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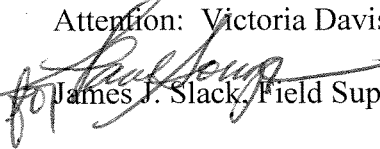


FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

March 31, 2006

Memorandum

To: Gloria Bell, Chief of Endangered Species, Southeast Regional Office
Attention: Victoria Davis

From:  James J. Slack, Field Supervisor, South Florida Ecological Services Office

Subject: Biological opinion addressing effects of requested recovery permit TE117769-0 for Stephan Schoech

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed recovery permit to allow research on the threatened Florida scrub-jay (*Aphelocoma coerulescens*) at the Archbold Biological Station in Highlands County, Florida in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

This biological opinion is based on information provided in research reports, the complete permit application and subsequent correspondence, telephone conversations, field investigations, and other sources of information. A complete administrative record of this consultation is maintained and available for review at the Service's South Florida Ecological Service Office (SFESO), Vero Beach, Florida.

CONSULTATION HISTORY

The Southeast Regional Office received a permit application from Stephan Schoech, dated December 27, 2005. Permit number TE117769-0 was assigned to this permit request.

On January 3, 2006, the SFESO received a request from the Southeast Regional Office for formal consultation on the recovery permit mentioned above.

On January 5, 2006, the SFESO contacted the Southeast Regional Office via email and concurred that the proposed action was likely to adversely affect the listed species and initiated formal consultation.

On January 9, 2006, the SFESO contacted Stephan Schoech via email requesting electronic copies of information provided in the permit request.



On January 9, 2006, the SFESFO received the requested information via email from Stephan Schoech.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Proposed Action

The Federal activity is issuance of a recovery permit to administer of low doses of stress hormone, banding, measuring, and monitoring of breeding and nesting activity, of the Florida scrub-jays in Highland County, Florida. Listed below is a brief description of the activities proposed.

1. Application of low dosage stress hormone to adult female scrub-jays:

Low doses of corticosterone will be administered to select breeding female scrub-jays to observe subsequent effects on the timing of clutch initiation in wildland and suburban populations. Because of conflicting results from prior studies using corticosterone (Morici et al. 1997), the present study will employ an alternate method for delivering dosage to experimental birds. Corticosterone will be delivered by injecting a corticosterone dose into a mealworm and then feeding it to a target bird. This technique has been used successfully in white-crowned sparrows (*Zonotrichia leucophrys*) and western scrub-jays (*Aphelocoma californica*) to generate increases in corticosterone that mimic stress responses to natural stimuli (Breuner et al. 1998). Field methodology will employ a small feeding box equipped with a servo motor (a common component of radio-controlled model airplanes) that can open the container by remote control. By placing mealworms in this device, it will be possible to control access such that only the target bird receives the corticosterone-dosed mealworm. After a training period that allows target birds to associate the box with a food reward, mealworms dosed with corticosterone dissolved in peanut oil will be provided to the target birds (the lipophilic nature of steroid hormones, such as corticosterone, necessitate dissolving the crystalline hormone in oil).

Based on trials with the western scrub-jay, which is approximately equal in size to the Florida scrub-jay, the actual amount of corticosterone that will be delivered to each bird will be in the range of 20 µg. The peak blood corticosterone levels will occur 7 to 8 minutes after administration followed by a subsequent slow decrease back toward baseline levels over the course of 1 hour.

Because the effects of orally administered corticosterone are transient and last approximately 1 hour, it will be necessary to give several doses each day to each bird in order to elevate corticosterone levels sufficiently that they will have the potential to result in a behavioral change. Therefore, corticosterone doses will be provided three times each day. Corticosterone administration will begin several weeks before egg laying which starts in mid-February, and will cease when the first egg is laid (usually mid-March). Efforts will focus exclusively on breeding

females. During this study's first breeding season, the effects of corticosterone will be tested in the wildlands population of scrub jays at Archbold Biological Station. A subset of 25 jay territories will receive food supplementation beginning in mid-January. Food supplementation advances the timing of reproduction by approximately 1.5 weeks (Schoech 1996, Reynolds et al. 2003). Of these supplemented territories, 12 will receive corticosterone-injected mealworms while the remaining 13 will serve as controls and receive mealworms injected with pure peanut oil. In the study second breeding season, the experimental protocol will switch to studies in the suburban population.

2. Locate and monitor nest attempts to determine treatment effects:

Scrub-jay territories will be searched during nesting season in an attempt to locate as many nests as possible. Most often nests are located while they are being built or during egg-laying. Nest searching begins in mid- to late-February. Nest searching will be conducted in the morning, between the hours of 7:00 and 10:00 AM, when nest building activity is at its peak. At the wildland study sites, jays usually do not begin egg-laying until early March, but nest building can begin as early as mid-February. Nesting typically continues until early June. Nests are found by observing the behavior of the breeding pair. At suburban sites, jays frequently begin egg-laying by late-February. Researchers watch for either of the pair carrying fibers or twigs and flying to a potential nest site. Once found, a detailed map will be drawn of the nest location so that subsequent observers can find it. The location will be marked with a small piece of orange surveyors flagging, usually placed no closer than 10 meters (m) (32.8 feet) to the nest. Nests visits will be conducted daily once a nest is found, and occur every third day after a clutch is complete.

Once a nest has been located, depending upon the stage of the nest (i.e., whether it is a rudimentary stick platform or fully lined with palmetto fibers), it will be checked regularly to assure that the first egg date is known. If a located nest is still in its early stages, it will be checked every third day. Once a nest is fully lined it will be checked each day to determine the date of clutch initiation. After a clutch is initiated, the nest will be visited 5 days later to determine final clutch size. The nest will then be checked every fourth day to establish whether the nest has been depredated and, if it has, these data will allow researchers to accurately assess the date of failure. If a female scrub-jay is found on the nest on a given sampling date, then data will be noted from a distance and the nest assumed viable rather than force the female from the nest. Because hatching occurs on average 18 days after the last egg has been laid, nest checks for hatching will occur on days 17, 18, or 19, depending on the individual nest. Nests will be visited between the hours 9:00 AM and 3:00 PM, when terrestrial predator activity is low (Schaub et al. 1992). If aerial predators (e.g., common grackles [*Quiscalus quiscula*], fish crows [*Corvus ossifragus*], etc.) are observed near the nest at the scheduled visit, then the visit will be postponed until the predator is absent. With the exception of the day 11 nestling visits, when the nestlings are measured and banded, nest visits will be kept as short as possible, usually less than 20 to 30 seconds, just time enough to accurately record nest contents. Nestlings will be banded on day 11.

During subsequent fledging checks on day 17 and 18 post, nests will be viewed with binoculars from 5 to 10 m (16.4 to 32.8 feet). Nestlings will be considered successfully

fledged if still alive, whether in the nest or not, on day 18 post-hatching. Fledglings will be continually checked at 5 to 6-day intervals through the rest of the breeding season. After a nest attempt has failed or fledged young, researchers will visit the nest and record the species of the nest shrub, the height of the nest, the height of the nest shrub, and the spatial location of the nest using a global positioning system (GPS).

3. Capture and banding nestlings, including weighing and measuring:

Nestlings will be carefully extracted from the nest by hand. Care will be taken to disentangle feet from the nest fibers. Nestlings will be placed in a cloth bag and removed at least 10 m (32.8 feet) from the nest for processing. If the parental birds are nearby and scolding, then peanuts will be thrown to them as a distraction and means of calming them. In urban areas, adult birds frequently remain on the nest while the nestlings are extracted. In these instances, the nestling is carefully shielded as it is removed from the nest so that the parent does not inadvertently peck the chick. Nestlings will be banded with an aluminum Service band and a single plastic color-leg band. From each bird the following morphological measurements will be collected: tarsus length, head length and width, culmen length, distance from nares to bill tip, and wing and tail length to the nearest 0.1 millimeter (mm) (0.0004 inches) using Vernier calipers, and mass to the nearest 0.1 gram (g) (0.004 ounces) using a 100 g (0.22 lbs) Pesola scale. In addition, researchers will visually assess molt, the presence of ectoparasites, and the amount of subcutaneous fat visible through the skin. As many as 160 nestlings may be banded during each study year.

4. Capture and banding of adults and subadults, including weighing and measuring:

Nestlings are the primary focus of banding activities in these studies, however, if immigrant adults are encountered at the study sites these birds also will be captured and banded. Banding protocols for adults and juveniles are identical.

Adults and independent juveniles will be captured using a variety of methods, including Potter traps, drop traps, bow traps, and mist nests depending on whichever trapping method is most efficient. As many as 15 adults may be banded during each study year.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project is Archbold Biological Station in Highlands County, Florida.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE

The following discussion is summarized from the Multi-Species Recovery Plan (MSRP) (Service 1999), as well as from recent research publications and monitoring reports. A discussion of the Florida scrub-jay's life history may be found in the MSRP. No critical habitat has been designated for the Florida scrub-jay; therefore, none will be affected.

Species/Critical Habitat Description

Scrub-jays are about 10 to 12 inches long and weigh about 3 ounces. They are similar in size and shape to blue jays (*Cyanocitta cristata*), but differ significantly in coloration (Woolfenden and Fitzpatrick 1996a). Unlike the blue jay, the scrub-jay lacks a crest. It also lacks the conspicuous white-tipped wing and tail feathers, black barring, and bridle of the blue jay. The scrub-jay's head, nape, wings, and tail are pale blue, and its body is pale gray on its back and belly. Its throat and upper breast are lightly striped and bordered by a pale blue-gray "bib" (Woolfenden and Fitzpatrick 1996a). Scrub-jay sexes are not distinguishable by plumage (Woolfenden and Fitzpatrick 1984), and males, on the average are only slightly larger than females (Woolfenden 1978). The sexes may be identified by a distinct "hiccup" call made only by females (Woolfenden and Fitzpatrick 1984, 1986). Scrub-jays that are less than about 5 months of age are easily distinguishable from adults; their plumage is smoky gray on the head and back, and they lack the blue crown and nape of adults. Molting occurs between early June and late November and peaks between mid-July and late September (Bancroft and Woolfenden 1982). During late summer and early fall, when the first basic molt is nearly done, fledgling scrub-jays may be indistinguishable from adults in the field (Woolfenden and Fitzpatrick 1984). The wide variety of vocalizations of scrub-jays is described in Woolfenden and Fitzpatrick (1996b).

Scrub-jays are in the order Passeriformes and the family Corvidae. They have been called a "superspecies complex" and described in four groups that differ in geographic distribution within the United States and Mexico: *A. californica*, from southwestern Washington through Baja California; *A. insularis*, on Santa Cruz in the Channel Islands, California; *A. woodhousii*, from southeastern Oregon and the Rocky Mountains and Great Plains to Oaxaca, Mexico; and *A. coerulescens* in peninsular Florida (American Ornithological Union [AOU] 1983). Other jays of the same genus include the Mexican jay or gray-breasted jay (*A. ultramarina*) and the unicolored jay (*A. unicolor*) of Central America and southwest North America (Woolfenden and Fitzpatrick 1996b).

The Florida scrub-jay, which was originally named *Corvus coerulescens* by Bosc in 1795, was transferred to the genus *Aphelocoma* in 1851 by Cabanis. In 1858, Baird made *coerulescens* the type species for the genus, and it has been considered a subspecies (*A. c. coerulescens*) for the past several decades (AOU 1957). It recently regained recognition as a full species (Florida scrub-jay, *Aphelocoma coerulescens*) from the AOU (AOU 1995) because of genetic, morphological, and behavioral differences from other members of this group: the western scrub-jay (*A. californica*) and the island scrub-jay (*A. insularis*). The group name is retained for species in this complex; however, it is now hyphenated to "scrub-jay" (AOU 1995). From here on in the document, Florida scrub-jays will be referred to as scrub-jays.

This species account references the full species name, *A. coerulescens*, as listed in the most recent Service Federal Register notice of Endangered and Threatened Wildlife and Plants (50 Code of Federal Regulations [CFR] §§ [sections] 17.11 and 17.12).

No critical habitat has been designated for this species; therefore, none will be affected.

Life History

The scrub-jay has specific habitat needs. It is endemic to peninsular Florida's ancient dune ecosystems or scrubs, which occur on well-drained to excessively well-drained sandy soils (Laessle 1958, 1968; Myers 1990; Fitzpatrick et al. unpubl. data). This relict oak-dominated scrub, or xeric oak scrub, is essential habitat to the scrub-jay. This community type is adapted to nutrient-poor soils, periodic drought, and frequent fires (Abrahamson 1984). Xeric oak scrub on the Lake Wales Ridge (LWR) is predominantly made up of 4 species of stunted, low-growing oaks: sand live oak (*Quercus geminata*), Chapman oak (*Q. chapmanii*), myrtle oak (*Q. myrtifolia*), and scrub oak (*Q. inopina*) (Myers 1990). In optimal habitat for scrub-jays on the LWR, these oaks are 0.9 to 3 m (3 to 10 feet) high, interspersed with 10 to 50 percent unvegetated, sandy openings, and a sand pine (*Pinus clausa*) canopy of less than 20 percent (Woolfenden and Fitzpatrick 1991). Trees and dense herbaceous vegetation is rare. Other vegetation noted along with the oaks includes saw palmetto (*Serenoa repens*) and scrub palmetto (*Sabal etonia*), as well as woody shrubs such as Florida rosemary (*Ceratiola ericoides*) and rusty lyonia (*Lyonia ferruginea*).

Scrub-jays occupy areas with less scrub oak cover and fewer openings on the Merritt Island/Cape Canaveral Complex and in southwest Florida than typical of xeric oak scrub habitat on the LWR (Schmalzer and Hinkle 1992b; Breininger et al. 1995; Thaxton and Hingtgen 1996). The predominant communities here are oak scrub and scrubby flatwoods. Scrubby flatwoods differ from scrub by having a sparse canopy of slash pine (*P. elliotii*); sand pines are rare. Shrub species mentioned above are common, except for scrub oak and scrub palmetto, which are restricted to the LWR. Runner oak (*Q. minima*), turkey oak (*Q. laevis*), bluejack oak (*Q. incana*), and longleaf pine (*P. palustris*) also have been reported. Kennedy Space Center, in Brevard County, supports one of the largest contiguous populations of scrub-jays. Studies conducted there give good descriptions of this habitat type (Schmalzer and Hinkle 1992b).

Human interference with natural fire regimes continues to play a major part in the decline of the scrub-jay, and today may exceed habitat loss as the single most important limiting factor (Woolfenden and Fitzpatrick 1991, 1996a; Fitzpatrick et al. 1994). Lightning strikes cause virtually all naturally-occurring fires in south Florida scrub habitat (Abrahamson 1984; Hofstetter 1984; Woolfenden and Fitzpatrick 1990). Fire has been noted to be important in maintenance of scrub habitat for decades (Nash 1895; Harper 1927; Webber 1935; Davis 1943; Laessle 1968; Abrahamson et al. 1984). Human efforts to prevent and/or control natural fires have allowed the scrub to become too dense and tall to support populations of scrub-jays, resulting in the decline of local populations of scrub-jays throughout the state (Fernald 1989; Fitzpatrick et al. 1994, unpubl. data; Percival et al. 1995; Stith et al. 1996; Thaxton and Hingtgen 1996; Woolfenden and Fitzpatrick 1990, 1996a; Toland 1999).

Optimal scrub-jay habitat occurs as patches with the following attributes: (1) 10 to 50 percent of the oak scrub made up of bare sand or sparse herbaceous vegetation; (2) greater than 50 percent of the shrub layer made up of scrub oaks; (3) a mosaic of oak scrubs that occur in optimal height 1.2 to 1.8 m (4 to 6 feet) and shorter; (4) less than 15 percent canopy cover; and (5) greater than 300 m (984 feet) from a forest (Breininger et al. 1998). Much potential scrub-jay habitat occurs as patches of oak scrub within a matrix of little-used habitat of saw palmetto and herbaceous

swale marshes (Breininger et al. 1991, 1995). These native matrix habitats supply prey for scrub-jays and habitat for other species of conservation concern. The flammability of native matrix habitats is important for spreading fires into oak scrub (Breininger et al. 1995, 2002). Degradation or replacement of native matrix habitats with habitat fragments and industrial areas attract predators of scrub-jays, such as fish crows, that are rare in most regularly burned native matrix habitats (Breininger and Schmalzer 1990; Woolfenden and Fitzpatrick 1991). Matrix habitats often develop into woodlands and forests when there is a disruption of fire regimes. These woodlands and forests are not suitable for scrub-jays, decrease the habitat suitability of nearby scrub, attract predators, and further disrupt fire patterns.

Scrub-jays have a social structure that involves cooperative breeding, a trait that the other North American species of scrub-jays do not show (Woolfenden and Fitzpatrick 1984, 1990). Scrub-jays live in families ranging from 2 birds (a single mated pair) to extended families of 8 adults (Woolfenden and Fitzpatrick 1984) and 1 to 4 juveniles. Fledgling scrub-jays stay with the breeding pair in their natal territory as “helpers,” forming a closely-knit, cooperative family group. Pre-breeding numbers are generally reduced to either a pair with no helpers or families of 3 or 4 individuals (a pair plus 1 or 2 helpers) (Woolfenden and Fitzpatrick 1996a).

Scrub-jays have a well-developed intra-familial dominance hierarchy with breeder males most dominant, followed by helper males, breeder females, and, finally, female helpers (Woolfenden and Fitzpatrick 1977, 1984). Helpers take part in sentinel duties (Woolfenden and Fitzpatrick 1984; McGowan and Woolfenden 1989), territorial defense (Woolfenden and Fitzpatrick 1984), predator-mobbing, and the feeding of both nestlings (Stallcup and Woolfenden 1978) and fledglings (Woolfenden and Fitzpatrick 1984; McGowan and Woolfenden 1990). The well-developed sentinel system involves having one individual occupying an exposed perch watching for predators or territory intruders. When a predator is seen, the sentinel scrub-jay gives a distinctive warning call (McGowan and Woolfenden 1989, 1990), and all family members seek cover in dense shrub vegetation (Fitzpatrick et al. 1991).

Scrub-jay pairs occupy year-round, multi-purpose territories (Woolfenden and Fitzpatrick 1978, 1984; Fitzpatrick et al. 1991). Territory size averages 8.9 to 10 hectares (ha) (22 to 25 acres) (Woolfenden and Fitzpatrick 1990; Fitzpatrick et al. 1991); with a minimum size of about 4.9 ha (12 acres) (Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). The availability of territories is a limiting factor for scrub-jay populations (Woolfenden and Fitzpatrick 1984). Because of this limitation, non-breeding adult males may stay at the natal territory as helpers for up to 6 years, waiting for either a mate or territory to become available (Woolfenden and Fitzpatrick 1984). Scrub-jays may become breeders in several ways: (1) by replacing a lost breeder on a non-natal territory (Woolfenden and Fitzpatrick 1984); (2) through “territorial budding,” where a helper male becomes a breeder in a segment of its natal territory (Woolfenden and Fitzpatrick 1978); (3) by inheriting a natal territory following the death of a breeder; (4) by establishing a new territory between existing territories (Woolfenden and Fitzpatrick 1984); or (5) through “adoption” of an unrelated helper by a neighboring family followed by resident mate replacement (Woolfenden and Fitzpatrick 1984). Territories also can be created by restoring habitat through effective habitat management efforts in areas that are overgrown (Thaxton and Hingtgen 1994).

To become a breeder, a scrub-jay must find a territory and a mate. Evidence presented by Woolfenden and Fitzpatrick (1984) suggests that scrub-jays are monogamous. The pair retains ownership and sole breeding privileges in its particular territory year after year. Courtship to form the pair is lengthy and ritualized and involves posturing and vocalizations made by the male to the female (Woolfenden and Fitzpatrick 1996b). Copulation between the pair is generally out of sight of other scrub-jays (Woolfenden and Fitzpatrick 1984). These authors also reported never observing copulation between unpaired scrub-jays or courtship behavior between a female and a scrub-jay other than her mate. Age at first breeding in the scrub-jay varies from 1 to 7 years, although most individuals become breeders between 2 and 4 years of age (Fitzpatrick and Woolfenden 1988). Persistent breeding populations of scrub-jays exist only where there are scrub oaks in sufficient quantity and form to provide an ample winter acorn supply, cover from predators, and nest sites during the spring (Woolfenden and Fitzpatrick 1996b).

Scrub-jay nests are typically constructed in shrubby oaks, at a height of 1 to 2 m (3.3 to 6.6 feet) (Woolfenden 1974). Sand live oak and scrub oak are the preferred shrub on the LWR (Woolfenden and Fitzpatrick 1996b), and myrtle oak is favored on the Atlantic Coastal Ridge (ACR) (Toland 1991) and southern Gulf coast (J. Thaxton, Uplands, Incorporated, pers. comm. 1998). In suburban areas, scrub-jays nest in the same evergreen oak species as well as in introduced or exotic trees; however, they build their nests in a significantly higher position in these oaks than when in natural scrub habitat (Bowman et al. 1996). Scrub-jay nests are an open cup, about 18 to 20 cm (7 to 8 inches), and inside diameter of 7.6 to 10 cm (3 to 4 inches). The outer basket is bulky and built of course twigs from oaks and other vegetation, and the inside is lined with tightly wound palmetto or cabbage palm fibers. There is no foreign material as may be present in a blue jay nest (Woolfenden and Fitzpatrick 1996b).

Nesting is synchronous, normally occurring from 1 March through 30 June (Woolfenden and Fitzpatrick 1984). On the ACR and southern Gulf coast, nesting may be protracted through the end of July (B. Toland, Service, pers. comm. 1996; J. Thaxton, Uplands, Incorporated, pers. comm. 1998). In suburban habitats, nesting is consistently started earlier (March) than in natural scrub habitat (Fleischer 1996), although the reason for this is unknown.

Clutch size ranges from 1 to 5 eggs, but is typically 3 or 4 eggs (Woolfenden and Fitzpatrick 1990). Clutch size is generally larger in suburban habitats, and the birds try to rear more broods per year (Fleischer 1996). Double brooding by as much as 20 percent has been documented on the ACR and in suburban habitat within the southern Gulf coast, compared to about 2 percent on the LWR (B. Toland, Service, pers. comm. 1996; J. Thaxton, Uplands, Inc., pers. comm. 1998). Scrub-jay eggs measure 2.8 cm by 2.0 cm (1.1 inches by 0.8 inches) (length by breadth) (Woolfenden and Fitzpatrick 1996b), and coloration “varies from pea green to pale glaucous green blotched and spotted with irregularly shaped markings of cinnamon rufous and vinaceous cinnamon, these being generally heaviest about the larger end” (Bendire *in* Bent 1946). Eggs are incubated for 17 to 19 days (Woolfenden 1974), and fledging occurs 15 to 21 days after hatching (Woolfenden 1978; Fitzpatrick et al. unpubl. data). Only the breeding female incubates and broods eggs and nestlings (Woolfenden and Fitzpatrick 1984). Average production of young is 2 fledglings per pair, per year (Woolfenden and Fitzpatrick 1990; Fitzpatrick et al. 1991), and the presence of helpers improves fledging success (Woolfenden and Fitzpatrick 1990; Mumme

1992). Annual productivity must average at least two young fledged per pair for a population of scrub-jays to support long-term stability (Fitzpatrick et al. 1991).

Fledglings depend upon adults for food for about 10 weeks, during which time they are fed by both breeders and helpers (Woolfenden 1975; McGowan and Woolfenden 1990). Survival of scrub-jay fledglings to yearling age class averages about 35 percent in optimal scrub, while annual survival of both adult males and females averages around 80 percent (Fitzpatrick et al. unpubl. data). Data from Archbold Biological Station, however, suggest that survival and reproductive success of scrub-jays in sub-optimal habitat is lower (Woolfenden and Fitzpatrick 1991). These data help explain why local populations inhabiting unburned, late successional habitats become extirpated. Similarly, data from Indian River County show that mean annual productivity declines significantly in suburban areas where Toland (1991) reported that productivity averaged 2.2 young fledged per pair in contiguous optimal scrub, 1.8 young fledged per pair in fragmented moderately-developed scrub, and 1.2 young per pair fledged in very fragmented suboptimal scrub. The longest observed lifespan of a scrub-jay is 15.5 years at Archbold Biological Station in Highlands County (Woolfenden and Fitzpatrick 1996b).

Scrub-jays are nonmigratory and permanently territorial. Juveniles stay in their natal territory for up to 6 years before dispersing to become breeders (Woolfenden and Fitzpatrick 1984, 1986). Once scrub-jays pair and become breeders, generally within 2 territories of their natal area, they stay on their breeding territory until death. In suitable habitat, fewer than 5 percent of scrub-jays disperse more than 8 kilometers (km) (5 miles) (Fitzpatrick et al. unpubl. data). All documented long-distance dispersals have been in unsuitable habitat such as woodland, pasture, or suburban plantations. Scrub-jay dispersal behavior is affected by the intervening land uses. Protected scrub habitats will most effectively sustain scrub-jay populations if they are located within surrounding habitat types that can be used and traversed by scrub-jays. Brushy pastures, scrubby corridors along railway and road rights-of-way, and open burned flatwoods offer links for colonization among scrub-jay populations. Stith et al. (1996) believe that a dispersal distance of 8 km (5 miles) miles is close to the biological maximum for scrub-jays.

Scrub-jays forage mostly on or near the ground, often along the edges of natural or man-made openings. They visually search for food by hopping or running along the ground beneath the scrub or by jumping from shrub to shrub. Insects, particularly orthopterans (e.g., locusts, crickets, grasshoppers, beetles) and lepidopteran (e.g., butterfly and moth) larvae, form most of the animal diet throughout most of the year (Woolfenden and Fitzpatrick 1984). Small vertebrates are eaten when encountered, including frogs and toads (*Hyla femoralis*, *H. squirella*, rarely *Bufo quercicus*), and unidentified tadpoles, lizards (*Anolis carolinensis*, *Chemidophorus sexlineatus*, *Sceloporus woodi*, *Eumeces inexpectatus*, *Neoseps reynoldsi*, *Ophisaurus compressus*, *O. ventralis*), small snakes (*Thamnophus sauritus*, *Opheodrys aestivus*, *Diadophis punctatus*), small rodents (*Sigmodon hispidus*, *Peromyscus polionotus*, *Rattus rattus* young), downy chicks of the bobwhite (*Colinus virginianus*), and fledgling common yellowthroat (*Geothlypis trichas*). In suburban areas, scrub-jays will accept supplemental foods once the scrub-jays have learned about them (Woolfenden and Fitzpatrick 1984).

Acorns are the principal plant food (Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). From August to November each year, scrub-jays may harvest and cache 6,500 to 8,000 oak (*Quercus* spp.) acorns throughout their territory. Acorns are typically buried beneath the surface of bare sand patches in the scrub during fall, and retrieved and consumed year-round, though most are consumed in fall and winter (DeGange et al. 1989). On the ACR, acorns are often cached in pine trees, either in forks of branches, in distal pine boughs, under bark, or on epiphytic plants, between 0.3 to 9.1 m (1 to 30 feet) in height (B. Toland, Service, pers. comm. 1996). Other small nuts, fruits, and seeds also are eaten (Woolfenden and Fitzpatrick 1984).

Many scrub-jays occur in habitat conditions where their long-term persistence is doubtful, although their persistence in these areas can occur for many years (Swain et al. 1995; Stith et al. 1996; Root 1998; Breininger et al. 2001). A primary cause for scrub-jay decline is poor demographic success associated with reductions in fire frequency (Woolfenden and Fitzpatrick 1984, 1991; Schaub et al. 1992; Stith et al. 1996; Breininger et al. 1999). The reduction in fire frequency is associated with increases in shrub height, decreases in open space, increases in tree densities, and the replacement of scrub and marshes by forests (Duncan and Breininger 1998; Schmalzer and Boyle 1998; Duncan et al. 1999). These habitat trajectories result in declines in habitat use and demographic success (Woolfenden and Fitzpatrick 1984, 1991). As a result, mean family size declines, and eventually the number of breeding pairs can decline by 50 percent every 5 to 10 years (Woolfenden and Fitzpatrick 1991; Breininger et al. 1999, 2001).

Status and Distribution

The Florida scrub-jay was federally listed as threatened in 1987 primarily because of habitat fragmentation, degradation, and loss (52 FR 20719).

Historically, oak scrub occurred as numerous isolated patches in peninsular Florida. These patches were concentrated along both the Atlantic and Gulf coasts and on the central ridges of the peninsula (Davis 1967). Probably until as recently as the 1950s, scrub-jay populations occurred in the scrub habitats of 39 of the 40 counties south of, and including Levy, Gilchrist, Alachua, Clay, and Duval Counties. Historically, most of these counties would have contained hundreds or even thousands of breeding pairs (Fitzpatrick et al. 1994). Only the southernmost county, Monroe, lacked scrub-jays (Woolfenden and Fitzpatrick 1996a). Although scrub-jay numbers probably began to decline when European settlement began in Florida (Cox 1987), the decline was first noted in the literature by Byrd (1928). After 40 years of personal observation of the Etonia scrub (now known as Ocala National Forest), Webber (1935) observed many changes to the previously-undisturbed scrub habitat found there, noting that "The advent of man has created a new environmental complex."

A state-wide scrub-jay census was last conducted in 1992-1993, at which time there were an estimated 4,000 pairs of scrub-jays left in Florida (Fitzpatrick et al. 1994). At that time, the scrub-jay was considered extirpated in 10 counties (Alachua, Broward, Clay, Duval, Gilchrist, Hernando, Hendry, Pinellas, and St. Johns), and were considered functionally extinct in an additional 5 counties (Flagler, Hardee, Levy, Orange, and Putnam), where 10 or fewer pair remained. Recent information indicates that there are at least 12 to 14 breeding pairs of scrub-jays located within Levy County, higher than previously thought (K. Miller, FWC, pers.

comm. 2004), and there is at least one breeding pair of scrub-jays remaining in Clay County (K. Miller, FWC, pers. comm. 2004). A scrub-jay has been documented in St. Johns County as recently as 2003 (J.B. Miller, FDEP, pers. comm. 2003). Populations are close to becoming extirpated in Gulf coast counties (from Levy south to Collier) (Woolfenden and Fitzpatrick 1996a). In 1992-1993, population numbers in 21 of the counties were below 30 or fewer breeding pairs (Fitzpatrick et al. 1994). Based on the amount of destroyed scrub habitat, scrub-jay population loss along the LWR is 80 percent or more since pre-European settlement (Fitzpatrick et al. 1991). Since the early 1980s, Fitzpatrick et al. (1994) estimated that in the northern third of the species' range, the scrub-jay has declined somewhere between 25 and 50 percent. The species may have declined by as much as 25 to 50 percent in the last decade alone (Stith et al. 1996).

On protected lands, scrub-jays have continued to decline due to inadequate habitat management (Stith 1999). However, over the last several years, steps to reverse this decline have occurred, and management of scrub habitat is continuing in many areas of Florida (Hastie and Eckl 1999; Stith 1999; TNC 2001; A. Birch, Brevard County Endangered Lands Program, pers. comm.; M. Camardese, U.S. Air Force, pers. comm.).

Stith (1999) utilized a spatially explicit individual-based population model developed specifically for the scrub-jay to complete a metapopulation viability analysis of the species. The species' range was divided into 21 metapopulations demographically isolated from each other. Metapopulations are defined as collections of relatively discrete demographic populations distributed over the landscape; these populations are connected within the metapopulations through dispersal or migration (National Research Council 1995). A series of simulations were run for each of the 21 metapopulations based on different scenarios of reserve design ranging from the minimal configuration consisting of only currently protected patches of scrub (no acquisition option) to the maximum configuration, where all remaining significant scrub patches were acquired for protection (complete acquisition option) (Stith 1999). The assumption was made that all areas that were protected were also restored and properly managed.

Results from Stith's (1999) simulation model included estimates of extinction, quasi-extinction (the probability of a scrub-jay metapopulation falling below 10 pairs), and percent population decline. These were then used to rank the different state-wide metapopulations by vulnerability. The model predicted that five metapopulations (Northeast Lake, Martin, Merritt Island, Ocala National Forest, and LWR) have low risk of quasi-extinction. Two of the five (Martin and Northeast Lake), however, experienced significant population declines under the "no acquisition" option; the probability for survival of both of these metapopulations could be improved with more acquisitions.

Eleven of the remaining 21 metapopulations were shown to be highly vulnerable to quasi-extinction if no more habitat were acquired (Central Brevard, North Brevard, Central Charlotte, Northwest Charlotte, Citrus, Lee, Levy, Manatee, Pasco, St. Lucie, and West Volusia). The model predicted that the risk of quasi-extinction would be greatly reduced for 7 of the 11 metapopulations (Central Brevard, North Brevard, Central Charlotte, Northwest Charlotte, Levy, St. Lucie, and West Volusia) by acquiring all or most of the remaining scrub habitat. The model

predicted that the remaining 4 metapopulations (Citrus, Lee, Manatee, and Pasco) would moderately benefit if more acquisitions were made.

Stith (1999) classified two metapopulations (South Brevard and Sarasota) as moderately vulnerable with a moderate potential for improvement; they both had one or more fairly stable subpopulations of scrub-jays under protection, but the model predicted population declines. The rest of the metapopulations could collapse without further acquisitions, making the protected subpopulations there vulnerable to epidemics or other catastrophes.

Three of the metapopulations evaluated by Stith (1999) (Flagler, Central Lake, and South Palm Beach) were classified as highly vulnerable to quasi-extinction and had low potential for improvement, since little or no habitat is available to acquire or restore.

Current Threats

Research and monitoring of scrub-jays has revealed more information about threats to this species since the time the first scrub-jay recovery plan was approved in 1990. The following discussion is intended to give an up-to-date analysis:

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range:

Scrub habitats have continued to decline throughout peninsular Florida since listing occurred, and habitat destruction continues to be one of the main threats to the scrub-jay. Cox (1987) noted local extirpations and major decreases in numbers of scrub-jays and attributed them to the clearing of scrub for housing and citrus groves. Eighty percent or more of the scrub habitats have been destroyed along the Lake Wales Ridge since pre-European settlement (Fitzpatrick et al. 1991). Fernald (1989), Fitzpatrick et al. (1991), and Woolfenden and Fitzpatrick (1996a) noted that habitat losses due to agriculture, silviculture, and commercial and residential development have continued to play a role in the decline in numbers of scrub-jays throughout the state. State-wide, estimates of scrub habitat loss range from 70 to 90 percent (Woolfenden and Fitzpatrick 1996a; Fitzpatrick et al. unpubl. data). Various populations of scrub-jays within the species' range have been monitored closely, and more precise estimates of habitat loss in these locations are available.

Toland (1999) estimated that about 70 to 78 percent of pre-European settlement scrub habitats had been converted to other uses in Brevard County. This is due mainly to development activity and citrus conversion, which were the most important factors that contributed to the scrub-jay decline between 1940 and 1990. A total of only 4,312 ha (10,656 acres) of scrub and scrubby flatwoods remain in Brevard County (excluding federal ownership), of which only 648 ha (1,600 acres) (15 percent) is in public ownership for the purposes of conservation. Less than 800 ha (1,977 acres) of an estimated pre-settlement of 6,000 ha (14,826 acres) of scrubby flatwoods habitat remain in Sarasota County, mostly occurring in patches averaging less than 1 ha (2.5 ac) in size (Thaxton and Hingtgen 1996). Only 4,319 ha (10,673 acres) of viable coastal scrub and scrubby flatwoods remained in the Treasure Coast region of Florida (Indian River, Saint Lucie, Martin, and Palm Beach counties) according to Fernald (1989). He estimated that 95 percent of scrub had already been destroyed for development purposes in Palm Beach County.

Habitat destruction not only reduces the amount of area scrub-jays can occupy, but also increases fragmentation of habitat. As more scrub habitat is altered, the habitat is cut into smaller and smaller pieces, separated from other patches by larger distances; such fragmentation increases the probability of inbreeding and genetic isolation, which is likely to increase extinction probability (Fitzpatrick et al. 1991; Woolfenden and Fitzpatrick 1991; Stith et al. 1996; Thaxton and Hingtgen 1996). Dispersal distances of scrub-jays in fragmented habitat are further than in optimal unfragmented habitats, and demographic success is poor (Thaxton and Hingtgen 1996; Breininger 1999).

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes: The USFWS knows of only a few cases where scrub-jays have been shot. One was in Volusia County, which was investigated and prosecuted under MBTA (J. Oliveros, Service, pers. comm.). The Florida Fish and Wildlife Conservation Commission (FWC) investigated a case, in which three scrub-jays were shot in Highlands County (N. Douglass, FWC, pers. comm.). It does not seem that the small number and infrequent occurrence of scrub-jays taken in this manner has had an impact on the species.

Disease or Predation: Most scrub-jay mortality probably is from predation (Woolfenden and Fitzpatrick 1996b). The second most frequent cause may be disease, or predation on disease-weakened scrub-jays (Woolfenden and Fitzpatrick 1996b). Known predators of scrub-jays are listed by Woolfenden and Fitzpatrick (1990), Fitzpatrick et al. (1991), Schaub et al. (1992), Woolfenden and Fitzpatrick (1996a, b), Breininger (1999), and K. Miller (FWC, pers. comm. 2004); the list includes eastern coachwhip (*Masticophis flagellum*, known to eat adults, nestlings, and fledglings), eastern indigo snake (*Drymarchon corais couperi*, known to eat adults and fledglings), black racer (*Coluber constrictor*, known to eat eggs), pine snake (*Pituophis melanoleucus*), and corn snake (*E. guttata*). Mammalian predators include bobcats (*Lynx rufus*), raccoons (*Procyon lotor*), sometimes cotton rats (*Sigmodon hispidus*, known to eat eggs), black rat (*Rattus rattus*), and domestic cats (*Felis catus*, known to eat adults). Franzreb and Puschock (2004) also have documented spotted skunks (*Spilogale putorius*) and grey fox (*Urocyon cinereoargenteus*) as mammalian predators of scrub-jay nests. Fitzpatrick et al. (1991) suspect that populations of domestic cats are able to eliminate small populations of scrub-jays. Avian nest predators include the great horned owl (*Bubo virginianus*), eastern screech-owl (*Otus asio*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), fish crow (*Corvus ossifragus*), boat-tailed grackle (*Quiscalus major*), common grackle (*Q. quiscula*), American crow (*C. brachyrhynchos*), blue jay (*Cyanocitta cristata*), and swallow-tailed kites (*Elanoides forficatus*). Fitzpatrick et al. (1991) reported that overgrown scrub habitats are often occupied by the blue jay, which may be one factor limiting scrub-jay populations in such areas. Raptors which seem to be important predators of adult scrub-jays are merlin (*Falco columbarius*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*A. cooperii*), and northern harrier. During migration and winter, these four raptor species are present in areas which contain scrub habitat, and scrub-jays may experience frequent confrontations (as many as one pursuit a day) with them (Woolfenden and Fitzpatrick 1990). In coastal scrub, Woolfenden and Fitzpatrick (1996b) report that scrub-jays are vulnerable to predation by raptors in October, March, and April, when high densities of migrating accipiters and falcons are present. Woolfenden and Fitzpatrick (1996b) and Toland (1999) suggest that in overgrown scrub habitats, hunting efficiency for scrub-jay

predators is increased. Bowman and Averill (1993) noted that scrub-jays occupying fragments of scrub found in or near housing developments were more prone to predation by house cats and competition from blue jays and mockingbirds. Woolfenden and Fitzpatrick (1996a, 1996b) stated that proximity to housing developments (and increased exposure to domestic cats) needs to be taken into consideration when designing scrub preserves. Young scrub-jays are especially vulnerable to ground predators (e.g., snakes and mammals) before they are fully capable of sustained flight.

The scrub-jay hosts two protozoan blood parasites (*Plasmodium cathemerium* and *Haemoproteus danilewskyi*), but incidence is low (M. Garvin pers. comm, cited in Woolfenden and Fitzpatrick 1996b). Several scrub-jays sick from these two agents in March 1992 survived to become breeders. The scrub-jay carries at least three types of mosquito-borne encephalitis (St. Louis, eastern equine, and “Highlands jay”; M. Garvin and J. Day pers. comm., cited in Woolfenden and Fitzpatrick 1996b). Of particular concern is the arrival of West Nile virus (the agent of another type of encephalitis) in Florida during 2001 (G. Wallace, FWC, pers. comm. 2001; Stark and Kazanis 2001); since corvids have been particularly susceptible to the disease in states north of Florida, it is expected that scrub-jays will be affected (Breininger et al. 2003).

Woolfenden and Fitzpatrick (1996b) noted three episodes of elevated mortality (especially among juveniles) in 26 years at Archbold Biological Station. Each of these incidents occurred in conjunction with elevated water levels following unusually heavy rains in the fall, although high mortality does not occur in all such years. During the most severe of these presumed epidemics (August 1979 through March 1980), all but one of the juvenile cohort and almost half of the breeding adults died (Woolfenden and Fitzpatrick 1984, 1990). The 1979-1980 incident coincided with a known outbreak of eastern equine encephalitis among domestic birds in central Florida (J. Day pers. comm., cited in Woolfenden and Fitzpatrick 1996b). From the fall of 1997 through the spring of 1998, the continuing population decline of scrub-jays along the Atlantic coast and in central Florida may have been augmented by an epidemic of unknown origin (Breininger 1999).

At Cape Canaveral Air Force Station, Stevens and Hardesty (1999) noted a decline in juvenile survival from 60 to 70 percent in the preceding years to only 22 percent in 1997-98. It stayed low (only 25 percent) in 1998-99 before again climbing into the mid-60 percent range. Also, adult survival dropped from 70 to 80 percent survival in the preceding years to 50 to 60 percent in 1997-98. Overall, their annual surveys documented the largest one-year drop (pairs decreased by 17 percent and birds by 20 percent) in this population at the same time as the presumed state-wide epidemic.

In winter-summer of 1973, 15 species of intestinal parasitic fauna (including 8 nematodes, 5 trematodes, 1 cestode, and 1 acanthocephalan) were found in 45 scrub-jays collected in south-central Florida; the parasite load was attributed to a varied arthropod diet (Kinsella 1974). These naturally-occurring parasites are not believed to have a negative impact on scrub-jay population levels.

Larvae of a fly, *Philornis* (= *Neomusca*) *porteri*, occur irregularly on scrub-jay nestlings. The species pupates in the base of the nest; larvae locate in nares (nasal openings), mouth flanges,

bases of remiges, and toes; apparently no serious effect on the scrub-jay host occurs (Woolfenden and Fitzpatrick 1996b). Additionally, one undescribed chewing louse (*Myrsidea* sp., R. Price pers. comm, cited in Woolfenden and Fitzpatrick 1996b), one wing-feather mite (*Pterodectes* sp.), two chiggers (*Eutrombicula lipovskiyana*), and a flea (*Echidnophaga gallinacea*; J. Kinsella pers. comm., cited in Woolfenden and Fitzpatrick 1996b) occur on some individuals, usually at low densities. Nymphs and larvae of four ticks (*Amblyomma americanum*, *A. tuberculatum*, *Haemaphysalis leporispalustris*, and *Ixodes scapularis*) are known to occur on scrub-jays, as well as the larvae of the tick *Amblyomma maculatum* (L. Durden and J. Keirans pers. comm., cited in Woolfenden and Fitzpatrick 1996b). These naturally-occurring parasites are not believed to have a negative impact on scrub-jay population levels.

Other Natural or Manmade Factors Affecting its Continued Existence: Human interference with natural fire regimes has continued to play a major part in the decline of the scrub-jay and today may exceed habitat loss as the single most important limiting factor (Woolfenden and Fitzpatrick 1991, 1996a; Fitzpatrick et al. 1994). Lightning strikes cause virtually all naturally-occurring fires in south Florida scrub habitat (Abrahamson 1984; Hofstetter 1984; Woolfenden and Fitzpatrick 1990). Fire has been noted to be important in maintenance of scrub habitat for decades (Nash 1895; Harper 1927; Webber 1935; Davis 1943; Laessle 1968; Abrahamson et al. 1984). Human efforts to prevent and/or control natural fires have allowed the scrub to become too dense and tall to support populations of scrub-jays, resulting in the decline of local populations of scrub-jays throughout the state (Fernald 1989; Fitzpatrick et al. 1994, unpubl. data; Percival et al. 1995; Stith et al. 1996; Thaxton and Hingtgen 1996; Woolfenden and Fitzpatrick 1990, 1996a; Toland 1999). Woolfenden and Fitzpatrick (1996a) cautioned, however, that fire applied too often to scrub habitat also can result in local extirpations. Experimental data at Archbold Biological Station (Fitzpatrick and Woolfenden, unpubl. data) show that fire-return intervals varying between 5 and 15 years are optimal for long-term maintenance of productive scrub-jay populations in central Florida. These intervals also correspond with those yielding healthy populations of listed scrub plants (Menges and Kohfeldt 1995; Menges and Hawkes 1998). Optimal fire-return intervals may, however, be shorter in coastal habitats (Schmalzer and Hinkle 1992a, b).

Stith et al. (1996) estimated that at least 2,100 breeding pairs of scrub-jays were living in overgrown habitat state-wide. Toland (1999) reported that most of Brevard County's remaining scrub (estimated to be only 15 percent of the original acreage) is overgrown due to fire suppression. He further suggests that the overgrowth of scrub habitats reduces the number and size of sand openings which are crucial not only to scrub-jays, but also many other scrub plants and animals. Reduction in the number of potential scrub-jay nesting sites, acorn cache sites, and foraging sites presents a problem for scrub-jays. Fernald (1989) reported that overgrowth of scrub results not only in the decline of species diversity and abundance but also a reduction in the percentage of open sandy patches (Fernald 1989; Woolfenden and Fitzpatrick 1996b). Fitzpatrick et al. (1994) believed that fire suppression was just as responsible as habitat loss in the decline of the scrub-jay, especially in the northern third of its range. Likewise, the continued population decline of scrub-jays within Brevard County between 1991 and 1999 has been attributed mainly to the overgrowth of remaining habitat patches (Breininger et al. 2001). Breininger et al. (1999) concluded that optimal habitat management is essential in fragmented

ecosystems maintained by periodic fire, especially to lessen risks of decline and extinction resulting from epidemics and hurricanes.

Fitzpatrick et al. (1991, 1994) and Woolfenden and Fitzpatrick (1996a) expressed concern for the management practices taking place on federal lands at Ocala National Forest, Merritt Island National Wildlife Refuge/Kennedy Space Center, and Cape Canaveral Air Force Station, all supporting large contiguous populations of scrub-jays. They predicted that fire suppression and/or too frequent fires (on the latter two) and silvicultural activities involving the cultivation of sand pine on Ocala National Forest would be responsible for declines of scrub-jays in these large contiguous areas of scrub. These areas should be those where populations are most secure because of federal agencies' responsibilities under section 7(a)(1) of the ESA. Monitoring of scrub-jay populations, demography, and nesting success is ongoing on all of these properties to assess the effectiveness of management practices in meeting scrub-jay recovery objectives.

Housing and commercial developments within scrub habitats are accompanied by the development of roads. Since scrub-jays often forage along roadsides and other openings in the scrub, they are often killed by passing cars. Research by Mumme et al. (2000) along a two-lane paved road indicated that clusters of scrub-jay territories found next to the roadside represented population sinks (breeder mortality exceeds production of breeding-aged recruits), which could be supported only by immigration. Since this species may be attracted to roadsides because of their open habitat characteristics, road mortality presents a significant and growing management problem throughout the remaining range of the scrub-jay (Dreschel et al. 1990; Mumme et al. 2000), and proximity to high-speed paved roads needs to be considered when designing scrub preserves (Woolfenden and Fitzpatrick 1996a).

Another potential problem in suburban areas supporting scrub-jays is supplemental feeding by humans (Bowman and Averill 1993; R. Bowman unpubl. data, cited in Woolfenden and Fitzpatrick 1996a; Bowman 1998). The presence of additional food may allow scrub-jays to persist in fragmented habitats, but recruitment in these populations is lower than in native habitats. However, even though human-feeding may postpone local extirpations, long-term survival cannot be ensured in the absence of protecting native oak scrub habitat necessary for nesting.

Scrub-jays in suburban settings often nest high in tall shrubbery. During March winds, these nests tend to be susceptible to destruction (R. Bowman and G.E. Woolfenden unpubl data, cited in Woolfenden and Fitzpatrick 1996b; Bowman 1998).

Hurricanes pose a potential risk for scrub-jays, although the exact impact of such catastrophic events is unknown. Breininger et al. (1999) modeled the effects of epidemics and hurricanes on scrub-jay populations in varying levels of habitat quality. Small populations of scrub-jays are more vulnerable to extirpation where epidemics and hurricanes are common. Storm surge from a category 3 to 5 hurricane could inundate entire small populations of scrub-jays, and existing habitat fragmentation could prevent repopulation of affected areas. However, this model also predicted that long-term habitat degradation had greater influence on extinction risk than hurricanes or epidemics.

Fernald (1989) reported that many of the relatively few remaining patches of scrub within the Treasure Coast region of Florida had been degraded by trails created by off-road vehicles, illegal dumping of construction debris, abandoned cars and appliances, or household waste. The invasion of these areas by exotic species, including Brazilian pepper (*Schinus terebinthifolius*), cypress pine (*Callitris* sp.), and Australian pine (*Casuarina equisetifolia*) also was a problem. Other human-induced impacts identified by Fernald (1989) include the introduction of domestic dogs (*Canis familiaris*) and cats, black rats (*Rattus rattus*), greenhouse frogs (*Eleutherodactylus planirostris*), giant toads (*Bufo marinus*), Cuban tree frogs (*Osteopilus septentrionalis*), brown anoles (*Anolis sagrei*), and other exotic animal species. These exotic species may compete with scrub-jays for both space and food, although scrub-jays sometimes feed on them.

ENVIRONMENTAL BASELINE

The environmental baseline includes the effects of past and ongoing human and natural factors leading to current status of the species and their habitats.

Status of the Species/Critical Habitat Within the Action Area

Within the action area, there are an estimated 565 pairs of scrub-jays, which is approximately 19 percent of the entire scrub-jay population, within the action area (Stith 1999; Breininger et al. 2003). The Service estimates there are approximately 5,717 ha (14,125 acres) of appropriate scrub-jay habitat within the action area. No critical habitat has been designated for the Florida scrub-jay.

The decline in the number and distribution of scrub-jays in Florida has been exacerbated by tremendous urban growth in the past 50 years. Much of the historic commercial and residential development has occurred on the dry soils which previously supported scrub-jay habitat. Based on existing soils data, much of the historic and current scrub-jay habitat of coastal Florida occurs close to the current shoreline and larger river basins. Much of this area of Florida was settled early, because few wetlands restricted urban and agricultural development. Due to the effects of urban and agricultural development over the past 100 years, much of the remaining scrub-jay habitat occurs in relatively small and isolated patches. What remains is largely degraded, due to the interruption of the natural fire regime, needed to maintain xeric uplands in a condition suitable for scrub-jays.

Scrub-jays have declined in abundance and distribution due to habitat loss and fragmentation as a result of increasing urban and agricultural development. Furthermore, degradation of habitat due to exclusion of fire negatively affects the demography of scrub-jays. These influences are expected to increase the likelihood of localized extirpations in many areas throughout Florida, including the action area

Factors Affecting Species Habitat Within the Action Area

Habitat loss and fire suppression (and the subsequent change in habitat structure and composition) are the leading causes of decline among populations of scrub-jays in the action area. Changes within scrub-jay habitat unique to urban environments, such as access to human

provided foods, changes in predator communities, and roads are believed to have increased the rate of decline in populations of scrub-jays that occur within the suburban parts of the action area. It appears likely that in some parts of the action area where small scrub-jay populations have been isolated, the potential for inbreeding and a lack of immigration also may be contributing to population declines.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities. All activities authorized by the Service under section 10(a)(1)(A) of the ESA must meet permit issuance criteria at 50 CFR 17.22 and 17.32. All activities considered must be justified in relation to enhancement of survival and recovery, effects to the wildlife species, peer review, and qualifications of permittees. By definition, authorized activities should benefit species recovery with minimal adverse effects by qualified permittees.

It is expected that no more than 25 female Florida scrub-jays in Archbold Biological Station in Highlands County will be affected by the proposed research. Potential adverse effects include harassment, injury, and death of scrub-jays during testing and monitoring in wild and urban settings. During the testing and monitoring of scrub-jays, individuals may be temporarily and permanently harmed through physical injury, behavioral modification, physiological stress, increased predation risk, and death.

The applicant, Stephan Schoech has extensive experience in trapping, measuring, banding, laparotomies, blood-collecting, and monitoring scrub-jays for more than 18 years. Schoech has logged more than 10,000 hours in scrub-jay research activities and has also worked extensively with similar jay species. Co-investigators Eli S. Bridge, Travis E. Wilcoxon, Michelle Rensel and Gina M. Morgan each have 1 year of full-time experience working with scrub-jays.

Schoech has not had any known deaths or injuries of scrub-jays while conducting his long-term studies. Handling time will be kept to a minimum, and all birds will be immediately released back into the wild. Duration of temporary effects to all birds will be minimal. Therefore, few adverse impacts are anticipated to occur.

The expected benefit of the proposed research is the collection and analysis of data on current population trends and genetic diversity of Florida scrub-jay that will ultimately aid in the recovery of the species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

State, local, and private actions not associated with the proposed action, such as development and agriculture, are likely to continue throughout the area covered by the proposed permit. This action is likely to result in varying degrees of adverse effects to Florida scrub-jays. Therefore, cumulative effects may occur. Considering the scientific and conservation goals of the applicant, these activities in the project area in the foreseeable future are not expected to be extensive enough to jeopardize their continued existence of the Florida scrub-jay.

SUMMARY OF EFFECTS

Although short-term, minimal adverse effects may occur, this research on the Florida scrub-jay will lead to an increased understanding of the natural history of this threatened species. The ability to recognize individual birds is necessary for the study of demographic topics including survivorship, fecundity, dispersal of adult and juvenile birds, territory size, reproductive rate, reproductive strategy, specific habitat requirements, and homerange. Results from the proposed study could also lead to modification of current land management strategies for the maximum benefit of the species. The net effect of the research is beneficial.

CONCLUSION

After reviewing the status of the scrub-jay, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the issuance of a recovery permit, as proposed, is not likely to jeopardize the continued existence of the Florida scrub-jay. No critical habitat has been designated for this species, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Service so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in action 7(o)(2) to apply. The Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Service (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms

and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the researchers must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement.

AMOUNT OR EXTENT OF TAKE

The Service anticipates that the proposed action will result in unintentional injury and mortality to the Florida scrub-jay during capture, banding and monitoring. Trapping and handling associated with research and monitoring may result in the injury or death of up to one Florida scrub-jay per year. Incidental take is expected to be in the form of harm or harass.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to any of the scrub-jay.

REASONABLE AND PRUDENT MEASURES

The Service is not aware of any further actions that can be taken to minimize incidental take. However, to monitor the effect and extent of take, the applicant must provide a written report on the results of the research activities.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Service must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. The reporting and monitoring requirements outlined in the section 10(a)(1)(A) permit will also satisfy the reporting/monitoring requirements required pursuant to section 7 of the ESA and its implementing regulations.
2. Upon locating a dead, injured, or sick specimen, initial notification must be made to the nearest Service Law Enforcement Office (9549 Koger Boulevard, Suite 111, St. Petersburg, Florida 33702; 727-570-5398). Secondary notification should be made to the Florida Fish and Wildlife Conservation Commission; South Region, 3900 Drane Field Road, Lakeland, Florida 33811-1299; 1-800-282-8002. Care should be taken in handling sick or injured specimens to ensure effective treatment and care or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured specimens or preservation of biological

materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed. Permitted activities that appear to be resulting in excessive injury or death will be immediately suspended until more protective measures or an alternative resolution can be initiated.

3. While trapping scrub-jays, only unsalted peanuts will be used and in modest amounts.
4. Traps and mist nets must be continually attended and no captures should be left in the traps.
5. No more than two 12-m (39.4-foot) mist nets per qualified person should be operational at any one time.
6. Minimize disturbance to vegetation, especially near nests, when setting up nets and traps.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to further minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service should continue to implement the MSRP (Service 1999).

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects, or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the proposed action. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions, please contact Mark Salvato at 772-562-3909, extension 340.

cc:

Service, Jacksonville, Florida (Dawn Zattau-Species Lead-Florida scrub-jay)

Service, Atlanta, Georgia (Joe Johnson, Victoria Davis)

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