. 11, acoustical data). Although this survey had targeted areas that likely support the Florida bonneted bat (i.e., all previous known locations and other previously unsurveyed areas), the species' echolocation calls were only recorded at 6 of the 48 areas surveyed over 50 survey nights (Marks and Marks 2008a, pp. 3, 9–10).

Additional work in the Coral Gables, South Miami, and Homestead area in September 2008 helped to better determine presence in these areas and resulted in 42 additional Florida bonneted bat calls (39 in Coral Gables, 2 in Homestead, and 1 at Snapper Creek Park). However, no additional calls were recorded in five other areas searched (Marks and Marks 2008b, p. 5).

In the 2008 study of WMAs along the Kissimmee River (see *Surveys along the Kissimmee River* above), of 673 call sequences recorded and analyzed, only 10 (1.4 percent) were the Florida bonneted bat (Marks and Marks 2008c, pp. 7–17). This study involved 9 nights at 25 locations in May 2008 (Marks and Marks 2008c, pp. 1–28). Additionally, none of the 533 call sequences along the Lake Wales Ridge area were of the Florida bonneted bat (Marks and Marks 2008d, pp. 7–13). That study involved 6 nights at 13 locations along the Lake Wales Ridge in May 2008.

Recordings taken continuously (24 hours a day) from a fifth floor balcony of a condominium in Naples generated only 5 Florida bonneted bat calls in 398 nights of recording (R. Arwood, pers. comm. 2008a; Marks and Marks 2008a, p. 11). The number of Florida bonneted bat calls was exceedingly low, considering that on an average night more than 1,000 total calls (i.e., all bat species) were recorded (R. Arwood, pers. comm. 2008a). Recordings taken in Everglades City generated 33 Florida bonneted bat calls in 328 nights of sampling (R. Arwood, pers. comm. 2008a; Marks and Marks 2008a, p. 11).

Results from 42 acoustical surveys (36 mobile and 6 stationary) conducted on 41 nights (from October 2011 to May 2012) in the ENP and surrounding areas (see *Surveys in the Everglades region* above) also produced relatively few call sequences indicating presence of the Florida bonneted bat (S. Snow, pers. comm. 2012). One call sequence was recorded at the junction of Main Park Road and the road to Long Pine Key campground in an acoustic mobile survey route that was run 24 times (covering a total of 1,108.5 km (688.8 miles)). On the evening of March 29, 2012, a total of 11 call sequences were confirmed for the Florida bonneted bat along the L–31N canal FPL corridor along a 13.7-km (8.5-mile) stretch. On December 22, 2011, and January 9, 2012, a total of five call sequences were confirmed for the Florida bonneted bat at FTBG. Additional suspect calls were recorded along SR 9336 in a rural and agricultural area and along the suburban streets of the village of Palmetto Bay.

Results of the 2010–2012 study to examine the northern and southern parts of the species' range (see *Surveys to examine extent of range* above) located the species in only 8 of 48 locations, 3 of which were previously known (Marks and Marks 2012, pp. 1–22 and appendices). Given that researchers were specifically targeting areas to maximize the chances of recording the species (G. Marks, pers. comm. 2012), the number of presences recorded was extremely low. Of 5,289 calls recorded and analyzed, only 33 (0.71 percent) were from Florida bonneted bats (Marks and Marks 2012, pp. 16–18 and acoustical data).

Overall, considering existing literature and data by multiple parties and expert opinion (see above), it appears that the species has a very small population. Given so few Florida bonneted bat calls recorded with considerable survey efforts, it is not likely that abundance is appreciably

larger than the current available population estimates given above.

Estimating Colony Sizes and Locations

Actual colony sizes or locations of roosts other than bat houses are not known. However, some limited information from natural and artificial roosting sites exists (see *Life History* above). Based upon roosting information from Belwood (1981, pp. 411–413) and current bat houses (at Babcock-Webb WMA and North Fort Myers), Marks and Marks (2012, p. 12) estimated an average colony size of 11 for the species. Based upon the surveys conducted to date and experience with the species, researchers estimated 26 colonies at the following 11 locations (Marks and Marks 2012, pp. 13–14).

Babcock-Webb Wildlife Management Area—The colonies at Babcock-Webb WMA are the only known roosts on public lands and effectively tripled the number of known active colonies (N. Douglass, pers. comm. 2009). The 33 individuals recorded in 2009 appeared to be the largest single discovery of the species recorded in recent years (N. Douglass, pers. comm. 2009). In 2010, monitoring by FWC indicated approximately 25 individuals at 2 additional bat houses, bringing the potential total at Babcock-Webb WMA to 58 individuals, occupying 4 roosts (J. Birchfield, pers. comm. 2010). In 2012, researchers found 42 individuals using 4 roosts (J. Myers, pers. comm. 2012a). In addition, FWC biologists report also hearing Florida bonneted bat calls in the vicinity of red-cockaded woodpecker cavity trees on site (J. Myers, pers. comm. 2012a). Researchers counted the occupied bat houses as four colonies, but believe that there may be an additional two natural roost sites within the area for a possible total of 6 colonies (Marks and Marks 2012, p. 13, 15). In their estimation, the low numbers of calls recorded during numerous roving surveys did not support estimating more colonies in this area (Marks and Marks 2012, p. 13).

Babcock Ranch—Calls recorded at Telegraph Swamp at Babcock Ranch in 2007 are believed to represent separate colonies from those at Babcock-Webb WMA (Marks and Marks 2008a, p. A9; 2012, p. 13). Due to the property's size, more than one colony may be present; researchers estimated two colonies (based upon area), until additional survey work can be completed (Marks and Marks 2012, p. 13).

North Fort Myers—In Lee County, the Florida bonneted bat has continually used bat houses on one private property since December 2002 (S. Trokey, pers. comm. 2006a; 2012; Marks and Marks 2008a, p. 7). This was the first record of this species using a bat house as a roost and the only known location of an active colony roost located on private land (S. Trokey, pers. comm. 2006a; Marks and Marks 2008a, pp. 7–15). The colony had included approximately 20 to 24 individuals in 2 houses (S. Trokey, pers. comm. 2008a, 2008b), but only 10 remained by April 2010 after the prolonged cold temperatures in January and February 2010 (S. Trokey, pers. comm. 2010a, 2010b, 2010c) (see also *Summary of Factors Affecting the Species, Factor E* below). In May 2011, researchers found 20 Florida bonneted bats using this site (S. Trokey, pers. comm. 2011), and as of February 2012, they found 18 individuals using 2 houses (S. Trokey, pers. comm. 2012). Surveys in the area did not detect additional Florida bonneted bat calls (Marks and Marks 2008a, p. 11). Researchers counted the bat houses as two colonies (Marks and Marks 2012, p. 13).

Naples—Available data from a single fixed site suggest that the species is present in the area (R. Arwood, pers. comm. 2008a; Marks and Marks 2008a, p. 11). The few positive calls are not indicative of a large number of Florida bonneted bats in the area; however, researchers estimate that at least one colony occurs in the area (Marks and Marks 2012, p. 13).

Fakahatchee Strand Preserve State Park and Picayune Strand State Forest—A large number of Florida bonneted bat calls have been reported in recent years in the FSPSP and vicinity (Marks and Marks 2008a, pp. 6, 11). A juvenile male was captured in a mist net above a canal in PSSF in 2009, but no other Florida bonneted bats were captured during additional trapping efforts (14 trap nights) (K. Smith, pers. comm. 2010; Smith 2010, p. 1). Researchers suspect that there are at least two and possibly three colonies using this area; they estimated three colonies, based upon the large number of calls recorded consistently at these adjacent sites (Marks and Marks 2012, p. 13).

Big Cypress National Preserve—Calls have been recorded at various locations (e.g., Deep Lake, Cal Stone's camp, Loop Road) by multiple parties (R. Arwood, pers. comm. 2008b, 2012; S. Snow, pers. comm. 2012; Marks and Marks 2008a, pp. 11, A12–A14; 2012, pp. 13–14). Survey efforts from 2003 and 2007 by one contractor (Fly-By-Night) recorded presence at several locations (S. Snow, pers. comm. 2012). However, results of the rangewide survey in 2006–2008 recorded only one call at Deep Lake in 12 nights of surveys (R. Arwood, pers. comm. 2008b; Marks and Marks 2008a, pp. 11, A12–A14). In 2012, five calls were recorded at Cal Stone's camp during 2 nights of survey (R. Arwood, pers. comm. 2012; Marks and Marks 2012, pp. 13–14). Based upon their experience of calls recorded on only two occasions with considerable effort, researchers estimate there are three colonies using this area (Marks and Marks 2012, pp. 13–14). However, since the area is large and protected, additional colonies may also exist in this area.

Everglades City—Available data suggest that the species is present in the area (R. Arwood, pers. comm. 2008a), but due to the paucity of positive calls, researchers estimate that one colony occurs in the area (Marks and Marks 2012, p. 14).

Everglades National Park (mainland)—Despite significant effort (see above) in 2011 and 2012, only one call sequence was recorded at the junction of main park road and Long Pine Key campground road in an acoustic mobile survey route run 24 times (S. Snow, pers. comm. 2012). Results of the 2006–2008 survey did not detect Florida bonneted bat calls in the Long Pine Key area, which was thought to be the most likely location for the species (Marks and Marks 2008a, p. 10; 2012, p. 14). Researchers estimate one colony at Long Pine Key, given the few calls detected and considerable survey effort (Marks and Marks 2012, p. 14). Other areas of marshland are not likely to support colonies, due to lack of suitable roosting sites (Marks and Marks 2012, p. 14).

Ten Thousand Islands area—The Florida bonneted bat was found at Dismal Key in Ten Thousand Islands National Wildlife Refuge in 2000 (Timm and Genoways 2004, p. 861; B. Nottingham, pers. comm. 2006; T. Doyle, pers. comm. 2006; C. Marks, pers. comm. 2006c; Marks and Marks 2008a, p. 6). Calls were not recorded during the 2006–2007 survey in areas searched by boat from Dismal Key to Port of the Islands (Marks and Marks 2008a, pp. 11, 14, A9). In 2012, only one call was recorded at Darwin's Place in ENP in 18 survey nights in areas searched from Flamingo to Everglades City (Marks and Marks 2012, pp. 8, 14, A50). Darwin's Place is approximately 4.8 km (3 miles) from Watson's Place, where another researcher (Laura Finn, Fly-By-Night) had recorded 10 Florida bonneted bat calls in 2007 (Marks and Marks 2012, p. 14; S. Snow, pers. comm. 2012). Researchers estimate that there is one colony near Dismal Key and one colony in the Watson/Darwin area of ENP (Marks and Marks 2012, p. 14).

Homestead area—Calls recorded in the Homestead area in 2006 and in 2008 suggest that one colony exists, possibly located east of U.S. 1 (Marks and Marks 2008a, pp. 11, A6–A7; 2008b, p. 5; 2012, p. 14).

Coral Gables and Miami area—Florida bonneted bat calls have been consistently recorded in acoustical surveys at the Granada Golf Course in Coral Gables, but not elsewhere in the vicinity (Marks and Marks 2008a, p. 6, A4; 2008b, pp. 1–6; 2012, p. 14). Since calls are recorded so shortly after sunset, the species may be roosting on or adjacent to the golf course (Marks and Marks 2012, p. 14). Calls recorded at Snapper Creek Park in south Miami in 2008, Zoo Miami in 2011, FTBG in 2011 and 2012, and the L31–N canal in 2012 suggest that colonies are at or near these locations (Marks and Marks 2008b, pp. 1–2; 2012, pp. 1–22 and appendices; Ridgley 2012, p. 1; S. Snow, pers. comm. 2011, 2012). Overall, researchers estimate four colonies in southwestern Miami and Coral Gables (Marks and Marks 2012, pp. 14–15).

Summary of Factors Affecting the Species

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Habitat loss and alteration in forested and urban areas are major threats to the Florida bonneted bat (Belwood 1992, p. 220; Timm and Arroyo-Cabrales 2008, p. 1). In natural areas, this species may be impacted when forests are converted to other uses or when old trees with cavities are removed (Belwood 1992, p. 220; Timm and Arroyo-Cabrales 2008, p. 1). In urban settings, this species may be impacted when buildings with suitable roosts are demolished (Robson 1989, p. 15; Timm and Arroyo-Cabrales 2008, p. 1) or when structures are modified to exclude bats. Although the species' habitat preferences and extent of range are not well understood, significant land use changes have occurred in south Florida and additional habitat losses are expected in the future, placing the species at risk. Uncertainty regarding the species' specific habitat needs and requirements arguably contributes to the degree of this threat. Without information on key roosting sites and foraging areas, inadvertent impacts to and losses of habitat may be more likely to occur through various sources and stressors (see below), and habitat losses will likely be more difficult to avoid.

Land Use Changes and Human Population Growth

Significant land use changes have occurred through time in south Florida, including major portions of the species' historical and current range. In his examination of Florida's land use history, Solecki (2001, p. 350) stated that tremendous land use changes took place from the early 1950s to the early and mid-1970s. During this time, ''an almost continuous strip of urban development became present along the Atlantic coast'' and urban land uses became well established in the extreme southeastern portion of the region, particularly around the cities of Miami and Fort Lauderdale and along the entire coastline northward to West Palm Beach (Solecki 2001, p. 350). Similarly, Solecki (2001, p. 345) found tremendous urban expansion within the Gulf coast region, particularly near Ft. Myers since the 1970s, with the rate of urban land conversion superseding the rate of agricultural conversion in recent decades.

In another examination, the extent of land use conversions for southwest Florida (Collier, Lee, Hendry, Charlotte, and Glades Counties) between 1986 and 1996 was estimated using a change detection analysis performed by Beth Stys (FWC, unpublished data) (Service 2008, p. 37). The area of disturbed lands increased 31 percent in these five counties between 1986 and 1996, with the greatest increases in disturbed lands occurring in Hendry and Glades Counties. Most (66 percent) of the land use change over the 10-year period was due to conversion to agricultural uses. Forest cover types accounted for 42 percent of land use conversions, dry prairies accounted for 37 percent, freshwater marsh accounted for 9 percent, and shrub and brush lands accounted for 8 percent.

In another analysis, Stys calculated the extent of seminatural and natural lands that were converted to agricultural and urban or developed areas in Florida between 1985–1989 and 2003 (B. Stys, pers. comm. 2005; Service 2008, p. 38). Based upon this analysis, approximately 1,476 km^2 (570 mi^2) of natural and seminatural lands in Glades, Hendry, Lee, Collier, Broward, Monroe, and Miami-Dade Counties were converted during this time period (FWC, unpublished data). Of these, approximately 880 km^2 (340 mi^2) were conversions to agricultural uses and 596 km^2 (230 mi^2) to urban uses. In Charlotte County, 26,940 acres (10,902 hectares) (9.6 percent of the county) were converted to agriculture, and 21,712 acres (8,787 hectares) (7.8 percent) were converted to urban uses in the time period examined. In Lee County, 16,705 acres (6,760 hectares) (6.3 percent) were converted to agriculture, and 44,734 acres (18,103 hectares) (16.8 percent) were developed. In Collier County, 34,842 acres (14,100 hectares) (3.1 percent) were converted to agriculture, and 38,331 acres (15,512 hectares) (3.4 percent) were developed.

Habitat loss and human population growth in south Florida are continuing. The human population in south Florida has increased from fewer than 20,000 people in 1920 to more than 4.6 million by 1990 (Solecki 2001, p. 345). The population of Miami–Dade County, one area where the Florida bonneted bat was historically common, increased from fewer than 500,000 people in 1950 to nearly 2.5 million in 2010 (*http://quickfacts.census.gov*). In one projection, all counties with current Florida bonneted bat occurrences were forecasted to increase in human population density, with most counties expected to grow by more than 750 people per square mile by 2060 (Wear and Greis 2011, pp. 26–27).

In another model, three counties with current known occurrences of the Florida bonneted bat—Charlotte, Lee, and Collier—are expected to reach buildout (fully develop) before 2060 (Zwick and Carr 2006, pp. 12–13, 16). For the period between 2040 and 2060, the population of Lee and Collier Counties is projected to exceed the available vacant land area, so the population was modeled to allow spillover into adjacent counties (Zwick and Carr 2006, p. 13). According to human population distribution models, south Florida is expected to become mostly urbanized, with the exception of some of the agricultural lands north and south of Lake Okeechobee (Zwick and Carr 2006, p. 2). Even the central Florida region, at what would be the northern limit of this species' distribution, will be almost entirely urbanized (Zwick and Carr 2006, p. 2). In an independent

review of the FWC's biological status report for the species, Fleming stated, ''Continued urbanization of south Florida will undoubtedly have a negative impact on this bat'' (FWC 2011b, p. 3).

Loss of Forested Habitat

Loss of native forested habitat and roost sites are major threats to the Florida bonneted bat. A highway construction project in Punta Gorda in 1979 destroyed a roost tree (Belwood 1981, p. 412; 1992, p. 220). One museum specimen was originally discovered under a rock that was turned over by a bulldozer clearing land (Robson 1989, p. 9). Robson (1989, pp. 1–18) attributed the loss of native forested habitat, reduced insect abundance (see *Factor E*), and the ''active persecution of bats by humans'' (see *Factor E*) as the likely major impacts on the Florida bonneted bat in Miami-Dade County. Similarly, Belwood (1992, pp. 217, 220) indicated that bats in south Florida, including this species, appear to have declined drastically in numbers in recent years due to loss of roosting sites and effects of pesticides (see *Factor E*). More recently, Timm and Genoways (2004, p. 861) stated that habitat loss from development, in combination with other threats (i.e., pesticides and hurricanes, see *Factor E*), may have had a significant impact upon the already low numbers of Florida bonneted bats.

Belwood (1992, p. 220) stated that forested areas are becoming rare as a result of human encroachment and that this will severely affect the forest occurrences of this species. Similarly, Robson (1989, p. 15) indicated that pine rockland, live oak, and tropical hardwood hammocks constituted most of the remaining, natural forest in the Miami area and that these communities are essential to this species' survival. Belwood (1992, p. 220) argued that tree cavities are rare in southern Florida and competition for available cavities (e.g., southern flying squirrel [*Glaucomys volans*], red-headed woodpecker [*Melanerpes erythrocephalus*], corn snake [*Elaphe guttata guttata*]) is intense. She suggested that nonurban natural areas such as ENP, Big Cypress/Fakahatchee areas, and State WMAs may be the only areas where this species may be found in the future, provided old trees with hollows and cavities are retained (Belwood 1992, p. 220) (see *Land Management Practices*).

Approximately 90 percent of the forested habitats in Florida have been altered or eliminated, and losses are expected to continue (Wear and Greis 2002, p. 56). In the Southern Forest Resource Assessment, Florida was identified as one of the areas expected to experience substantial losses of forest in response to human population and changes in income (Wear and Greis 2002, p. 164). In the Southern Forest Futures Project, peninsular Florida is forecasted to lose the most forest land (34 percent) of any of the 21 sections analyzed in the south (Wear and Greis 2011, p. 35).

Land Management Practices

Although species occurrences on conservation lands are inherently more protected than those on private lands, habitat alteration during management practices may impact natural roosting sites because the locations of such sites are unknown. Removal of old or live trees with cavities during activities associated with forest management (e.g., thinning, pruning), prescribed fire, exotic species treatment, or trail maintenance may inadvertently remove roost sites, if such sites are not known. Loss of an active roost or removal during critical life-history stages (e.g., when females are pregnant or rearing young) can have severe ramifications, considering the species' small population size and low fecundity (see *Factor E*).

Overall, occupied and potential habitat for the Florida bonneted bat on forested or wooded lands, both private and public, continues to be at risk due to habitat loss, degradation, and fragmentation from a variety of sources. Additional searches for potential roosting sites in forested and other natural areas are especially needed.

Loss of Artificial Structures

Since the Florida bonneted bat will use human dwellings and other artificial structures, it is also vulnerable to habitat loss and alteration in urban environments (Belwood 1992, p. 220; Timm and Arroyo-Cabrales 2008, p. 1). Owre (1978, p. 43) stated that all recent specimens had been collected within the suburbs of greater Miami from structures built in the 1920s and 1930s. Owre (1978, p. 43) indicated that three specimens were taken on the ground, one in a rocky field that was being bulldozed, one next to sewer conduits piled near freshly dug excavations, and one on a lawn near a university building in which the bats roosted. Removal of buildings with spaces suitable for roosting is a threat to this species (Timm and Arroyo-Cabrales 2008, p. 1). Robson (1989, p. 15) stated that seemingly innocuous activities like destroying abandoned buildings and sealing barrel-tile roof shingles may have a severe impact on remaining populations in urban areas. Cyndi and George Marks (pers. comm. 2008) stated that Florida bonneted bats can move into new buildings as well and ''the fact that they adapt well to manmade structures has most likely been a large factor in their decline'' (see *Factor E*). The use of buildings or other structures inhabited by or near humans places bats at risk of inadvertent or purposeful removal and displacement (see *Factor E*).

Climate Change and Sea Level Rise

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms ''climate'' and ''climate change'' are defined by the Intergovernmental Panel on Climate Change (IPCC). ''Climate'' refers to the mean (average) and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term ''climate change'' thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Climatic changes, including sea level rise, are major threats to south Florida, including the Florida bonneted bat and its habitat. In general, the IPCC reported that the warming of the world's climate system is unequivocal based on documented increases in global average air and ocean temperatures, unprecedented melting of snow and ice, and rising average sea level (IPCC 2007, p. 2; 2008, p. 15). On a global scale, sea level rise results from the thermal expansion of warming ocean water, water input to oceans from the melting of ice sheets, glaciers, and ice caps, and the addition of water from terrestrial systems (United Nations (UN) 2009, p. 26). Sea level rise is the largest climate-driven challenge to low-lying coastal areas and refuges in the subtropical ecoregion of southern Florida (U.S. Climate Change Science Program [CCSP]

2008, pp. 5–31, 5–32). Loss of land due to sea level rise in south Florida is expected to increase development pressure inland and to the north, which may accelerate urbanization and exacerbate fragmentation from development (CCSP 2008, p. 5–32).

In a technical paper following its 2007 report, the IPCC (2008, p. 28) emphasized it is very likely that the average rate of sea level rise during the 21st century will exceed that from 1961 to 2003, although it was projected to have substantial geographical variability. Partial loss of the Greenland and Antarctic ice sheets could result in many feet (several meters) of sea level rise, major changes in coastlines, and inundation of low-lying areas (IPCC 2008, pp. 28–29). Low-lying islands and river deltas will incur the largest impacts (IPCC 2008, pp. 28–29). According to CCSP (2008, p. 5–31), much of low-lying, coastal south Florida ''will be underwater or inundated with saltwater in the coming century.'' This means that some occupied, suitable, and potential roosting and foraging habitat for the Florida bonneted bat in low-lying areas (e.g., Everglades and other coastal areas) will likely be either submerged or affected by increased flooding.

The IPCC (2008, pp. 87, 103) concluded that climate change is likely to increase the occurrence of saltwater intrusion as sea level rises. Since the 1930s, increased salinity of coastal waters contributed to the decline of cabbage palm forests on the west coast of Florida (Williams *et al.* 1999, pp. 2056–2059), expansion of mangroves into adjacent marshes in the Everglades (Ross *et al.* 2000, pp. 108, 110–111), and loss of pine rockland in the Keys (Ross *et al.* 1994, pp. 144, 151–155). Such changes will likely impact the species, since the Florida bonneted bat uses forested areas and coastal habitats.

Hydrology has a strong influence on plant distribution in these and other coastal areas (IPCC 2008, p. 57). Such communities typically grade from salt to brackish to freshwater species. Human developments will also likely be significant factors influencing whether natural communities can move and persist (IPCC 2008, p. 57; CCSP 2008, p. 7–6). Climate change, human population growth, forest management, and land use changes are also expected to increase water stress (water demand exceeding availability) within areas of the south, and south Florida is considered a hot spot for future water stress (Wear and Greis 2011, pp. 46–50). For the Florida bonneted bat, this means that some habitat in coastal areas will likely change as vegetation changes and additional human developments encroach. Any deleterious changes to important roosting sites or foraging areas could further diminish the likelihood of the species' survival and recovery.

Scientific evidence that has emerged since the publication of the IPCC Report (2007) indicates an acceleration in global climate change. Important aspects of climate change seem to have been underestimated previously, and the resulting impacts are being felt sooner. For example, early signs of change suggest that the 1 °C of global warming the world has experienced to date may have already triggered the first tipping point of the Earth's climate system—the disappearance of summer Arctic sea ice. This process could lead to rapid and abrupt climate change, rather than the gradual changes that were forecasted. Other processes to be affected by projected warming include temperatures, rainfall (amount, seasonal timing, and distribution), and storms (frequency and intensity) (see *Factor E*).

In the southeast, drier conditions and increased variability in precipitation associated with climate change are expected to hamper successful regeneration of forests and cause shifts in vegetation types through time (Wear and Greis 2011, p. 58). In their study on the impact and implications of climate change on bats, Sherwin *et al.* (2012, p. 8) suggested that bats specialized in individual roost sites (i.e., cave and tree roosts) at distinct life-history stages are at great risk from changing vegetation and climatic conditions. Rebelo *et al.* (2010, pp. 561–576) found that tree-roosting bats in Europe may face a reduction in suitable roosts if the rate of climate change is too rapid to allow the development of equivalent areas of mature broadleaf forests in new 'climatically suitable areas' as their range extends northward. Decreases in forest regeneration may further limit available roosting sites for the Florida bonneted bat or increase competition for them.

Drier conditions and increased variability in precipitation are also expected to increase the severity of wildfire events. Climate changes are forecasted to extend fire seasons and the frequency of large fire events throughout the Coastal Plain (Wear and Greis 2011, p. 65). Increases in the scale, frequency, or severity of wildfires could also have severe ramifications on the Florida bonneted bat, considering its forest-dwelling nature and general vulnerability due to its small population size, restricted range, few colonies, low fecundity, and relative isolation (see *Factor E*).

The ranges of recent projections of global sea level rise (Pfeffer *et al.* 2008, p. 1340; Vermeer and Rahmstorf 2009, p. 21530; Grinsted *et al.* 2010, pp. 469–470; Jevrejeva *et al.* 2010, Global Climate Change Impacts in the United States 2009, pp. 25–26) all indicate substantially higher levels than the projection by the IPCC in 2007, suggesting that the impact of sea level rise on south Florida could be even greater than indicated above. These recent studies also show a much larger difference (approximately 0.9 to 1.2 meters (3 to 4 feet)) from the low to the high ends of the ranges, which indicates the magnitude of global mean sea level rise at the end of this century is still quite uncertain.

Alternative Future Landscape Models

Various model scenarios developed at the Massachusetts Institute of Technology have projected possible trajectories of future transformation of the south Florida landscape by 2060 based upon four main drivers: climate change, shifts in planning approaches and regulations, human population change, and variations in financial resources for conservation (Vargas-Moreno and Flaxman 2010, pp. 1–6). The Service used various MIT scenarios in combination with available acoustical data to predict what may occur with Florida bonneted bat colonies in the future, assuming that all colonies are known, that acoustical data represented approximate location of a colony's roosting site in the future, and that projected impacts to a colony are solely tied to assumed roosting location. Potential impacts to foraging habitat could not be analyzed, since foraging distance is not known.

In the best-case scenario, which assumes low sea level rise, high financial resources, proactive planning, and only trending population growth, analyses suggest that three colonies may be lost. Based upon the above assumptions, colonies in North Fort Myers, the Ten Thousand Islands area, and the Miami area appear to be most susceptible to future losses, with losses attributed to increases in sea level and human population. In the worst-case scenario, which assumes high sea level rise, low financial resources, a 'business as usual' approach to planning, and a doubling of human population, six colonies may be lost—the colonies noted in the areas above and also some in Homestead and BCNP. Actual impacts may be greater or less than anticipated based upon high variability of factors involved (e.g., sea level rise, human population growth) and assumptions made.

Summary of Factor A

We have identified a number of threats to the habitat of the Florida bonneted bat which have operated in the past, are impacting the species now, and will continue to impact the species in the future. Habitat loss, fragmentation, and degradation, and associated pressures from increased human population are major threats; these threats are expected to continue, placing the species at greater risk. In natural or undeveloped areas, the Florida bonneted bat may be impacted when forests are converted to other uses or when old trees with cavities are removed. Routine land management activities (e.g., thinning, prescribed fire) may also cause impacts to roost sites. In urban areas, suitable roost sites may also be lost when buildings are demolished or when structures are modified to exclude bats. Uncertainty regarding the species' specific habitat needs and requirements (i.e., location of roost sites) arguably contributes to these threats, by increasing the likelihood of inadvertent impacts to and losses of habitat. The effects resulting from climatic change, including sea level rise, are expected to become severe in the future and result in additional habitat losses, including the loss of roost sites and foraging habitat. Although efforts are being made to conserve natural areas, the long-term effects of large-scale and wide-ranging habitat modification, destruction, and curtailment will last into the future. Therefore, based on our analysis of the best available information, present and future loss and modification of the species' habitat is a threat to the Florida bonneted bat throughout all of its range.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

There is a general lack of information about the species. Few individuals appear to have studied the species, and the majority of recent data comes from nonintrusive acoustical recordings. To our knowledge, those individuals who have studied or are actively studying the Florida bonneted bat are sensitive to its rarity and endemism (restricted range). Consequently, collection for scientific and educational purposes is extremely limited. We are not aware of any known commercial or recreational uses for the species. For these reasons, we find that overutilization for commercial, recreational, scientific, or educational purposes does not pose a threat to the species or is likely to become so in the future.

Factor C. Disease or Predation

The effects of disease or predation are not well known. Because the Florida bonneted bat is known from only a few locations and population size appears small, both disease and predation could pose threats to its survival.

Disease

White-nose syndrome (WNS) is an emerging infectious disease affecting insectivorous, cave-dwelling bats. It was first documented in 2006 in caves west of Albany, New York. Since its discovery, WNS has spread rapidly throughout the eastern and central United States and southeastern Canada, killing millions of bats. It is expected to continue spreading westward and southward. By May 2012, WNS had been confirmed in well over 200 caves and mines within 20 states and 4 Canadian provinces (J. Coleman, pers. comm. 2012). It has not yet been documented in Florida.

WNS is caused by the cold-loving fungus *Geomyces destructans,* a newly described fungus, and is named after the white fungal growth that often occurs on the muzzle of affected bats (Gargas *et al.* 2009, pp. 147–154; Lorch *et al.* 2011, pp. 376–379). In North America, *G. destructans* appears to infect bats only during winter hibernation. Mortality rates have been observed to vary by species and site, but have been as high as 100 percent at some hibernacula (winter bat roosts).

WNS has been recorded in seven North American bat species, all of which are known to hibernate in caves and mines. WNS and *G. destructans* have not been detected in bats that typically live outside of caves, such as eastern red-bats (*Lasiurus borealis*), and the fungus is believed to need the cave environment to survive. Because the Florida bonneted bat spends its entire life cycle outside of caves and mines, and in subtropical environments where no torpor or hibernation is required, we do not anticipate that it will be adversely affected by WNS.

Prior to the discovery of WNS, infectious diseases had rarely been documented as a large-scale cause of mortality in bat populations and had not been considered a major issue (Messenger *et al.* 2003 as cited in Jones *et al.* 2009, p. 108). Jones *et al.* (2009, pp. 108–109) contended that, because increased environmental stress can suppress the immune systems of bats and other animals, increased prevalence of diseases may be a consequence of altered environments (i.e., bats may be more susceptible to disease if they are stressed by other threats). These authors contended that bats are excellent potential bioindicators because they are reservoirs of a wide range of emerging infectious diseases whose epidemiology may reflect environmental stress. Jones *et al.* 2009 (p. 109) suggested that an increased incidence of disease in bats may be an important bioindicator of habitat degradation in general. Sherwin *et al.* (2012, p. 14) suggest that warming temperatures associated with climate change may increase the spread of disease (along with other impacts, see *Factor E*), which could cause significant mortalities to bat populations in general.

At this time, it is difficult to assess whether disease is currently or likely to become a threat to the Florida bonneted bat. With anticipated climatic changes and increased environmental stress, it is possible that disease will have a greater impact on the Florida bonneted bat in the future.

Predation

In general, animals such as owls, hawks, raccoons, skunks, and snakes prey upon bats (Harvey *et al.* 1999, p. 13). However, few animals consume bats as a regular part of their diet (Harvey *et al.* 1999, p. 13). There is only one record of natural predation on this species (Timm and Genoways 2004, p. 860). A skull of one specimen was found in a regurgitated owl pellet at the FSPSP in June 2000 (Timm and Genoways 2004, pp. 860–861; C. Marks, pers. comm. 2006a; Marks and Marks 2008a, p. 6; M. Owen, pers. comm. 2012a, 2012b). Our review of the best available information does not suggest that predation is impacting the species at this time.

Summary of Factor C

Disease and predation have the potential to impact the Florida bonneted bat's continued survival, given its few colonies, low abundance, and restricted range. However, our review of the best available information does not indicate that disease (including WNS) and predation are threats to the Florida bonneted bat at this time.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Despite the fact that regulatory mechanisms provide several protections for the Florida bonneted bat, Federal, State, and local laws have not been sufficient to prevent past and ongoing impacts to the species and its habitat within its current and historical range.

The taxon was originally listed as endangered in the State of Florida as the Florida mastiff bat (*Eumops glaucinus floridanus*) (Florida Administrative Code, Chapter 68). As such, it is

afforded protective provisions specified in Chapter 68A–27 rules (68A–27.0011 and 68A–27.003). This designation prohibits any person from pursuing, molesting, harming, harassing, capturing, possessing, or selling this species, or parts thereof, except as authorized by specific permit, with permits being issued only when the permitted activity will clearly enhance the survival potential of the species. The protection currently afforded the Florida bonneted bat by the State of Florida primarily prohibits direct take of individuals (J. Gore, pers. comm. 2009). However, there is no substantive protection of habitat or protection of potentially suitable habitat at this time.

As a consequence of the revision of the FWC's listing classification system, the Florida bonneted bat's status (and the status of other imperiled species) in Florida was changed to ''threatened'' on November 8, 2010. However, the species' original protective measures remained in place (68A–27.003, amended). As part of the FWC's revision of its classification system, biological status review reports were prepared for numerous imperiled species in Florida, including the Florida bonneted bat. Based upon a literature review and the biological review group's findings, FWC staff recommended that the Florida bonneted bat remain listed as a threatened species (FWC 2011a, p. 5). The biological status review recognized the taxon as the Florida bonneted bat, and the State's current threatened and endangered list uses both names, Florida bonneted (mastiff) bat, *Eumops (=glaucinus) floridanus.*

As part of the FWC's revision to Florida's imperiled species rule, management plans will be developed for all species (68A–27), including the Florida bonneted bat. One component of these management plans is to include needed regulations and protections that are not provided in the current rule (M. Tucker, *in litt.* 2012). A first draft for the Florida bonneted bat management plan is in development (M. Tucker, *in litt.* 2012; J. Myers, pers. comm. 2012). When completed, the management plan should allow for tailored protections for the species, which may improve the ability of FWC to address habitat issues in addition to take of individuals (M. Tucker, *in litt.* 2012).

Humans often considered bats to be ''nuisance'' species when they occur in or around human dwellings or infrastructure (see *Factor E*). The rules for taking of nuisance wildlife are provided under Florida Administrative Code Chapter 68A–9.010. Under these rules, property owners can take nuisance wildlife or may authorize another person to take nuisance wildlife on their behalf. Although these rules do not authorize the taking of species listed under Chapter 68A–27 (without an incidental take permit from the State), these rules do allow other bat species to be taken under certain circumstances. These include when: (1) the take is incidental to the use of an exclusion device, a device which allows escape from and blocks reentry into a roost site located within a structure, or incidental to the use of a registered chemical repellant, at any time from August 15 to April 15; or (2) the take is incidental to permanent repairs that prohibit the egress of bats from a roost site located within a structure, provided an exclusion device is used as above for a minimum of 4 consecutive days or nights for which the low temperature is forecasted to remain above 10 °C (50 °F) prior to repairs and during the time period specified. Chapter 68A–9.010 provides the methods that may not be used to take nuisance wildlife, including any method prohibited pursuant to Section 828.12 of the Florida Statutes (Florida Cruelty to Animals Statutes).

Use of bat exclusion devices or any other intentional device or materials at a roost site that may prevent or inhibit the free ingress or egress of bats is prohibited from April 16 through August 14. While these restrictions help to limit potential impacts during the maternity season for many bat species in Florida, regulations do not require definitive identification of the bat species to be excluded prior to the use of the device. In addition, it is not clear if this time period is broad enough to prevent potential impacts to the Florida bonneted bat, which is possibly polyestrous and more tropical in nature, with a potentially prolonged sensitive time window where females and young are especially vulnerable. Pregnant Florida bonneted bats have been found in June through September (Marks and Marks 2008a, p. 9), and a second birthing season can occur possibly in January–February (Timm and Genoways 2004, p. 859; FBC 2005, p. 1). During the early portion of the maternal period, females may give birth to young and leave them in the roost while making multiple foraging excursions to support lactation (Marks and Marks 2008a, pp. 8–9). Therefore, despite regulations restricting the use of exclusion devices, it is still possible that use of such devices can affect the species during sensitive time periods, including possible impacts to pregnant females, newborns, or juvenile pups.

The FWC, FBC, Bat Conservation International, and other groups maintain a list of qualified exclusion devices, but it is not clear how often work is performed by recommended personnel or if it is in accordance with State regulations. It is also not clear if those who install exclusion devices can readily distinguish between Florida bonneted bats and other bat species in Florida (M. Tucker, pers. comm. 2012). Despite regulations, in some cases, nuisance bats are likely being removed by nuisance wildlife trappers through methods that are not approved (e.g., removed from roosts with vacuum cleaner-like apparatuses) or excluded during time periods that are not permitted (e.g., inside the maternity season) (A. Kropp, FWC, pers. comm. 2009).

In addition, there is conflict between legislation passed by the Florida Department of Agriculture and Consumer Services (FDACS), which classifies bats as rodents, and the current FWC nuisance wildlife regulations above (Florida Bat Working Group [FBWG] 2009, p. 3). According to FDACS Chapter 482, bats may be considered pests, and pest control including methods to prevent, destroy, control, or eradicate pests in, on, or under a structure, lawn, or ornamental are allowable under certain rules and provisions. Bat advocacy groups are concerned over the lack of awareness of the regulations among people paid to perform exclusions (FBWG 2009, p. 3). Education is needed about the dates during which exclusion is prohibited for nuisance wildlife trappers, pest control companies, law enforcement, county health departments, and local animal control (FBWG 2010, p. 3). FDACS is currently developing a limited license for those individuals or companies that conduct wildlife removal services in or near structures (M. Tucker, *in litt.* 2012). To obtain this license, operators will be required to complete an educational program and pass a test based on a training manual in development by staff with the University of Florida-Institute of Food and Agricultural Sciences (M. Tucker, *in litt.* 2012). The manual will include information on proper exclusion techniques and existing regulations protecting bats during the maternity season (M. Tucker, *in litt.* 2012).

Additional educational efforts are underway. To better address violations of the maternity season and exclusion rule, FWC is training Law Enforcement officers (M. Tucker, *in litt.* 2012). Training on the importance of bats and the rules relating to exclusions has been provided to some officers in the northern part of the State, and an online training module is being developed as

part of the FWC law enforcement educational curriculum that all officers must complete (M. Tucker, *in litt.* 2012). The Service and other agencies and partners are also planning to increase awareness among land managers, environmental professionals, pest control operators, and others who may be in a position to have an impact on bat habitat or bat roosts. It is not clear to what extent training programs will be supported in the future or how effective efforts to raise awareness will be in reducing violations.

The Florida bonneted bat's presence on Federal, State, and county lands provides some protection, but does not insulate it from many threats (e.g., see *Factor A* and *Factor E*). The NPS manages the natural resources on their lands in accordance with NPS-specific statutes, including the NPS Organic Act, as well as other general environmental laws and applicable regulations. Similarly, all property and resources owned by FDEP are generally protected from harm in Chapter 62D–2.013(2), and animals are specifically protected from unauthorized collection in Chapter 62D–2.013(5) of the Florida Statutes. Despite these protections, risks to the Florida bonneted bat on conservation lands remain. For example, routine land management practices can cause the loss of roost sites, especially since locations of natural roosts are unknown (see *Factor A*). Use of pesticides may increase the likelihood of direct exposure or may impact the prey base (see *Factor E*).

Collecting permits can be issued ''for scientific or educational purposes.'' Permits are required from the FWC for scientific research on the Florida bonneted bat. For work on Federal lands (e.g., ENP, BCNP), permits are required from the NPS or the Service, if work is on National Wildlife Refuges. For work on State lands, permits are required from FDEP. Permits are also required for work on county-owned lands.

Summary of Factor D

Despite existing regulatory mechanisms, the Florida bonneted bat remains at risk due to the effects of a wide array of threats (see *Factors A* and *E*). Based on our analysis of the best available information, we find that existing regulatory measures, due to a variety of constraints, do not provide adequate protection, and, in some instances, may be harmful (i.e., taking of bats as ''nuisance'' wildlife). Educational efforts and training should help to raise awareness and address some violations of existing regulations. When finalized, the FWC's Florida bonneted bat management plan may contain additional measures that can help protect habitat. However, we do not have information to indicate that the aforementioned regulations and programs, which currently do not offer adequate protection to the Florida bonneted bat, will be revised and sufficiently supported, so that they would be adequate to provide protection for the species in the future. Therefore, we find that the existing regulatory mechanisms are inadequate to address threats to the species throughout all of its range.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

In general, bat populations are in decline due to their sensitivity to environmental stresses and other factors, such as slow reproductive rates (Jones *et al.* 2009, pp. 93–115). The Florida bonneted bat is likely affected by a wide array of natural and anthropogenic threats, operating singly or synergistically, and in varying immediacy, severity, and scope.

Inadvertent and Purposeful Impacts From Humans

In general, bats using old or abandoned and new dwellings are at significant risk. Bats are often removed when they are no longer tolerated by humans or inadvertently killed or displaced when structures are demolished. Adverse human impacts on bats involve direct killing, persecution, vandalism, and disturbance of hibernating and maternity colonies (Harvey *et al.* 1999, p. 13). Unpublished data from a survey of 100 pest control companies on the southeastern coast of Florida showed that requests to remove ''nuisance'' bats from this area all but ceased in the 1960s (Belwood 1992, p. 217), indicating a sharp decline in bats. Homeowners and professionals use a variety of methods to remove bats, including lethal means (C. Marks and G. Marks, pers. comm. 2008). Even when attempts are made to remove bats humanely, bats may be sealed into buildings (C. Marks and G. Marks, pers. comm. 2008). Despite regulations (see *Factor D* above), in some situations, bats are still likely removed through inhumane and prohibited methods (e.g., removed from roosts with vacuum cleaner-like apparatuses) and excluded from artificial roost sites during sensitive time periods (e.g., inside the maternity season before young are volant (capable of flying)) (A. Kropp, pers. comm. 2009). Such activities can result in direct mortality or injury of adults, juveniles, dependent newborn pups, or fetuses, if pregnant females are affected. In some cases, excluded individuals may not be able to readily locate other suitable roosts (due to competition with other species, lack of availability, or other factors).

In his dissertation on the ecological distribution of bats in Florida, Jennings (1958, p. 102) stated that Florida bonneted bats are encountered more often by humans than other bat species known to frequent the Miami area. He attributed this to the species' habits, which make it more conducive to discovery by humans. Jennings (1958, p. 102) noted, ''Some individuals were taken in shrubbery by gardners [sic], some flew into houses at dusk and other isolated individuals were taken under conditions indicating injury of some kind.'' The Florida bonneted bat's ability to adapt well to manmade structures contributes to its vulnerability and has likely been a factor in its decline (C. Marks and G. Marks, pers. comm. 2008). Since roosting sites are largely unknown, the potential to remove and exclude Florida bonneted bats from human dwellings and artificial structures, either inadvertently or accidentally, is high. Despite regulatory protections provided under Florida law (see *Factor D* above), direct and indirect threats from humans continue, especially in urban, suburban, and residential areas.

Similarly, Robson (1989, p. 15) stated that urban development has resulted in the persecution of bats wherever they come in contact with humans. ''Seemingly innocuous activities like removing dead pine or royal palm trees, pruning landscape trees (especially cabbage palms), sealing barrel-tile roof shingles with mortar, destroying abandoned buildings, and clearing small lots of native vegetation cumulatively may have a severe impact on remaining populations in urban areas'' (Robson 1989, p. 15). Harvey *et al.* (1999, p. 13) indicated that disturbance to summer maternity colonies of bats is extremely detrimental. In general, maternity colonies of bats do not tolerate disturbance, especially when flightless newborns are present (Harvey *et al.* 1999, p. 13). Newborns or immature bats may be dropped or abandoned by adults if disturbed (Harvey *et al.* 1999, p. 13). Disturbance to maternity colonies of the Florida bonneted bat may be particularly damaging because of this species' low fecundity and low abundance. In short, wherever this species occurs in or near human dwellings or structures, it is at risk of inadvertent or purposeful removal, displacement, and disturbance.

Routine maintenance and repair of bridges and overpasses is a potential

threat. The Florida bonneted bat has not been documented to use these structures. However, a large colony of Brazilian free-tailed bats uses the I–75 overpass at the entrance of Babcock-Webb WMA and a single Florida bonneted bat call was recorded within 1.6 km (1.0 mile) of this overpass; given the species' flight capabilities and roosting behavior, the Florida bonneted bat could be using this overpass (S. Trokey, pers. comm. 2008c; C. Marks and G. Marks, pers. comm. 2008). When bridges and overpasses are cleaned (typically by the Florida Department of Transportation), bats are subjected to high water pressure from hoses, which likely results in death or injury (C. Marks, pers. comm. 2007). Bats using the I–75 overpass at the entrance of Babcock-Webb WMA are at risk (C. Marks, pers. comm. 2007). During the fall of 2009, the FWC constructed a community bat house near the overpass to provide an alternate roost site; while it is not known if Florida bonneted bats will use community bat houses, space was included to accommodate larger-bodied bats in that structure (J. Morse, pers. comm. 2010). To date, the species has not been found in the large community bat house at this site.

Proposed Wind Energy Facilities

Wind power is one of the fastest growing sectors of the energy industry (Horn *et al.* 2008, p. 123; Cryan and Barclay 2009, p. 1330), and the development of wind energy facilities in Florida may be of particular concern for the Florida bonneted bat.

Migratory, tree-dwelling, and insectivorous bat species are being killed at wind turbines in large numbers across North America (Kunz *et al.* 2007, pp. 317–320; Cryan and Barclay 2009, pp. 1330–1340). Although it is not clear why such species are particularly susceptible (Boyles *et al.* 2011, p. 41), Kunz *et al.* (2007, pp. 315–324) proposed 11 hypotheses for the large numbers of fatalities at wind energy facilities. Some of these include: attraction to tall structures as potential roost sites, attraction to enhanced foraging opportunities (e.g., insects attracted to heat of turbines), echolocation failure, electromagnetic field disorientation, and decompression (rapid pressure changes causing internal injuries or disorientation of bats while foraging). Similarly, Cryan and Barclay (2009, pp. 1330–1340) categorized the causes of fatalities into two categories: proximate, which explain the direct means by which bats die, and ultimate, which explain why bats come close to turbines.

Based upon data modified from Johnson (2005 as cited in Arnett *et al.* 2008, p. 64), researchers found that the Brazilian free-tailed bat comprised 85.6 percent of bat mortalities noted at a wind energy facility in Woodward, Oklahoma, and 41.3 percent of bat mortalities at a High Wind, California, wind energy facility. Since the Florida bonneted bat is also a free-tailed bat, it may demonstrate some similar behaviors that place it at risk when encountering wind energy facilities.

Bat mortalities at wind energy facilities may be seasonal in nature (Johnson 2005, as cited in Kunz *et al.* 2007, p. 317). Most documented mortalities in North America occurred between late summer and early fall (Johnson 2005, as cited in Arnett *et al.* 2008, p. 66); Kunz *et al.* 2007, p. 317; Arnett *et al.* 2008, pp. 65–66). Taller turbines with greater rotor-swept areas may be responsible for more bat mortalities than shorter turbines with smaller rotor-swept areas (Arnett *et al.* 2008, p. 68). Bat mortalities are absent where turbines are not spinning, indicating that bats do not strike stationary blades or towers (Kerns *et al.* 2005, p. 91). Fatalities at wind energy facilities tend to occur when wind speeds are <6 meters/second (19.7 feet/second) (Kerns *et al.* 2005, p. 76). Bat mortalities were also negatively correlated with rain (Kerns *et al.* 2005 p. 76). It should be noted, however, that mortality monitoring at wind energy facilities is not standardized, and there is a paucity of data for analysis. Most studies include less than a full field season and may miss significant bat mortality events. Differences between sites including scavenging rates, carcass detection, and observer bias may all contribute to variations in bat mortality records (Arnett *et al.* 2008, pp. 71–72).

The cause of bat mortality at wind energy facilities is not a simple one of direct contact with blades or towers. Baerwald *et al.* (2008, pp. 695–696) found that barotrauma is the cause of death in a high proportion of bats found at wind energy facilities. Barotrauma involves tissue damage to air-containing structures (such as lungs) caused by rapid or excessive pressure change; wind turbine blades may create zones of low pressure as air flows over them. In their examination, Baerwald *et al.* (2008, pp. 695–696) found 90 percent of the bat fatalities involved internal hemorrhaging consistent with barotrauma, while direct contact with turbine blades only accounted for about half of the fatalities. Baerwald *et al.* (2008, pp. 695–696) suggested that the differences in respiratory anatomy between bats and birds may explain the higher incidence of bat fatalities from wind energy facilities (see also Barclay *et al.* 2007, pp. 381–387). In short, the large pliable lungs of bats expand when exposed to sudden drop in pressure, causing tissue damage, whereas birds' compact, rigid lungs do not respond in the same manner (Baerwald *et al.* 2008, pp. 695–696).

Wind turbine facilities are being planned for sites east and west of Lake Okeechobee, and these may have an impact on the Florida bonneted bat (M. Tucker, *in litt.* 2012). One proposed facility in Glades County is roughly 14.5 km (9 miles) south of locations where the species was recorded on the Kissimmee River in 2008 (M. Tucker, *in litt.* 2012). In 2011, ''possible'' Florida bonneted bat calls were also recorded on the proposed project site (C. Coberly, pers. comm. 2012). Potential impacts from this proposed facility cannot be accurately assessed at this time because it is not clear that the species uses the site (i.e., occurs on site or moves to it during activities such as foraging). The other proposed facility in Palm Beach County has not recorded Florida bonneted bat calls on site (C. Newman, pers. comm. 2012), and this county is not part of the species' known historical or current range. Both wind energy development companies have indicated that areas around Lake Okeechobee are the most suitable sites in Florida for wind development, and if successfully developed, additional sites could be proposed, increasing the risk of impacts from wind energy to the Florida bonneted bat (M. Tucker, *in litt.* 2012).

While bat fatalities from wind energy facilities are well documented, potential impacts to the Florida bonneted bat are difficult to evaluate at this time, partly due to the uncertainty involving many factors (e.g., location of facilities, operations, foraging distance). Certain aspects of the species' status and life history may increase vulnerability to this threat. The species' small population and low fecundity make any additional potential sources of mortality cause for concern. The species' high and strong flight capabilities and fast-hawking foraging behavior may increase risk. Conversely, since the species is nonmigratory, potential impacts from wind energy facilities may not be as great in magnitude as perhaps other bat species that are migratory. Implementation of the Service's new land-based wind energy guidelines may also help to avoid and minimize some impacts (Service 2012, pp. 1–71).

Pesticides and Contaminants

The life history of the Florida bonneted bat may make it susceptible to

both direct and indirect impacts from mosquito control and other pesticide application activities. Mosquito control spraying activities commonly begin at dusk when mosquitoes are most active (*http://www.miamidade.gov/pubworks/spraying_insecticides.asp*). Because the Florida bonneted bat forages at dusk and after dark, the possibility exists for individuals to be directly exposed to airborne mosquito control chemicals or to consume invertebrates containing pesticide residues from recent applications. Additionally, because the Florida bonneted bat has been documented to roost in residential areas (Belwood 1992, pp. 219–220), it is possible for individuals to be exposed, either directly or through diet, to a variety of undocumented, localized pesticide applications conducted by homeowners.

Organochlorine (OC) pesticides have been linked to lethal effects in bats (Clark *et al.* 1978, p. 1358; Clark *et al.* 1983, pp. 215–216; O'Shea and Clark 2002, p. 239). Such pesticides have not been registered for use in the United States for several decades, but due to the extreme ability of OCs to persist in the environment, residues are still detectable in soil and sediment in some locations in south Florida. The possibility exists that the Florida bonneted bat may consume invertebrates with elevated OC concentrations in areas with substantial OC environmental concentrations, though this scenario would be limited to specific sites and would not be expected to be a widespread threat. No studies have been conducted that attempt to assess the historical impact of OC pesticides on the Florida bonneted bat.

Currently, OC pesticides have largely been replaced with organophosphate (OP), carbamate, and pyrethroid pesticides. Carbamate and OP pesticides act as cholinesterase inhibitors and are generally more toxic to mammals than OC pesticides. However, they are not as persistent in the environment and do not tend to bioaccumulate in organisms. Despite this lack of persistence, Sparks (2006, pp. 3–4, 6–7) still found OP residues in both bats and guano in Indiana and suspected that the residues originated from consuming contaminated insects. Pyrethroids, one of which is permethrin, are commonly used mosquito control pesticides in south Florida and interfere with sodium channel function and display greater persistence than OP and carbamate pesticides, but still degrade much more rapidly than OC pesticides and are believed to exhibit low toxicity to mammals.

Grue *et al.* (1997, pp. 369–388) reviewed the sublethal effects of OPs and carbamates on captive small mammals and birds and found impaired thermoregulation, reduced food consumption, and reproductive alterations. Clark (1986, p. 193) observed a depression in cholinesterase activity in little brown bats following both oral and dermal application of the OP pesticide methyl parathion. Bats with reduced cholinesterase activity may suffer loss of coordination, impaired echolocation, and elongated response time. Alteration of thermoregulation could have serious ramifications to bats, given their high metabolic and energy demands (Sparks 2006, pp. 1–2). Reduced reproductive success would be of concern because the Florida bonneted bat already displays a low reproductive rate (Sparks 2006, p. 2). In order to accurately evaluate the impact of such pesticides on the Florida bonneted bat, additional work characterizing both pesticide exposure and effects in bats is needed.

In addition to pesticide exposure, mercury represents another potential threat to the Florida bonneted bat that has not been investigated. According to the National Atmospheric Deposition Program, the mercury deposition rate in south Florida is among the highest in the United States (*http://nadp.isws.illinois.edu*). The movement of mercury through the aquatic system and into the terrestrial food web through emergent invertebrates has been documented in other areas (Konkler and Hammerschmidt 2012, p. 1659; Cristol *et al.* 2008, p. 335). Assuming that a similar mechanism is occurring in south Florida coupled with high mercury deposition rates, the consumption of such invertebrates may constitute a pathway for the Florida bonneted bat to be exposed to mercury. Nam *et al.* (2012, pp. 1096–1098) documented mercury concentrations in brain, liver, and fur in little brown bats near a mercury-contaminated site in Virginia that were significantly greater than mercury concentrations in the same tissues of little brown bats at a reference site, indicating the potential for bats to be exposed to and accumulate mercury near mercury-impacted systems. It is likely that the Florida bonneted bat experiences some degree of mercury exposure when foraging to a large extent above mercury-impacted water bodies. While no known studies have attempted to evaluate the impact of mercury on bat populations in south Florida, the neurotoxic effects of mercury on mammals in general have been well characterized in the scientific literature.

A reduction in the number of flying insects is a potential secondary effect to consider when evaluating the impact of pesticides, and mosquito control chemicals in particular, on the Florida bonneted bat. In his status survey for the Florida bonneted bat, Robson (1989, p. 15) suggested that mosquito control programs are contributing to reduced food supplies for bats. Robson (1989, p. 14) attributed the general reduced activity of bats along the southeastern coastal ridge to the reduction of forested habitat and reduced insect abundance. Although insect activity was not measured, Robson (1989, p. 14) noted that the ''lack of insects on the southeastern coastal ridge was striking when contrasted to all other areas.'' While it is reasonable to suggest that reduced food supply or increased exposure to pesticides may have led to the decline of the population in the Miami area, this link is only speculative because no rigorous scientific studies or direct evidence exists. Timm and Genoways (2004, p. 861) indicated that the extant, although small, population of the bat in the Fakahatchee-Big Cypress area of southwest Florida is located in one of the few areas of south Florida that has not been sprayed with pesticides. Marks and Marks (2008a, p. 15) contended that if the species' rarity and vulnerability are due to a dependence on a limited food source or habitat, then the protection of that food source or habitat is critical.

In summary, the effects of pesticides and contaminants on bat populations in general have not been studied thoroughly. In the case of the Florida bonneted bat, data concerning the effects of pesticides and other contaminants is virtually nonexistent. Despite this lack of data, the possibility certainly exists for the Florida bonneted bat to be exposed to a variety of compounds through multiple routes of exposure. Additionally, areas with intensive pesticide activity may not support an adequate food base for the species. Pesticides and contaminants might be impacting the Florida bonneted bat, but further studies are required to fully assess whether they are impacting the species at the population level and are, therefore, posing a threat.

Effects of Small Population Size, Isolation, and Other Factors

The Florida bonneted bat is vulnerable to extinction due to its small population size, restricted range, few colonies, low fecundity, and relative isolation. The Florida bonneted bat only occurs in south Florida and only in limited numbers (Timm and Genoways 2004, pp. 861–862; Marks and Marks

2008a, pp. 11, 15; 2008b, p. 4; 2012, pp. 12–15). Based on the small number of locations where calls were recorded, the low numbers of calls recorded at each location, and the fact that the species forms small colonies, Marks and Marks (2008a, p. 15) stated that it is possible that the entire population of Florida bonneted bats may number less than a few hundred individuals. Due to its small population size and restricted range, the species is considered to be one of the most critically endangered mammals in North America (Timm and Genoways 2004, p. 861). In general, species with restricted ranges are often characterized by small population sizes and high habitat specialization and are, therefore, more vulnerable to stochastic, demographic, and environmental processes (Lande *et al.* 2003 as cited in Lee and Jetz 2010, p. 5).

In a vulnerability assessment, the FWC's biological status review team determined that the species met criteria or listing measures for geographic range, population size and trend, and population size and restricted area (Gore *et al.* 2010, pp. 1–2). For geographic range, the review team estimated that the species occurs in a combined area of roughly 17,632 km^2 (6,808 mi^2), well below the criterion of < 20,000 km^2 (7,722 mi^2). The review team also estimated potentially three subpopulations in a fragmented range, all of which occur in coastal locations susceptible to hurricanes and other losses in habitat (see *Climate Change and Sea Level Rise* and *Land Use Changes and Human Population Growth* above). The review team also inferred continuing decline in both extent of occurrence and area, extent, or quality of habitat. For population size and trend, the review team estimated <100 individuals known in roosts, with an assumed total of mature individuals, well below the criterion of 10,000. Similarly, for population size and restricted area, the review team estimated a total population of mature individuals at <1,000, with <100 individuals in known roosts, and all three subpopulations were located in at-risk coastal zones.

Slow reproduction and low fecundity are also serious concerns because this species produces only one young at a time and roosts singly or in small groups (FBC 2005, p. 1; Timm and Arroyo-Cabrales 2008, p. 1). Assuming a lifespan of 10 to 20 years for bats of this size (Wilkinson and South 2002, pp. 124–131), the average generation time is estimated to be 5 to 10 years (Gore *et al.* 2010, p. 7). The small numbers within localized areas may also make the Florida bonneted bat vulnerable to extinction due to genetic drift (loss of unique genes through time), inbreeding depression (reduced fitness or survival due to low genetic diversity), extreme weather events (e.g., hurricanes), and random or chance changes to the environment (Lande 1988, pp. 1455–1459; Smith 1990, pp. 310–321) that can significantly impact its habitat (see *Environmental Stochasticity* below). Information on the extent of genetic diversity in historical or current populations is lacking.

In general, isolation, whether caused by geographic distance, ecological factors, or reproductive strategy, will likely prevent the influx of new genetic material and can result in low diversity, which may impact viability and fecundity (Chesser 1983, pp. 66–77). Distance between subpopulations or colonies, the small sizes of colonies, and the general low number of bats may make recolonization unlikely if any site is extirpated. Isolation of habitat can prevent recolonization from other sites and potentially result in extinction. The probability of extinction increases with decreasing habitat availability (Pimm *et al.* 1988, pp. 758–762, 776; Noss and Cooperrider 1994, pp. 162–165; Thomas 1994, pp. 373–378; Kale 1996, pp. 7–11). Although changes in the environment may cause populations to fluctuate naturally, small and low-density populations are more likely to fluctuate below a minimum viable population (i.e., the minimum or threshold number of individuals needed in a population to persist in a viable state for a given interval) (Shaffer 1981, pp. 131–134; Shaffer and Samson 1985, pp. 146–151; Gilpin and Soulé 1986, pp. 19–34). If populations become fragmented, genetic diversity will be lost as smaller populations become more isolated (Rossiter *et al.* 2000, pp. 1131–1135). Fragmentation and aspects of the species' natural history (e.g., reliance on availability of suitable roost sites, constant supply of insects) can contribute to and exacerbate other threats facing the species.

Overall, the Florida bonneted bat is vulnerable to a wide array of factors, including small population size, restricted range, few occurrences, low fecundity, and relative isolation. These threats are significant and expected to continue or possibly increase.

Environmental Stochasticity

Natural events such as severe hurricanes may cause the loss of old trees with roosting cavities (Timm and Genoways 2004, p. 861). In August 1992, Hurricane Andrew, a category 5 hurricane, struck southern Miami-Dade County with sustained surface windspeeds of more than 145 mph and gusts exceeding 175 mph (Timm and Genoways 2004, p. 861). The winds destroyed the majority of older trees within several kilometers of the coast that were potentially available as roost trees (Timm and Genoways 2004, p. 861). Timm and Genoways (2004, p. 861) indicated that habitat loss from development (see *Factor A*), increased use of pesticides, and Hurricane Andrew may have had a significant impact on an already small population of the Florida bonneted bat.

Several less intense hurricanes have impacted both coasts of Florida during the past decade. Acoustical surveys conducted in south Florida prior to the hurricane season of 2004 (from 1997 through 2003) were compared with results after the hurricanes (Marks and Marks 2008a, pp. 12, D1–D6, E1–E26). The limited number of locations and low number of recorded calls suggested that the species was rare before the 2004 storm season and that the population remained low afterward (Marks and Marks 2008a, pp. 12–15). Prior to the 2004 hurricane season, calls were recorded at 4 of 10 locations; after the hurricane season, calls were recorded at 9 of 44 locations (Marks and Marks 2008a, pp. 12–15). Actions taken by a private landowner to reinforce bat houses prior to Hurricane Charlie in 2004 and Hurricane Wilma in 2005 likely prevented the only known extant roost site (at that time) from being destroyed; these storms caused significant damage to both trees and other property on the site (S. Trokey, pers. comm. 2008c).

Major impacts of intense storms may include mortality during the storm, exposure to predation immediately following the storm, loss of roost sites, and impacts on foraging areas and insect abundance (Marks and Marks 2008a, pp. 7–9). In general, bats could be blown into stationary objects or impacted by flying debris, resulting in injury or mortality (Marks and Marks 2008a, p. 7). Trees with cavities can be snapped at their weakest point, which for the Florida bonneted bat may have the most severe impact since the species uses cavities (Marks and Marks 2008a, p. 8), competition for available cavities in south Florida is intense (Belwood 1992, p. 220), and suitable roosting sites in general are often limiting factors (Humphrey 1975, pp. 341–343). Displaced bats may be found on the ground or other unsuitable locations and exposed to natural predators, domestic pets, and humans (Marks and Marks 2008a, p. 8). As pregnant females have been found in June through September, hurricanes in Florida can

occur at critical life-history stages—when females are pregnant or rearing young—possibly resulting in losses of pregnant females, newborns, or juvenile pups (Marks and Marks 2008a, pp. 7–9). Because the entire population may be less than a few hundred individuals (Marks and Marks 2008a, p. 15; 2012, pp. 12–15), the Florida bonneted bat may not be able to withstand losses from intense storms or storms at a critical life-history stage. Alternatively, less intense hurricanes or mild, isolated storms may create roosting opportunities, if tree snags (dead trees) are left in place.

According to the Florida Climate Center, Florida is by far the most vulnerable State in the United States to hurricanes and tropical storms (*http://coaps.fsu.edu/climate_center/tropicalweather.shtml*). Based on data gathered from 1856 to 2008, Klotzbach and Gray (2009, p. 28) calculated the climatological and current-year probabilities for each State being impacted by a hurricane and major hurricane. Of the coastal States analyzed, Florida had the highest climatological probabilities for hurricanes and major hurricanes, with a 51 percent probability of a hurricane and a 21 percent probability of a major hurricane over a 152-year timespan. Of the States analyzed, Florida also had the highest current-year probabilities, with a 45 percent probability of a hurricane and an 18 percent probability of a major hurricane (Klotzbach and Gray 2009, p. 28). Based upon data from the period 1886–1998, Neumann *et al.* (1999, pp. 29–30) also found that the number of tropical cyclones within south Florida is high; analyses suggested that areas within the species' range (e.g., Fort Myers, Miami) are expected to experience more than 50 occurrences (tropical cyclones) per 100 years. In addition, the analyses suggested that the incidence of hurricanes in south Florida was roughly 30 per 100 years, higher than any other area except for North Carolina (Neumann *et al.* 1999, pp. 29–30). The number of major hurricanes (roughly 14 per 100 years) was higher than any other area examined (Neumann *et al.* 1999, p. 30).

If hurricanes and tropical storms increase in severity, frequency, or distribution, vulnerable, tropical tree-roosting bat species may be heavily impacted (Gannon and Willig 2009, pp. 281–301). Given the Florida bonneted bat's tree-roosting habits, small population size, few isolated colonies, and use of coastal areas, the species is at risk from hurricanes, storms, or other extreme weather. Depending on the location and intensity of a hurricane or other severe weather event, it is possible that multiple colonies could become extirpated, even from one storm event. Due to the bat's overall vulnerability, intense hurricanes are a significant threat, which is expected to continue or increase in the future.

Other processes to be affected by climate change include temperatures, rainfall (amount, seasonal timing, and distribution), and storms (frequency and intensity). Temperatures are projected to rise approximately 2 °C to 5 °C (3.6 °F to 9 °F) for North America by the end of this century (IPCC 2007, pp. 7–9, 13). Based upon modeling, Atlantic hurricane and tropical storm frequencies are expected to decrease (Knutson *et al.* 2008, pp. 1–21). By 2100, there should be a 10–30 percent decrease in hurricane frequency due to more wind shear impeding initial hurricane development. However, the intensity of hurricanes is expected to increase, with a 5–10 percent increase in wind. This is due to more hurricane energy available for intense hurricanes. In addition to climate change, weather variables are extremely influenced by other natural cycles, such as El Niño Southern Oscillation with a frequency of every 4–7 years, solar cycle (every 11 years), and the Atlantic Multi-decadal Oscillation. All of these cycles influence changes in Floridian weather. The exact severity, direction, and distribution of all of these changes at the regional level are difficult to project.

This species is also vulnerable to prolonged extreme cold weather events. Air temperatures dropped to below freezing and reached a low of −2.0 °C (28 °F) in ENP on January 11, 2010; air temperatures at Royal Palm for the first 2 weeks of January marked the coldest period recorded over the previous 10 years (Hallac *et al.* 2010, p. 1). The effects of this severe and prolonged cold event on the Florida bonneted bats or other bats in Florida are not known, but some mortality was observed. At least 8 Florida bonneted bats were lost from the North Fort Myers colony during the event, before 12 remaining bats were brought into captivity, warmed, and fed (S. Trokey, pers. comm. 2010). Those rescued were emaciated and in poor condition. Initially, only 9 individuals appeared to survive after this event, although 10 individuals were still alive at this site in April 2010 (S. Trokey, pers. comm. 2010a, 2010b, 2010c). Approximately 30 Brazilian free-tailed bats were found dead below a bat house in Everglades City during this event (R. Arwood, pers. comm. 2010). Overall, approximately 100 Brazilian free-tailed bats using bat houses were found dead following this severe cold event (C. Marks, pers. comm. 2011). South Florida again experienced cold temperatures in December 2010. Temperatures in December 2010 were among the coldest on record within ENP (J. Sadle, NPS, pers. comm. 2011). In the short term, the severe and prolonged cold events in south Florida resulted in mortality of at least several adult Florida bonneted bats at one observed site. However, it is not known if the species persisted at all sites previously documented following the prolonged and repeated cold temperatures in 2010. Overall, the long-term effects of prolonged and repeated cold events on the species are not known.

Molossids, the family of bats which includes the Florida bonneted bat, appear to be an intermediate between tropical and temperate zone bat families (Arlettaz *et al.* 2000, pp. 1004–1014). Members of this family that inhabit the warmer temperate and subtropical zones incur much higher energetic costs for thermoregulation during cold weather events than those inhabiting northern regions (Arlettaz *et al.* 2000, pp. 1004–1014). At such temperatures, bats are likely unable to find food, and cannot re-warm themselves. Such a stochastic, but potentially severe, event poses a significant threat to the entire population. Impacts of the cold weather event are evident, but the effect on all colonies is not known. Additional extreme weather events are anticipated in the future, and such extremes can turn into ''disasters for small populations of mammals'' (R. Timm, pers. comm. 2012).

Aspects of the Species' Life History and Climate Change Implications

For bats in general, climate changes can affect food availability, timing of hibernation, frequency of torpor, rate of energy expenditure, reproduction, and development rate (Sherwin *et al.* 2012, pp. 1–18). Although increased temperatures may lead to benefits (e.g., increased food supply, faster development, range expansion), other negative outcomes may also occur (e.g., extreme weather, reduced water availability, spread of disease) (Sherwin *et al.* 2012, p. 14). Food abundance is a fundamental factor influencing bat activity (Wang *et al.* 2010, pp. 315–323). Insectivorous bats are dependent upon ectothermic (cold-blooded) prey, whose activity is affected by climate conditions (Burles *et al.* 2009, pp. 132–138). Aerial-hawking species such as the Florida bonneted bat are likely highly sensitive to climatic changes due to their dependence on a food supply that is highly variable in both time and space (Sherwin *et al.* 2012, p. 3). In assessing

implications of climate change, Sherwin *et al.* (2012, p. 4) identified two risk factors directly related to foraging: bats inhabiting water-stressed regions and aerial-hawking species, reliant on spatially variable food sources. Bats generally have higher rates of evaporative water loss than other similarly sized terrestrial mammals and birds (Herreid and Schmidt-Nielsen 1966, Studier 1970 as cited in Chruszcz and Barclay 2002, p. 24 and Webb *et al.* 1995, p. 270). Due to their high surface area to volume ratios and large, naked flight membranes (wings), the potential for loss of evaporative water is generally high (Webb *et al.* 1995, pp. 269–278). Travelling farther to access water and food entails more energy expenditure and may affect reproductive success (Sherwin *et al.* 2012, p. 4). Considering foraging risk alone, the Florida bonneted bat may be especially susceptible to climate changes since it is an insectivorous, aerial-hawking species restricted to south Florida, a region expected to become water-stressed in the future (see *Factor A* above).

Summary of Factor E

Based on our analysis of the best available information, we have identified a wide array of natural and manmade factors affecting the continued existence of the Florida bonneted bat. Inadvertent or purposeful impacts by humans caused by intolerance or lack of awareness (e.g., removal, landscaping activities, bridge maintenance) can lead to mortality or disturbances to maternity colonies. The Florida bonneted bat's ability to adapt well to manmade structures has likely been a factor in its decline because the bat tends to inhabit structures that place it at risk from inadvertent or purposeful harm by humans. Proposed wind energy facilities in the species' habitat can cause mortalities. The species may be exposed to a variety of chemical compounds through multiple routes of exposure, and intensive pesticide use may alter insect prey availability. Small population size, restricted range, low fecundity, and few and isolated colonies are serious ongoing threats. Catastrophic and stochastic events are of significant concern. All colonies are at risk due to hurricanes, which can cause mortality, loss of roost sites, and other impacts. Extreme cold weather events can also have severe impacts on the population and increase risks from other threats by extirpating colonies or further reducing colony sizes. Collectively, these threats have operated in the past, are impacting the species now, and will continue to impact the Florida bonneted bat in the future.

Proposed Determination

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Florida bonneted bat. The species occurs in limited numbers in a restricted range in south Florida. Habitat loss, degradation, and modification from human population growth and associated development and agriculture have impacted the Florida bonneted bat and are expected to further curtail its limited range (see *Factor A*). Environmental effects from climatic change, especially sea level rise, are expected to become severe in the future, resulting in additional habitat losses that are expected to place the species at greater risk (see *Factor A*).

The Florida bonneted bat is also currently threatened by a wide array of natural and manmade factors (see *Factor E*). Effects of small population size, restricted range, few colonies, slow reproduction, low fecundity, and relative isolation contribute to the species' vulnerability. Other aspects of the species' natural history (e.g., aerial-hawking foraging, tree-roosting habits) and environmental stochasticity may also contribute to its imperilment. Multiple anthropogenic factors (e.g., impacts or intolerance by humans, wind energy projects) are also threats of varying severity. As an insectivore, the species is also likely exposed to a variety of pesticides and contaminants through multiple routes of exposure; pesticides may also affect its prey base. Given its vulnerability, disease and predation (see *Factor C*) have the potential to impact the species. Finally, existing regulatory mechanisms (see *Factor D*), due to a variety of constraints, do not provide adequate protection for the species. Overall, impacts from increasing threats, operating singly or in combination, place the species at risk of extinction.

Section 3 of the Act defines an endangered species as ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a threatened species as ''any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' By all indications, the species occurs only in limited numbers within a restricted range and faces considerable and immediate threats, which place it at risk of extinction. Aspects of the species' natural history may also contribute to and exacerbate threats and increase its vulnerability to extinction. Since immediate and ongoing significant threats to the Florida bonneted bat extend throughout its entire range, we have determined that the species is currently in danger of extinction throughout all of its range. Because threats extend throughout the entire range, it is unnecessary to determine if the Florida bonneted bat is in danger of extinction throughout a significant portion of its range. Therefore, on the basis of the best available scientific and commercial information, we have determined that the Florida bonneted bat meets the definition of an endangered species under the Act. In other words, we find that a threatened species status is not appropriate for the Florida bonneted bat because of the severity and immediacy of the threats, the restricted range of the species, and its small population size. Consequently, we propose to list the Florida bonneted bat as an endangered species throughout its entire range.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness and conservation by Federal, State, Tribal, and local agencies, private organizations, and individuals. The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed, preparation of a draft and final recovery plan, and revisions to the plan as

significant new information becomes available. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. The recovery plan identifies site-specific management actions that will achieve recovery of the species, measurable criteria that determine when a species may be downlisted or delisted, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (comprising species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our Web site (*http://www.fws.gov/endangered*), or from our South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribal, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

If this species is listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, pursuant to section 6 of the Act, the State of Florida would be eligible for Federal funds to implement management actions that promote the protection and recovery of the Florida bonneted bat. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants.*

Although the Florida bonneted bat is only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for this species. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with the Service.

Federal agency actions within the species' habitat that may require conference or consultation or both as described in the preceding paragraph include, but are not limited to: management and any other landscape-altering activities on Federal lands administered by the Department of Defense, Fish and Wildlife Service, National Park Service, and U.S. Forest Service; issuance of section 404 Clean Water Act permits by the Army Corps of Engineers; permitting of construction and management of gas pipeline, power line rights-of-way, and wind energy facilities by the Federal Energy Regulatory Commission; and construction and maintenance of roads, highways, or bridges by the Federal Highway Administration.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered wildlife. The prohibitions of section 9(a)(2) of the Act, codified at 50 CFR 17.21 for endangered wildlife, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import, export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. Under the Lacey Act (18 U.S.C. 42–43; 16 U.S.C. 3371–3378), it is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies. The Florida bonneted bat is listed by the State of Florida; therefore, certain State laws also apply. Listing would also require Federal agencies to avoid actions that might jeopardize the species (16 U.S.C. 1536(a)(2)), and would provide opportunities for funding of conservation measures and land acquisition that would not otherwise be available to them (16 U.S.C. 1534, 1535(d)).

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22 for endangered species, and at 17.32 for threatened species. With regard to endangered wildlife, a permit must be issued for the following purposes: for scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a proposed listing on proposed and ongoing activities within the range of the species proposed for listing.

We estimate that the following activities would be likely to result in a violation of section 9 of the Act; however, possible violations are not limited to these actions alone:

(1) Unauthorized possession, collecting, trapping, capturing, killing, harassing, sale, delivery, or movement, including interstate and foreign commerce, or harming or attempting any of these actions, of Florida bonneted bats (research activities where Florida bonneted bats are handled, captured (e.g., netted, trapped), tagged, or collected will require authorization pursuant to the Act).

(2) Incidental take of the Florida bonneted bat without authorization pursuant to section 7 or section 10 (a)(1)(B) of the Act.

(3) Sale or purchase of specimens of this taxon, except for properly documented antique specimens of this taxon at least 100 years old, as defined by section 10(h)(1) of the Act.

(4) Unauthorized destruction or alteration of Florida bonneted bat habitat (including unauthorized grading, leveling, plowing, mowing, burning,

herbicide spraying, or other destruction or modification of occupied or potentially occupied habitat or pesticide application in known occupied habitat) in ways that kills or injures individuals by significantly impairing the species' essential breeding, foraging, sheltering, or other essential life functions.

(5) Unauthorized release of biological control agents that attack any life stage of this taxon.

(6) Unauthorized removal or destruction of cavity trees and other natural structures being utilized as roosts by the Florida bonneted bat that results in take of the species.

(7) Unauthorized removal or exclusion from buildings or artificial structures being used as roost sites by the species, resulting in take of the species.

(8) Unauthorized maintenance or repair of bridges or overpasses that are being used as roost sites by the Florida bonneted bat that result in take of the species.

(9) Unauthorized building and operation of wind energy facilities within areas used by the Florida bonneted bat, which results in take of the species.

We will review other activities not identified above on a case-by-case basis to determine whether they may be likely to result in a violation of section 9 of the Act. We do not consider these lists to be exhaustive, and we provide them as information to the public.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Field Supervisor of the Service's South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**). Requests for copies of the regulations concerning listed animals and general inquiries regarding prohibitions and permits may be addressed to the U.S. Fish and Wildlife Service, Endangered Species Permits, 1875 Century Boulevard, Atlanta, GA 30345 (Phone 404–679–7313; Fax 404–679– 7081).

Critical Habitat

Background

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features

(a) Essential to the conservation of the species and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that Federal agencies ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Where a landowner requests Federal agency funding or authorization for an action that may affect a listed species or critical habitat, the consultation requirements of section 7(a)(2) of the Act would apply, but even in the event of a destruction or adverse modification finding, the obligation of the Federal action agency and the landowner is not to restore or recover the species, but to implement reasonable and prudent alternatives to avoid destruction or adverse modification of critical habitat.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information developed during the listing process for the species. Additional information sources may include the recovery plan for the species, articles in peer-reviewed journals, conservation plans developed by States and counties, scientific status surveys and studies, biological assessments, other unpublished materials, or experts' opinions or personal knowledge.

Critical Habitat Prudency

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12), require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be endangered or threatened. Our regulations (50 CFR 424.12(a)(1)) state that the designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species; or (2) such designation of critical habitat would not be beneficial to the species.

We have carefully considered all known threats to the species to determine the prudency of critical habitat for the species. Because humans may be intolerant of bats in general, some individual Florida bonneted bats may be threatened by taking or other human activity in instances where they reside in conflict with humans (e.g., roosting in an occupied human dwelling). However, we are not aware of any current situations where this is the case, and we do not have any evidence that this was a major threat previously. Based upon available information, taking by humans does not appear to be a primary threat to the species. Furthermore, as discussed in *Summary of Factors Affecting the Species, Factors A* and *E,* Florida bonneted bats could be inadvertently killed or displaced if their roost sites are not known, and the species could possibly benefit from having additional roosting and foraging locations identified. Therefore, we do

not anticipate that identification of critical habitat would be expected to increase the degree of threat to the species, and designation of essential habitat, particularly roosting sites, could actually reduce the degree of threat to the species.

Designation of critical habitat would offer other benefits to the species. The principal benefit of including an area in a critical habitat designation is the requirement for Federal agencies to ensure actions they fund, authorize, or carry out are not likely to result in the destruction or adverse modification of any designated critical habitat, the regulatory standard of section 7(a)(2) of the Act under which consultation is completed. Federal agencies must also consult with us on actions that may affect a listed species and refrain from undertaking actions that are likely to jeopardize the continued existence of such species. The analysis of effects of a proposed project on critical habitat is separate and different from that of the effects of a proposed project on the species itself. The jeopardy analysis evaluates the action's impact to survival and recovery of the species, while the destruction or adverse modification analysis evaluates the action's effects to the designated habitat's contribution to conservation. Therefore, the difference in outcomes of these two analyses represents the regulatory benefit of critical habitat. This will, in some instances, lead to different results and different regulatory requirements. Thus, critical habitat designations may provide greater benefits to the recovery of a species than those provided solely by listing.

Designation of critical habitat for the Florida bonneted bat may also benefit the species by focusing conservation efforts on the restoration and maintenance of ecosystem functions that are essential for attaining short- and long–term viability and recovery. The designation of critical habitat can also serve to inform management and conservation decisions by identifying any additional physical and biological features of the ecosystem that may be essential for the conservation of the species. Critical habitat designation can also help raise awareness and educate landowners about the potential conservation value of the area.

We, therefore, find that designation of critical habitat for the Florida bonneted bat is prudent, because once determined, critical habitat would be beneficial, and there is no evidence that the designation of critical habitat would result in an increased threat from taking or other human activity for this species.

Critical Habitat Determinability

Our regulations (50 CFR 424.12(a)(2)) further state that critical habitat is not determinable when one or both of the following situations exist: (1) Information sufficient to perform the required analysis of the impacts of the designation is lacking, or (2) the biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat. When we find that critical habitat is not determinable, the Act provides for an additional year to publish a critical habitat designation (16 U.S.C. 1533(b)(6)(C)(ii)).

In accordance with sections 3(5)(A)(i) and 4(b)(1)(A) of the Act and regulations at 50 CFR 424.12, in determining which areas to propose as critical habitat, we must consider those physical and biological features essential to the conservation of the species. These include, but are not limited to:

(1) Space for individual and population growth and for normal behavior;

(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;

(3) Cover or shelter;

(4) Sites for breeding, reproduction, and rearing (or development) of offspring; and

(5) Habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distribution of a species.

We have done a preliminary evaluation to find if the designation of critical habitat for the Florida bonneted bat is prudent and determinable at this time. Based on that evaluation, we are currently unable to identify the physical and biological features essential for the conservation of the Florida bonneted bat because information on those features for this species is not known at this time. The apparent poor viability of the species recorded in recent years indicates that current conditions are not sufficient to meet the basic biological requirements of the species in most areas of its current range. Because the Florida bonneted bat has not been found for decades in many of its historical locations, and much of the habitat in which it still persists has been drastically altered, the optimal conditions that would provide the biological or ecological requisites of this species are not known. Although we can surmise that habitat loss and degradation from a variety of factors has contributed to the decline of the species, we do not know specifically what essential physical or biological features of that habitat are currently lacking.

Key features of the basic life history, ecology, reproductive biology, and habitat requirements of many bats, including the Florida bonneted bat, are unknown. Species-specific ecological requirements have not been determined (e.g., natural roost sites, seasonal changes in roosting habitat, dietary needs, seasonal changes in diet, prime foraging habitat). Population dynamics, such as species interactions and community structure, population trends, and population size and age class structure necessary to maintain long-term viability, have not been determined. As we are unable to identify many physical and biological features essential to the conservation of the Florida bonneted bat, we are unable to identify areas that contain features necessary for long-term viability. Therefore, we find that critical habitat is not determinable at this time.

We are, therefore, seeking information from the public regarding which physical or biological features or specific areas may be essential to the conservation of the Florida bonneted bat. Please see Information Requested above for specific information we are seeking to assist us in trying to identify the biological requirements for the Florida bonneted bat. We are particularly in need of information on location of natural roosts, roosting and foraging habitat preferences, dietary requirements, and foraging distance. Information gleaned from the public comment period, as well as from ongoing research efforts we are employing with the help of our partners (new survey technologies, computer modeling, etc.), will hopefully yield sufficient new information on those physical and biological features essential to the species to allow us to propose critical habitat.

Peer Review

In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), we will seek the expert opinions of at least three appropriate and independent specialists regarding this proposed rule. The purpose of peer review is to ensure that our proposed listing determination is based on scientifically sound data, assumptions, and analyses. We have invited these peer reviewers to comment during this public comment period on our proposal to list the Florida bonneted bat as an endangered species.

We will consider all comments and information received during this comment period on this proposed rule during preparation of a final determination. Accordingly, the final decision may differ from this proposal.

Public Hearings

Section 4(b)(5) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings, as well as how to obtain reasonable accommodations, in the **Federal Register** and local newspapers at least 15 days before the hearing.

Required Determinations

Clarity of the Rule

Executive Order 12866 requires each agency to write regulations that are easy to understand. We invite your comments on how to make this rule easier to understand including answers to questions such as the following: (1) Are the requirements in the rule clearly stated? (2) Does the rule contain technical language or jargon that interferes with its clarity? (3) Does the format of the rule (grouping and order of sections, use of headings, paragraphing, etc.) aid or reduce its clarity? (4) Would the rule be easier to understand if it were divided into more (but shorter) sections? (5) Is the description of the rule in the **SUPPLEMENTARY INFORMATION** section of the preamble helpful in understanding the emergency rule? What else could we do to make the rule easier to understand?

Send a copy of any comments that concern how we could make this rule easier to understand to Office of Regulatory Affairs, Department of the Interior, Room 7229, 1849 C Street NW., Washington, DC 20240. You also may email the comments to this address: *Exsec@ios.goi.gov.*

Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.)

This proposed rule does not contain any new collections of information that require approval by OMB under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*). This rule will not impose recordkeeping or reporting requirements on State or local governments, individuals, businesses, or organizations. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), need not be prepared in connection with listing a species as an endangered or threatened species under the Endangered Species Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

References Cited

A complete list of references cited in this rulemaking is available on the Internet at *http://www.regulations.gov* and upon request from the Field Supervisor, South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this package are the staff members of the South Florida Ecological Services Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 16 U.S.C. 1531–1544; 16 U.S.C. 4201–4245; Pub. L. 99–625, 100 Stat. 3500; unless otherwise noted.

2. In § 17.11(h) add an entry for ''Bat, Florida bonneted'' to the List of Endangered and Threatened Wildlife in alphabetical order under Mammals, to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
MAMMALS							
*	*	*	*	*	*	*	
Bat, Florida bonneted.	*Eumops floridanus*	U.S.A. (FL)	U.S.A. (FL)	E	.....	NA	NA
*	*	*	*	*	*	*	

* * * * *

Dated: September 20, 2012.

Daniel M. Ashe,

Director, U.S. Fish and Wildlife Service.

[FR Doc. 2012–24300 Filed 10–3–12; 8:45 am]

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