United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
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June 11, 2001

William R. Straw
Regional Environmental Officer
Federal Emergency Management Agency
3003 Chamblee Tucker Road
Atlanta, Georgia 30341-4130

Log No.: 4-1-00-F-736
Dated: December 18, 2000
Applicant: Federal Emergency Management Agency
County: Monroe

Dear Mr. Straw:

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion based on our review of the Federal Emergency Management Agency's (FEMA) proposal to construct the Key Largo Wastewater Treatment Plant (WTP) and its effects on the endangered Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), the threatened Stock Island tree snail (*Orthalicus reses*), and the threatened eastern indigo snake (*Drymarchon corais couperi*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1631 *et seq.*). Your request for consultation was received on December 18, 2000.

This Biological Opinion is based on information provided in the October 30, 2000, draft Endangered Species Biological Assessment (FEMA 2000), telephone conversations with FEMA and Monroe County representatives, species experts, members of the public, field investigations, and other sources of information. A complete administrative record of this consultation is on file at the Florida Keys Ecological Services Field Office on Big Pine Key, Monroe County, Florida.

Consultation history

The Biological Opinion presented here is the result of informal coordination and consultation between the Service and FEMA. This consultation history represents coordination letters and documents from this process.

On April 7, 2000, the Service sent a letter to Monroe County informing the County of the presence of several federally-listed threatened and endangered species on Key Largo, and expressing an interest in assisting the County in the selection of wastewater treatment plant facility locations.

On June 23, 2000, the Service sent a letter to FEMA identifying the possible use of Federal funds for the proposed Key Largo WTP. The Service requested that FEMA evaluate the proposed construction for impacts to threatened and endangered species and initiate consultation in accordance with section 7 of the ESA.

On July 7, 2000, FEMA sent a letter to the Service acknowledging that Federal funds through FEMA's Hazard Mitigation Grant Program were being used for the proposed Key Largo WTP, and requested initiation of formal consultation to determine if construction of the proposed project would result in adverse effects to threatened and endangered species. A preliminary environmental assessment prepared by Monroe County describing the location and environmental conditions of the proposed site was included for the Service's review.

On July 14, 2000, the Florida Fish and Wildlife Conservation Commission sent a letter to FEMA expressing a concern that the site selected for the Key Largo WTP at Mile Marker 100.5 on Key Largo was important habitat for both State and federally-listed threatened and endangered species and recommended against FEMA funding for the project at this location.

On July 28, 2000, the Service sent a letter to Carlton Fields, Attorneys at Law, informing them that the Service was consulting with FEMA on the Key Largo WTP; a Biological Opinion would be prepared, if necessary; and preparation of a Habitat Conservation Plan is not required by section 7 of the ESA.

On October 30, 2000, FEMA sent a draft Biological Assessment (BA) to the Service for the Key Largo WTP.

On December 14, 2000, the Service sent an email correspondence to FEMA requesting that FEMA initiate formal consultation for the Key Largo WTP since the BA for the project identified the potential for take of the Schaus swallowtail butterfly, the Stock Island tree snail, and the eastern indigo snake.

On December 18, 2000, FEMA sent a letter to the Service requesting initiation of formal consultation for the Key Largo WTP.

On December 20, 2000, the Service sent a letter to FEMA acknowledging receipt of FEMA's request for formal consultation for the Key Largo WTP. In that letter, the Service concluded that all necessary information for the consultation had been received and established a date of May 4, 2001, for the completion of the Biological Opinion.

BIOLOGICAL OPINION

Description of the proposed action

FEMA is proposing to construct the Key Largo WTP on a 23-acre tropical hardwood hammock parcel located at Mile Marker 100.5, Key Largo, Monroe County, Florida (Figure 1). Anticipated impacts of the project include destruction of 2.6 acres of tropical hardwood

hammock that provide habitat for the Schaus swallowtail butterfly, the Stock Island tree snail, and the eastern indigo snake. Conservation measures proposed for this project include the establishment of a conservation easement over the unused 20 acres of tropical hardwood hammock remaining on the project site, 0.4 acre of on-site hardwood hammock restoration, and specific construction procedures aimed at impact avoidance.

For the purpose of this consultation, the action area will be defined as the 23-acre parcel of land proposed for the Key Largo WTP.

Key Largo is a long, narrow island situated in a northeast to southwest direction and is composed of Key Largo limestone, a porous limestone formed by ancient reef formations. The 23-acre action area consists mainly of tropical hardwood hammock, with minimal disturbed areas consisting of old clearings and debris located near the edges of the property. The property is located immediately south of U.S. 1 and Mile Marker 100.5, and lies adjacent to existing protected hardwood hammocks to the east and south and commercial development to the west.

The action area has been targeted for acquisition by the State of Florida's Conservation and Recreational Lands (CARL) program under the Florida Keys Ecosystem proposal and is part of the larger 191-acre Newport Hammocks project. Prior to purchase by Monroe County for the Key Largo WTP, the action area had been surveyed for purchase through CARL and acquisition was underway.

Tropical hardwood hammocks are closed canopy forests, dominated by a diverse assemblage of evergreen and semi-deciduous tree and shrub species, mostly of West Indian origin. Vegetation on the action area is typical of more mature hammocks on the Keys, with a varied overstory including poisonwood (*Metopium toxiferum*), West Indian mahagony (*Swietenia mahagoni*), wild tamarind (*Lysiloma latilisiliquum*), gumbo limbo (*Bursera simaruba*), pigeon plum (*Coccoloba diversifolia*), and ironwood (*Krugiodendron ferreum*). Understory plants are diverse and varied, but include both wild lime (*Zanthoxylum fagara*) and torchwood (*Amyris elemifera*), species specifically utilized by Schaus swallowtail butterflies for egg deposition and larval host plants.

Tropical hardwood hammocks are found nearly throughout the southern half of south Florida, with large concentrations in Miami-Dade County on the Miami Rock Ridge, in Miami-Dade and Monroe counties in the Florida Keys and along the northern shores of Florida Bay, and in the Pinecrest region of the Big Cypress Swamp. Tropical hardwood hammocks are critical habitat for many West Indian plant species and provide important habitat for many species of wildlife, including nine federally-listed species. While the majority of the remaining tropical hardwood hammocks outside the Florida Keys are in public ownership, hammocks are still significantly threatened by development in the Florida Keys, with Key Largo containing the largest stands of intact hammock remaining on the Keys. Tropical hardwood hammocks have been heavily impacted by conversion to agriculture, exotic plant and animal species, collecting pressure on plants and animals, anthropogenic fires, and alterations in hydrology.

Status of species/critical habitat

The Service has determined that the proposed action may adversely affect the Schaus swallowtail butterfly, the Stock Island tree snail, and the eastern indigo snake. Critical habitat has not been designated for any of these species.

Schaus swallowtail butterfly

A. Species description

The Schaus swallowtail is a large blackish-brown butterfly with contrasting markings that are mostly dull yellow (Service 1999). Their antennae are black with a yellow knob that has a black tip. Their forewings have a dull yellow median band from the apex to about midpoint of the inner margin, with a short side branch to costa about 1/3 distance from the apex. Their subterminal and terminal lines consist of lunular yellow spots from apex to anal angle. Their hindwings have a yellow median band continuing that of the forewing, and a submarginal row of large yellow lunular spots; the concavities of a deeply scalloped outer margin have yellow edging. Their blackish tail is straight-edged (not teardrop-shaped), and is bordered with yellow. The tails have a hollow red spot along the anal margin just above the anal angle, with bluish scaling.

The underside of a Schaus swallowtail wing is yellow with black shading mostly in the median and submarginal areas of the forewing, and in the terminal area and tails of the hindwing. A dull brownish red median band extends from costa to inner margin of the hindwing, narrowing before touching these margins. There is extensive bluish scaling along the outer edge of the reddish band of the wing. The wingspan is 2.9 to 4 inches (8.6 to 9.5 cm) (Covell 1985).

The Schaus swallowtail butterfly is most easily confused with the giant swallowtail butterfly (*Heraclides cresphontes*) Cramer, which is widespread in eastern North America and also occurs in habitat occupied by the Schaus swallowtail. The two butterflies are easily separated by size and color: the giant swallowtail is larger than the Schaus swallowtail and is more nearly coal-black with brighter yellow lines. The giant swallowtail has a broader median forewing band that is more broken into spots, and is less separated from the submarginal band toward the apex. The giant swallowtail antennae are solid black and its tail is teardrop-shaped, yellow inside bordered with black edging. The reddish markings on the underside of its wings are less brownish and much less extensive than on the Schaus swallowtail (Service 1999).

B. Life history

Distribution and habitat: The present distribution of the Schaus swallowtail butterfly is limited to undisturbed tropical hardwood hammocks in insular portions of Miami-Dade and Monroe counties from Elliott Key in Biscayne National Park in the northeast southwest to northern Key Largo (Service 1999 - Figure 1). Individuals have been seen in and adjacent to the Crocodile Lakes National Wildlife Refuge. Captive bred butterflies have been released on six sites in North Key Largo.

There have been two recent possible, but unverified, sightings of Schaus swallowtail butterflies in the lower Keys. One Schaus swallowtail was seen on Big Pine Key in 1966 (Service 1999). Another Schaus swallowtail butterfly was sighted on Lignumvitae Key, a State park, in 1973 (Covell 1977). A 1984 survey from Elliott Key to Key West found no Schaus swallowtail butterflies south of north Key Largo, although a verified sighting occurred on Upper Matecumbe Key in 1986 (Service 1999). In 1985, over 400 Schaus swallowtail butterflies were seen in Biscayne National Park, and a few were spotted at four sites in northern Key Largo (Service 1999). In 1986, the population of adult Schaus swallowtail butterflies on Elliott Key was estimated at 750-1,000 individuals; in the same year, there were an estimated 50-80 individuals (adults and immatures) on each of Old Rhodes, Totten, and Adams Keys (Emmel 1986a).

The Schaus swallowtail butterfly was described by Schaus in 1911 from specimens collected in May 1898, in the south Miami area. The last known mainland specimen was collected in Coconut Grove, Dade County, in May 1924 (Service 1999). One older specimen was reportedly collected in Key West (Service 1999). A colony flourished from 1935 to 1946 on Lower Matecumbe Key (Service 1999, Grimshawe 1940), with a single capture recorded there in 1964 (Service 1999). The Schaus swallowtail butterfly has been known to occur on northern Key Largo from 1940 to present, although rare since the mid-1970s (Service 1999). The Schaus swallowtail butterfly has been known to exist on the larger islands of Biscayne National Park since 1972 (Brown 1973, Covell and Rawson 1973).

The Schaus swallowtail butterfly occurs exclusively in mature subtropical dry forest (hardwood hammocks) that are now extensive only in the upper Keys in Miami-Dade and Monroe counties (Service 1999). Adults of this species may fly in clearings and along roads and trails, or even out over the ocean for short distances (Rutkowski 1971, Brown 1973), but they typically remain in the hammocks proper (Rutkowski 1971). Nectaring activity usually occurs on blossoms of wild coffee, guava (*Psidium guajava*), or cheese shrub (*Morinda royoc*), along the margins of these hammocks; they rarely feed in areas open to direct sunlight (Service 1999, Rutkowski 1971).

Other characteristics of Schaus swallowtail butterfly habitats are that they are relatively high elevation (3 to 4.6 m above sea level), away from tidal waters, and have a mature overstory of trees such as gumbo limbo, pigeon plum, black ironwood (*Krugiodendron ferreum*), West Indian mahogany, and wild tamarind (Covell 1976).

Dense, mature subtropical hardwood hammock habitat on well-drained substrate with dappled sunlight penetration are essential for the continued survival of both the Schaus swallowtail butterfly and its primary food plant, torchwood (*Amyris elemifera*) (Emmel 1985a, Service 1999, Covell 1976, Rutkowski 1971, Brown 1973, Loftus and Kushlan 1984). The minimum area required for a viable population is not known nor is the optimum density of primary and secondary food plants in the habitat.

Behavior: The Schaus swallowtail butterfly is territorial to the extent that males have been observed to investigate other males entering their territories within hardwood hammocks (Emmel 1985a). Male butterflies have also been reported as they patrolled the tree tops at a

height of 10 feet or more during the hot afternoon on bright days, sometimes descending into open spaces to investigate any other *H.c. ponceanus* (Rutkowski 1971). Emmel (1985a) also notes that male Schaus swallowtail butterflies are remarkably adapted to flight within hardwood hammocks and are able to pick their way among branches and around spider webs.

The Schaus swallowtail butterfly spends much of its time within hammocks, particularly where sunlight penetrates to give a dappling effect (Emmel 1985a). Courtship has been observed along narrow trails cut through the hammock (Rutkowski 1971). Open areas, such as trails or clearings within or near the dense hammock, are requisite for courtship activity and nectaring. These open areas may be natural or man-made. The Schaus swallowtail butterfly appears to be strictly diurnal.

While no mass migration of the Schaus swallowtail butterfly has ever been reported, an individual was followed as it crossed a half-mile expanse of Biscayne Bay between two islands (Brown 1973). In 1986, a Schaus swallowtail butterfly was seen crossing about 360 meters from Old Rhodes Key to Swan Key (Service 1999). These observations suggest that these butterflies can travel across open water for a considerable distance among the upper Keys and may be able to travel to and from the mainland.

Adult Schaus swallowtail butterflies are active primarily in May and June, with most sightings recorded between mid-April and mid-July (Service 1999). A few August and September records suggest either delayed-emergence during a year or a facultative second brood (Service 1999, Brown 1976).

There is only one generation of Schaus swallowtail butterflies per year and adults are short-lived (Emmel 1985a). There is some evidence from rearing that diapause may extend for at least 2 years (Grimshawe 1940). If this occurs in natural populations, the Schaus swallowtail butterfly could survive extreme droughts in the season following its larval development by delaying emergence, perhaps until July-September or later (Rutkowski 1971). Some adults are active during July-September as well as during the normal flight period of late April through early July (Brown 1973).

Feeding: Young caterpillars use tender, young leaves of plants, such as wild lime, and will avoid tougher, older leaves. However, fifth (final) instar larvae have been observed eating tougher older leaves of torchwood and prickly-ash (Service 1999, Rutkowski 1971). Adults have been observed taking nectar from blossoms of guava, cheese shrub, blue porterweed (*Stachylarpheta jamaicensis*), sea grape, dog's tail (*Heliotropium angiospermum*), lantana (*Lantana involucrata*), salt-and-pepper (*Melanthera nivea*), and wild coffee (Emmel 1986a, Service 1999, Rutkowski 1971).

Reproduction: While mating has not been observed in the wild, oviposition in nature has been described. The Schaus swallowtail butterfly uses torchwood and wild lime to deposit its eggs (Grimshawe 1940, Rutkowski 1971, Brown 1973). These food plants are either at the edge of hammocks along trails impartially sheltered by the canopy or they are in the hammocks proper, at the edge of a clearing or where a fairly large opening in the canopy exists. Females deposit

single eggs on the upper surface of the tips of the leaves, however, there is one record of two eggs on a leaf (Service 1999). Eggs and larvae are not found on plants in open sunlight; however, in contrast, the giant swallowtail butterfly has been observed ovipositing on wild lime growing in the open (Service 1999). Eggs take 3-5 days to hatch.

No studies on sex ratio have been published, but Covell (1985) has found that males are more abundant than females. Of 245 adult Schaus swallowtail butterflies in collections, 136 were males, 41 were females, and 68 had no sex indicated. These skewed sex ratios are likely biased. Female butterflies are typically more secretive than males. In addition, butterfly collectors may avoid killing females to allow the species to persist so that additional specimens may be taken at a later time.

Information on survival rate of adults is mostly anecdotal. Earlier projections are that adults live only about 2 weeks and suffer damage more quickly than similar species that live in more open areas because of hazards of life in the dense brush of the hammock (Emmel 1985a).

Egg survival rates of Schaus swallowtail in the wild are poorly known, but an egg survival rate of 29.7 percent (11 of 37) was cited in one case for a group of eggs collected in the wild. Further mortality of hatching larvae resulted in a survival rate of only 5 percent in the group studied (Emmel 1985b). Development from egg to adult was described by Grimshawe (1940) and Rutkowski (1971). Rutkowski (1971) noted a white osmeteria on the larvae and drinking of water droplets by fifth instar caterpillars.

C. Status and trends

The Schaus swallowtail butterfly was listed as a threatened species on April 28, 1976, because of population declines associated with habitat loss, pesticide use, and collecting (41 FR 17740). The Schaus swallowtail butterfly was reclassified to an endangered species on August 31, 1984, because its numbers and range had declined dramatically since its first listing (49 FR 34504).

Habitat loss, habitat fragmentation and application of pesticides are the primary factors responsible for the decline of Schaus swallowtail butterfly throughout its range. Paved roads through Schaus swallowtail butterfly habitat, particularly S.R. 905 on northern Key Largo, facilitate road kill of adults (Service 1999). Aerial application of insecticides for mosquito control throughout the Keys likely affect Schaus swallowtail butterfly populations. The pesticides Dibrom, Baytex, and Teknar, used in the Keys for mosquito control, are toxic to the related giant swallowtail butterfly in the laboratory (Emmel 1986b).

The primary threats to the survival and recovery of the Schaus swallowtail butterfly are habitat loss due to development, pesticide use, over-collecting, and climatic factors such as hurricanes, freezes, and droughts. The population on Key Largo is at-risk due to extensive habitat loss and fragmentation, making preservation of the remaining large contiguous forest fragments essential.

D. Analysis of the species likely to be affected

The current range of the Schaus swallowtail butterfly includes hardwood hammock on the upper Florida Keys from Lower Matecumbe Key north to Elliot Key. Habitat loss from development, pesticide use, and over-collecting are the primary causes for this subspecies decline. Hammock fragments such as the action area are increasingly rare in the upper Keys as a result of development activities and acquisition of the remaining patches for conservation is a high priority. The proposed project would adversely affect the Schaus' swallowtail butterfly through the loss and degradation of the remaining habitat on-site from secondary effects including microhabitat alteration, increased edge effects, and exotic species such as fire ants.

Stock Island tree snail

A. Species description

The Stock Island tree snail was first described by Say in 1830 based on a snail that was probably collected from Key West. That specimen was lost and the species was later described by Pilsbry around 1946 using a snail from Stock Island. The Stock Island tree snail is a subspecies in the genus *Orthalicus*. Pilsbry wrote that he believed *Orthalicus* migrated through tropical America on floating trees that were later blown ashore.

Pilsbry (1946) described the Stock Island tree snail as having a shell that is rather thin and light, less solid than [other] races of [*Orthalicus*]. White to warm buff, this tint deepening near the lip or behind the later varices; stripes... purplish brown, running with the growth-lines, the stripes and the streaks often interrupted between the bands, and mostly not extending below the lower one; growth-rest varices usually 2 to 4 on the last whorl; three spiral banks, the upper and lower interrupted, are indicated, but weaken with age. Apex white. Aperture showing the varices, bands and streaks vividly inside; columella white, straightened above; parietal callus white, or dilute chestnut in old shells. The characteristics that most distinguish this species from *O. reses nesodryas* are the white apex and white columella and parietal callus. These characteristics are chestnut-brown or darker in *O. reses nesodryas*.

B. Life history

Distribution and habitat: Historically, Stock Island tree snails were found only on Stock Island and Key West. Today, snails are only found in small numbers on Key West and in a few hardwood hammocks in the upper Keys. They feed on epiphytic growth on hardwood tree trunks, branches, and leaves. The Stock Island tree snail survives best in higher-elevation hammocks (minimum elevations of 5-11 feet) that support relatively large amounts of lichens and algae.

Larger trees support more Stock Island tree snails than smaller trees because they provide the snails with an increased surface area for foraging (Deisler 1987). There is no evidence that Stock Island tree snails prefer certain tree types or species (Deisler 1987), although they seem to prefer trees with smooth bark over trees with rough bark.

Stock Island tree snails are arboreal except when they move to the forest floor for nesting or traveling. Hammocks that contained well-developed soils or leaf litter are probably necessary for nesting activity and dispersal.

No data are available on minimal hammock size needed to support a viable population of tree snails. Suitable habitat would have to include an area large enough to provide for foraging and nesting requirements as well as provide for the microclimate (air temperature and humidity) needed by the Stock Island tree snail.

Behavior: The Stock Island tree snails are active mainly during the wet season. Besides the reproductive activities discussed above, most of the feeding and dispersion takes place during the wet season (May through November). Dry periods (usually December through April) are spent in aestivation in which the Stock Island tree snail forms a tight sealed barrier between the aperture and a tree trunk or branch. Snails may come out of aestivation briefly to feed during dry season rains or go into aestivation during summer dry spells.

Feeding: Little is known about the feeding habits or food preferences of the Stock Island tree snail. Probable food items include a large variety of fungi, algae, and lichens found on the bark of hammock trees. Mixobacteria and some small mites may serve as a secondary food source. Feeding can occur anytime during the day or night with peak feeding activity occurring from late afternoon through the night to midmorning and during or immediately after rainfall. Feeding Stock Island tree snails often follow a random twisting path that covers the entire bark surface but will move in a straight line if surface moisture is abundant.

Reproduction: The snails are hermaphroditic, but cross-fertilization appears to be common. They mate and nest in late summer and early fall during the wettest part of the rainy season. They lay approximately 15 eggs per clutch in a cavity that is dug into the soil humus layer, usually at the base of a tree, and take anywhere from 24 to 105 hours to deposit their eggs (Deisler 1987). The eggs hatch during the onset of the rains the following spring. Upon hatching, the Stock Island tree snails immediately proceed to climb adjacent trees. Most nesting snails appear to be approximately 2-3 years old and are estimated to live for up to 6 years, with 2.11 years being the mean age for the Stock Island population at the time of Deisler's study (1987). The Stock Island tree snail's age can be estimated by counting the number of dark suture-like lines resulting from pigment deposition during the dry season.

C. Status and trends

The Stock Island tree snail was listed as threatened by the Service on July 1978 (43 FR 28932) because of population declines, habitat destruction and modification, pesticide use, and over-collecting (Service 1999). Since its original listing, this threatened snail has probably been eliminated from its historic range on Stock Island by extensive habitat destruction. It currently exists in hardwood hammock patches on Key Largo and possibly the everglades, and in a residential setting on Key West.

The primary threats to the survival and recovery of the Stock Island tree snail include loss of habitat from development, application of pesticides, fragmentation of habitat, and predation by black rats (*Rattus rattus*) and fire ants (*Solenopsis invicta*). Increased urbanization in the Keys over the last 30 years has led to the destruction, fragmentation, and reduction in quality of habitat throughout its historic and present range. Pesticide use near known sites of the Stock Island tree snail has impacted populations either by poisoning animals directly or altering reproduction. Trash and debris piles have also served as a food source and provided home sites for black rats which prey on the snail. Illegal collecting of Stock Island tree snail has reduced snail populations and contributed to the extirpation of the snail from Stock Island (Service 1999). The population on Key Largo is at-risk due to extensive habitat loss and fragmentation, making preservation of the remaining large contiguous forest fragments essential (Forys *et al.* 1996).

D. Analysis of the species likely to be affected

The current range of the Stock Island tree snail includes only hardwood hammock fragments where the species has been relocated by collectors and conservationists. The subspecies is believed to be extirpated from its historic range, and the long-term survival of the taxon is doubtful. Hammock fragments, such as the action area, are increasingly rare in the upper Keys as a result of development activities, and acquisition of the remaining patches for conservation is a high priority. The proposed project would adversely impact the Stock Island tree snail through a direct loss of individuals and also through the degradation of the remaining habitat on-site from secondary effects including microhabitat alteration, increased edge effects, and exotic species such as fire ants.

Eastern indigo snake

A. Species description

The eastern indigo snake ranges from the southeastern United States to northern Argentina (Service 1999). This species has eight recognized subspecies, two of which occur in the United States: the eastern indigo and the Texas indigo *(D. c. erebennus)* (Service 1999). At one time, the eastern indigo snake occurred in the coastal plain of the southeastern United States, from South Carolina to Florida and west to Louisiana.

The eastern indigo snake is the largest non-venomous snake in North America, obtaining lengths of up to 104 inches (Service 1999). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. Its scales are large and smooth (the central 3-5 scale rows are lightly keeled in adult males) in 17 scale rows at midbody. Its anal plate is undivided.

In the Keys, adult eastern indigo snakes seem to have less red on their faces or throats compared to most mainland specimens (Service 1999). Several researchers have informally suggested that lower Keys eastern indigo snakes may differ from mainland snakes in ways other than color.

B. Life history

Distribution and habitat: Historically, the eastern indigo snake occurred throughout Florida and in the coastal plain of Georgia and has been recorded in Alabama and Mississippi. It may have occurred in southern South Carolina, but its occurrence there cannot be confirmed.

Georgia and Florida currently support the remaining, endemic populations of the eastern indigo snake (Service 1999), with only a few populations remaining in the Florida panhandle. Nevertheless, based on museum specimens and field sightings, the eastern indigo snake still occurs throughout Florida, though not common (Service 1999).

In the upper Keys, eastern indigo snakes occur on North Key Largo, likely restricted to Crocodile Lake National Wildlife Refuge and Key Largo State Botanical Site. It is unlikely that any resident individuals remain south of North Key Largo through Marathon as the remaining habitat is greatly reduced and fragmented. In the lower Keys, eastern indigo snakes have been reported on Big Pine and Middle Torch, Big Torch, Little Torch, Summerland, Cudjoe, Sugarloaf, and Boca Chica Keys (Service 1999). Since thorough surveys have not been conducted in the Keys, the eastern indigo snake may occur on other keys as well.

Over most of its range in Florida, the eastern indigo snake frequents diverse habitats such as pine flatwoods, scrubby flatwoods, flood plain edges, sand ridges, dry glades, tropical hammocks, edges of freshwater marshes, muckland fields, coastal dunes, and xeric sandhill communities. In south Florida, these snakes are found in pine flatwoods and tropical hammocks. Eastern indigo snakes also use agricultural lands and various types of wetlands, with higher population concentrations occurring in the sandhill and pineland regions of northern and central Florida. Eastern indigo snakes utilize similar habitats in the Keys.

Eastern indigo snakes require a mosaic of habitats. Interspersion of tortoise-inhabited sandhills and wetlands improves habitat quality for the eastern indigo snakes (Service 1999). Eastern indigo snakes require sheltered retreats from winter cold and desiccating conditions, and often use burrows of the gopher tortoise (*Gopherus polyphemus*) when available. In habitats lacking gopher tortoises, eastern indigo snakes may take shelter in hollowed root channels, hollow logs, or the burrows of rodents, armadillo, or crabs (Service 1999).

The average range of the eastern indigo snake is 4.8 hectares during the winter (December-April), 42.9 hectares during late spring/early summer (May-July), and 97.4 hectares during late summer and fall (August- November) (Service 1999). Adult male eastern indigo snakes have larger home ranges than adult females and juveniles; their ranges may encompass as much as 224 hectares and 158 hectares in the summer (Moler 1986). By contrast, a gravid female may use from 1.4 hectares to 42.9 hectares (Service 1999).

Feeding: The eastern indigo snake is a generalized predator and will eat any vertebrate small enough to be overpowered. The snake's food items include fish, frogs, toads, snakes (venomous as well as nonvenomous), lizards, turtles, turtle eggs, small alligators, birds, and small mammals.

Reproduction: Eastern indigo snakes breed between November and April, with females depositing 4-12 eggs during May or June (Service 1999). Young hatch in approximately 3 months from late May through August with peak hatching activity occurring between August and September, while yearling activity peaks in April and May (Service 1999). There is no evidence of parental care although the snakes take 3 to 4 years to reach sexual maturity (Service 1999).

Female eastern indigo snakes can store sperm and delay fertilization of eggs; there is a single record of a captive snake laying five eggs (at least one of which was fertile) after being isolated for more than 4 years (Service 1999). There is no information on eastern indigo snake lifespan in the wild, but in captivity an eastern indigo snake lived 25 years, 11 months (Service 1999).

C. Status and trends

The eastern indigo snake was listed as a threatened species on January 31, 1978 (43 FR 4028). This snake was listed because of dramatic population declines caused by habitat loss, over-collecting for the domestic and international pet trade, and mortalities caused by rattlesnake collectors who gas gopher tortoise burrows to collect snakes (Service 1999). When the eastern indigo snake was listed, the main cause of its population decline was over-collecting for the pet trade.

The eastern indigo snake was listed based on habitat loss, over-collecting for the pet trade, and mortality from gassing gopher tortoise burrows to collect rattlesnakes. At the time of listing, the main factor in the decline of the eastern indigo snake was attributed to exploitation for the pet trade. Law enforcement has reduced pressure from the pet trade, but loss of habitat remains a major threat to the long-term survival of the species. The primary threats to the survival and recovery of the eastern indigo snake on the Keys are habitat loss due to development. The already greatly reduced population on Key Largo is at-risk due to extensive habitat loss and fragmentation, making preservation of the remaining large contiguous forest fragments essential.

The status of the eastern indigo snake is not well documented in the Keys, but it is believed to be nearly extirpated. Based on anecdotal information, the Keys population has declined over the last two decades. Currently, the eastern indigo snake probably only occurs on North Key Largo in the upper Keys, and on the larger keys from Big Pine Key through Lower Sugarloaf Key in the Lower Keys. Habitat loss, collecting, and road kills are likely causes for the observed decline, a trend further amplified by the small size of these islands relative to mainland habitat conditions.

The eastern indigo snake utilizes a majority of the habitat types available in the Keys, but tends to prefer open, undeveloped areas (Service 1999). Because of its relatively large home range, this snake is especially vulnerable to habitat loss, degradation, and fragmentation (Service 1999) on these small islands. Low density residential housing is also a threat to this species, increasing the likelihood of snakes being killed by property owners and domestic pets. Extensive tracts of wild land are the most important refuge for large numbers of eastern indigo snakes (Service 1999).

D. Analysis of the species likely to be affected

The current range of the eastern indigo snake in the Florida Keys is likely restricted to extreme northern Key Largo. Although possible, it is highly unlikely that this species occurs in the action area. For this reason, hammock fragments such as the action area contribute very little if at all to conservation of the Eastern indigo snake, and it is doubtful if the proposed action will adversely affect this species. Because the proposed action is not likely to adversely affect the eastern indigo snake, this species will not be considered further in this consultation.

Environmental baseline

A. Status of the species in the action area

A unique combination of geological history, climate, geography, and environmental forces has made the Keys an important reservoir of landscape, community, and species diversity. The vegetation of the Keys represents a mixture of Caribbean, southern temperate, and local influences. The upland areas of the Keys occur on limestone outcroppings that are called the south Florida rocklands. These rocklands, which form both the Miami Rock Ridge and the Florida Keys, support biotic communities that are a unique combination of a West Indian flora and a southeastern flora and fauna. The relative isolation of these rocklands has also allowed a significant amount of endemism to evolve: 37 endemic herbaceous plants, 5 endemic trees and shrubs, 10 endemic mammals, 5 endemic reptiles, and endemic invertebrates such as the Stock Island tree snail and the Schaus swallowtail butterfly all occur in these rocklands.

Before the arrival of Europeans, the upper Keys (Ragged Keys to Long Key) contained 4,816 hectares of hardwood hammock forests (Service 1999). These areas contained a continuous strand of deciduous, seasonal forests encircled by a fringe of mangroves. Since European settlement of the Keys, anthropogenic effects have directly affected the deciduous forests, hardwood hammocks, and mangrove fringes of the Keys. As a result of habitat destruction and modification for residential, commercial, and agricultural uses, most of the hammock forests in the upper Keys have been lost or fragmented. Since 1924, habitat destruction and modification for residential and commercial uses has had a dramatic, permanent effect on these forests. By 1991, 41.2 percent of the deciduous seasonal forests (1,985 hectares) had been either cleared or filled to meet human needs (Service 1999). The pattern of habitat loss and modification in the Keys has resulted in small, fragmented parcels of suitable habitat. Areas that are easily accessible to humans, such as those connected by U.S. Highway 1, have experienced the majority of the adverse effects.

Habitat destruction and modification have affected the northern and southern ends of Key Largo differently. On the northern end of Key Largo, land acquisition by the Service, the State of Florida, and Monroe County has protected extensive areas of hardwood hammocks. Ocean Reef Club as well as two, smaller, partially developed subdivisions have destroyed or modified extensively the hammocks on the northernmost portion of Key Largo. By contrast, residential and commercial construction projects have destroyed and fragmented extensive areas of the southern end of Key Largo; the fragmentation has been more severe in seasonal deciduous

forests than mangrove forests. Residential housing projects have severely deforested the hammocks on Plantation Key (which has suffered a 70 percent loss of its seasonal forests) and Lower Matecumbe Keys.

Schaus swallowtail butterfly

Although population numbers of the Schaus swallowtail butterfly fluctuate year to year, between 1924-1981 there has been a general decline in range and numbers. The Schaus swallowtail butterfly has been considered rare on Key Largo since the mid-1970s. This species was listed as threatened on April 28, 1976, because of population declines caused by the destruction of its tropical hardwood hammock habitat, mosquito control practices, and over-harvesting by collectors (41 FR 17740). The Schaus swallowtail butterfly was reclassified to an endangered species on August 31, 1984, because its numbers and range had declined dramatically since its first listing (49 FR 34504).

Tropical hardwood hammock suitable for Schaus swallowtail butterfly has been reduced by an estimated 57 percent in Biscayne National Park and 83 percent for Key Largo. The decline has been attributed primarily to habitat destruction. North Key Largo contains a large, relatively contiguous expanse of tropical hardwood hammock habitat, but habitat on Key Largo south of C.R. 905 is highly fragmented and greatly reduced from historic levels, placing greater importance on the preservation of the larger tracts of hardwood hammock habitat remaining on Key Largo.

The majority of the Schaus swallowtail butterfly population is found on Adams, Elliott, Old Rhodes, Swan, and Totten Keys within Biscayne National Park. Between 1985 and 1990, the Elliott Key population fluctuated between 600 to 1,000 adults annually, with smaller populations of at least 50 to 100 individuals on each of the other Keys. Hurricane Andrew temporarily reduced the Biscayne National Park's population in 1992 to 58 identified individuals; however, in 1994 the population rebounded to over 600 and is presumed stable (Emmel 1995a).

Within the major keys of Biscayne National Park (Elliott, Old Rhodes, Totten, and Adams Keys) and on northern Key Largo, the two food plants of the Schaus swallowtail butterfly seem adequate to support a healthy population. High numbers of individuals sighted in 1985 indicate that the Schaus swallowtail butterfly population is still capable of periodic peaks. Following 3 years of reintroductions, results of a 1997 season census indicate that the total annual population in the wild has increased to at least 1,200 butterflies (Emmel 1995b).

Prior to human influences, populations of this butterfly were probably subject to naturally occurring population depressions caused by hurricane damage, drought, and rare freezes (Covell 1976). The influence of the Labor Day Hurricane of 1935 on the Lower Matecumbe Key population was documented by Grimshawe (1940), though the claim that the species became extinct was incorrect (it was found there and on Key Largo in succeeding years) (Henderson 1945). The results of Grimshawe's careful searching were negative; however, the before and after surveys demonstrated that the hurricane had a detrimental effect on the biota of the Keys southwest of Key Largo.

Stock Island tree snail

The Stock Island tree snail is an arboreal snail inhabiting hardwood hammocks of the Keys. Its historic range includes the islands of Stock Island and Key West, but more recently individuals have been relocated to other hammocks in the Keys and mainland. The restricted range of this subspecies and near extirpation from Key West and Stock Island by 1978 led to its being listed as threatened. The population has continued to decline as a result of further habitat loss due to real estate development, pesticide use, over-collecting, and predation by exotic species such as fire ants and black rats. The snail was nearly extirpated from its historic range as early as 1938, and Pilsbry (1946) believed the snail was extinct from Key West.

Extant populations of the Stock Island tree snail exist at four locations outside the historical range, but is declining at all of the known sites. Surveys of known populations conducted in 1995 by the Service concluded that Stock Island tree snails are now totally absent from Stock Island and Key West. The populations on Key Largo were surviving, but precise population estimates were not obtained. The Monkey Jungle population apparently continues to do well, although Hurricane Andrew did extensive damage to the hardwood trees at this site. The single known mainland site documented by Deisler (1987) no longer contained Stock Island tree snails. Because tree snails are continuously being moved by collectors and conservationists and are also mobile themselves, it is difficult to assess their current distribution. For that reason, all large contiguous parcels of hardwood hammock on Key Largo are potential habitat for this species unless detailed surveys conducted during the months of July-September are conducted.

B. Factors affecting species environment within the action area

The action area is a 23-acre parcel of hardwood hammock fragmented from adjacent habitat by roads and existing development. Currently, no development exists on the action area although old, overgrown roads are evident. The habitat is exhibiting signs of secondary impacts resulting from this fragmentation including the presence of invasive exotic plants, fire ants and dumping of solid waste. Edge effects affecting the forest interior microhabitat including increased light penetration and reduced moisture has likely occurred considering the significant disturbed margins of the action area, further decreasing the suitability of the action area for both the Schaus swallowtail butterfly and the Stock Island tree snail. Because of these impacts, the action area is not optimal habitat for either Schaus swallowtail butterfly or Stock Island tree snail, but still serves as important habitat for these species considering the limited distribution of available habitat on Key Largo.

Effects of the action

A. Factors to be considered

Potential effects to Schaus swallowtail butterfly and Stock Island tree snail from implementation of the proposed project include: (1) the direct loss of 2.6 acres of habitat within these species range, (2) the fragmentation of a 23-acre parcel of habitat within these species range, (3) the potential loss of individual Schaus swallowtail butterflies and Stock Island tree snails inhabiting

the project site, and (4) the loss of 23 acres of habitat targeted for acquisition and management by Florida's Conservation and Recreational Lands (CARL) program which serves to aid in the recovery and survival of these species.

B. Analysis for effects of the action

The primary effect of the proposed action is the loss of 2.3 acres of tropical hardwood hammock habitat important for the long-term survival and recovery of Schaus swallowtail butterfly and Stock Island tree snail. In addition to the direct loss of habitat, the proposed action will also result in the additional degradation and fragmentation of the remaining 23 acres of habitat that comprise the action area.

C. Species response to a proposed action

Habitat loss resulting from the proposed action will affect Schaus swallowtail butterfly and Stock Island tree snail populations in the Keys by reducing the carrying capacity of the habitats to sustain viable populations of these species. Habitat loss has been cited as the principle threat to these species, altering their ability to feed, reproduce, disrupting movement routes, and altering habitat composition through the introduction of exotic plant species. Protection of habitat is considered essential for preventing the extinction of these three species.

In addition to a reduction in total carrying capacity, the proposed action will also contribute to the general reduction in the ranges of these species by further fragmenting suitable habitat. Habitat fragmentation is a severe threat to the ability of tropical hardwood hammock to sustain viable populations of Schaus swallowtail butterfly and Stock Island tree snail. Habitat fragmentation can result in secondary impacts that degrade habitat quality for these species including increased light penetration, reduced humidity, altered plant species composition, and introduction of exotic species (*e.g.*, imported red fire ants, exotic invasive plants).

Another effect of the action has been to prevent this 23-acre parcel of habitat from being acquired by the CARL program with subsequent management as a protected area. The South Florida Multi-Species Recovery Plan (Service 1999) for these species identifies habitat acquisition and management as a primary recovery objective for the Schaus swallowtail butterfly and Stock Island tree snail. The action area was targeted by the CARL program for acquisition and has been surveyed and appraised in anticipation of a purchase agreement. Actions by the Monroe County Board of County Commissioners and FEMA to construct the proposed action have prevented this pending purchase and placed the long-term conservation prospects for this property into doubt.

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.

As a result of a previous formal consultation with FEMA, Monroe County currently reviews building permits on a case-by-case basis to determine whether building-permit applicants must coordinate with the Service to address effects to threatened and endangered species (Service 1999b). If the FEMA review process results in a determination that either Schaus swallowtail butterfly or Stock Island tree snails will be taken, applicants may opt to pursue an incidental take permit (ITP) pursuant to section 10 of the ESA. Under this permitting process, the Service becomes a permitting Federal agency whose regulatory actions are addressed through an intra-Service section 7 consultation. Thus, any future effects to Schaus swallowtail butterfly or Stock Island tree snails due to this permitting authority do not represent cumulative effects.

Monroe County may request an expansion of the Key Largo WTP in the future as the result of increased demand resulting from future development on Key Largo. This increased demand in wastewater infrastructure could result from permitted development that itself has no direct impact on threatened or endangered species as determined through the previous FEMA consultation described above. This anticipated future action in the action area will degrade, fragment, or directly eliminate habitat within the action area, adversely affecting Schaus swallowtail butterflies and Stock Island tree snails.

CONCLUSION

After reviewing the current status of the Schaus swallowtail butterfly and Stock Island tree snail in the action area, 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 construction of the Key Largo WTP is not likely to jeopardize the continued existence of the Schaus swallowtail butterfly or Stock Island tree snail nor is it likely to adversely affect the eastern indigo snake. No critical habitat has been designated for these species, therefore, none will be affected.

INCIDENTAL TAKE

Sections 4(d) and 9 of the ESA prohibit taking (harass, harm, pursue, hunt, shoot, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patters which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or an applicant. 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 a prohibited taking provided that such taking complies with the terms and conditions of this incidental take statement.

The Service anticipates incidental take of endangered Schaus swallowtail butterfly and Stock Island tree snails associated with the direct loss of habitat resulting from this project. Incidental

take should be minimized by implementation of the following reasonable and prudent measures. The incidental take is expected to be in the form of harm and harassment.

Amount or extent of take anticipated

The Service anticipates incidental take of Schaus swallowtail butterfly and Stock Island tree snail associated with the direct loss of 2.6 acres of habitat. Incidental take should be minimized by implementation of the following reasonable and prudent measures. The incidental take is expected to be in the form of harm and harassment. The Service determined that this level of take is not likely to result in jeopardy to these species.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of Schaus swallowtail butterflies and Stock Island tree snails associated with the proposed action.

1. Restore an area of hardwood hammock habitat equal to the area lost (2.6 acres) as a result of the proposed action in order to replace the habitat functions essential to the long-term conservation of the species in the action area.

2. Preserve the 23 acres of the action area not required for construction of the proposed action to prevent any further adverse impacts and to ensure proper long-term management of the habitat.

Terms and conditions

In order to be exempt from the prohibitions of section 9 of the ESA, FEMA must comply with the following terms and conditions, which implement the reasonable and prudent measure described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. FEMA shall locate a site or sites totaling 2.6 acres for hardwood hammock habitat restoration on the island of Key Largo. The site should consist of habitat conditions currently unsuitable for the Schaus swallowtail butterfly and Stock Island tree snail, but through restoration actions could be reasonably expected to support these species. The selected site must be approved by the Service.

2. FEMA shall coordinate with the CARL program or another suitable environmental lands management program to receive title to the 23 acres of hardwood hammock in the action area not proposed for development. Coordination with the Florida Department of Community Affairs and Monroe County Growth Management should be initiated to address issues related to the Monroe County Comprehensive Plan open space requirements.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the incidental take of Schaus swallowtail butterfly and Stock Island tree snail that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review, with the Service, the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

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

1. FEMA should develop guidelines for the siting and construction of any future wastewater treatment facilities in the Florida Keys specifically aimed at avoiding adverse effects to threatened and endangered species. The Service recognizes the need for these facilities to be built in the Florida Keys, but has a responsibility to provide for the protection and conservation of trust resources. The Service is prepared to assist FEMA in the identification of potential wastewater treatment facility sites throughout the Keys that will have no effect on threatened or endangered species.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the consultation request. 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 agency 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.

Thank you for your cooperation in the effort to protect threatened and endangered species and their habitats. If you have any questions regarding this project, please contact Tom Grahl at (561) 562-3909, extension 236.

Sincerely yours,

for James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
FWS, Big Pine Key, FL
FWS, ARD-ES, Atlanta, GA
Florida Keys Aqueduct Authority, Key West, FL (Jack Teague)
Monroe County Growth Management, Marathon, FL (Tim McGarry)
EPA, Marathon, FL (Bill Kruczinsky)

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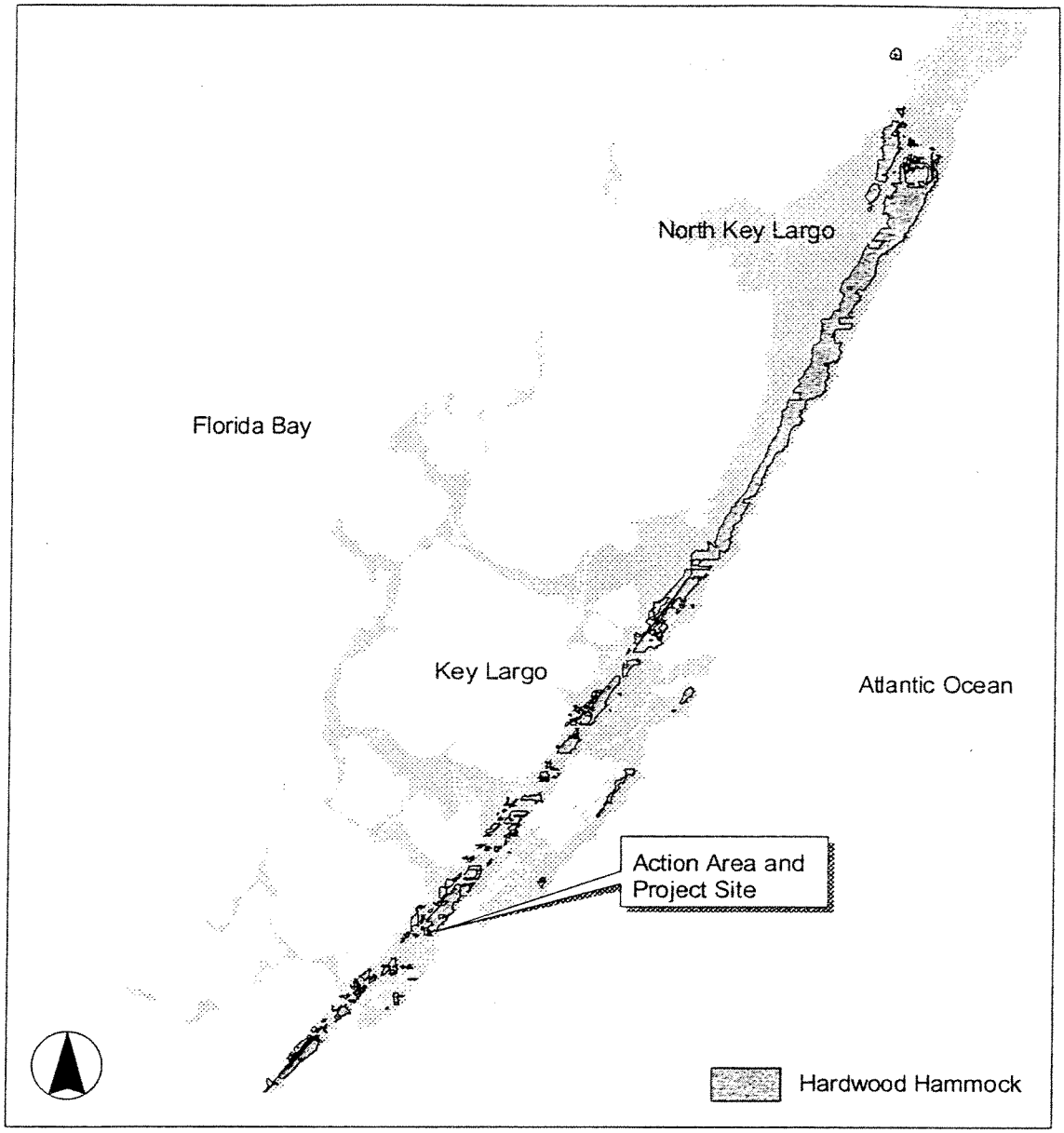

Figure 1. Location of the action area on Key Largo, Monroe County, Florida and remaining tropical hardwood hammock patches.

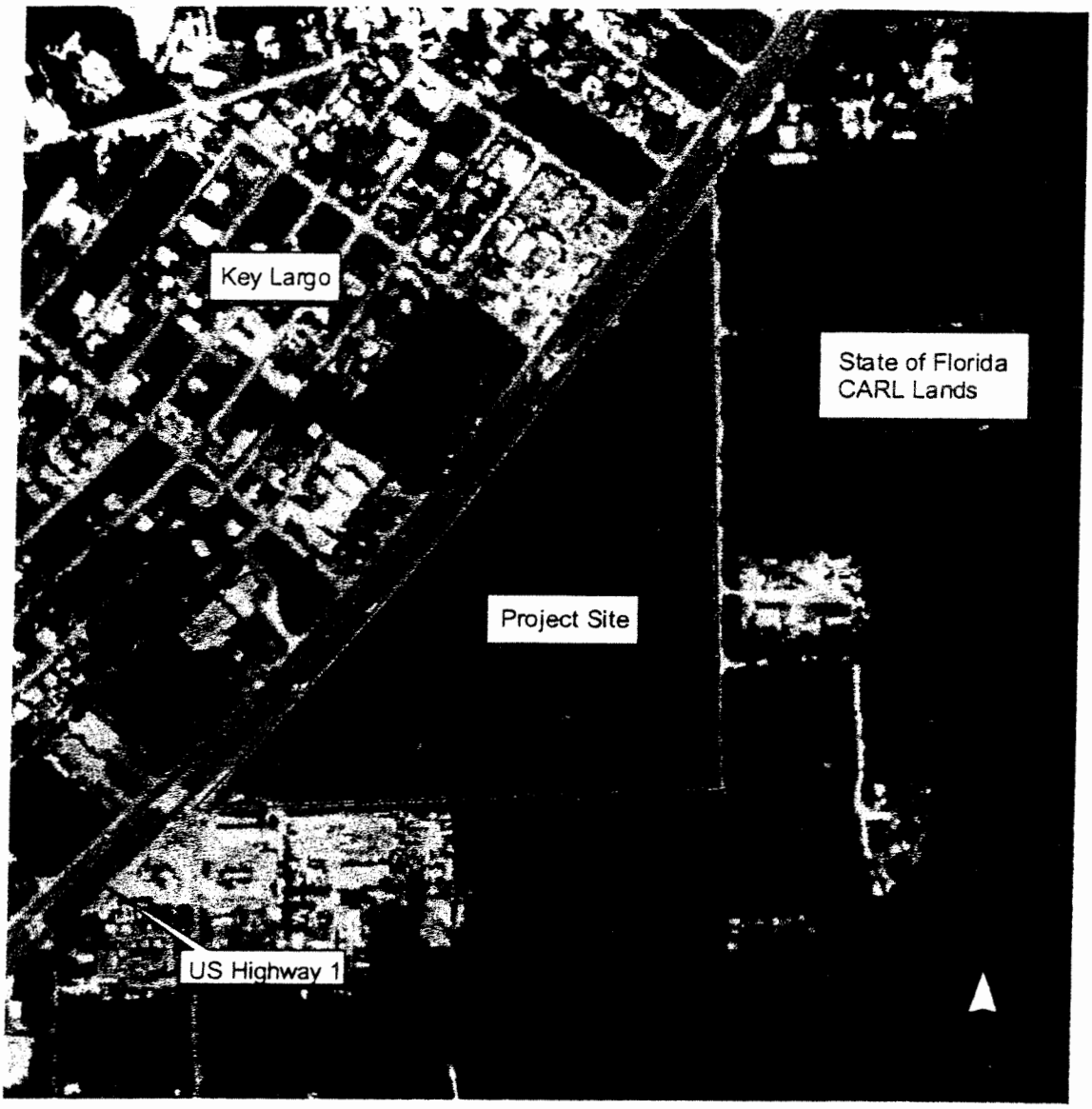

Figure 2. Location of proposed Key Largo wastewater treatment facility at Mile Marker 100.5 on Key Largo, Monroe County, Florida.

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