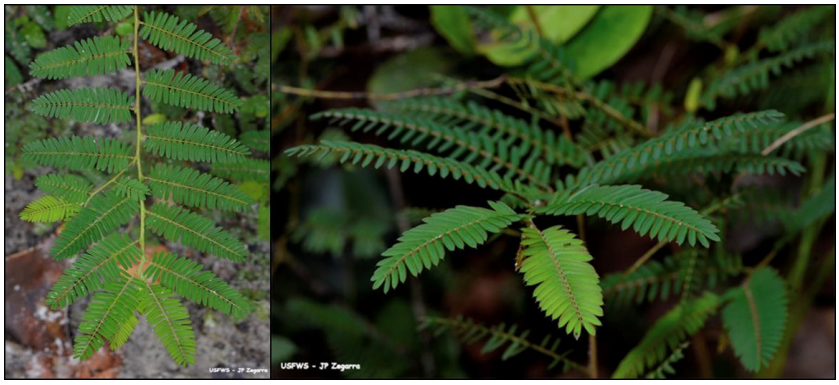
Chamaecrista glandulosa var. *mirabilis*

5-Year Review:
Summary and Evaluation



Photos by Jan Paul Zegarra (USFWS)

U.S. Fish and Wildlife Service
Southeast Region
Caribbean Ecological Services Field Office
Boquerón, Puerto Rico

5-YEAR REVIEW
Chamaecrista glandulosa* var. *mirabilis

I. GENERAL INFORMATION

A. Methodology used to complete the review:

On April 9, 2010, the U. S. Fish and Wildlife Service (USFWS) published a notice in the *Federal Register* (75 FR 18232) announcing the 5-year review of *Chamaecrista glandulosa* var. *mirabilis* and requested new information concerning the biology and status of the species. A 60-day comment period was opened; however, no information on *C. glandulosa* var. *mirabilis* was received from the public during the comment period.

After the comment period, the USFWS signed a cooperative agreement with the University of Puerto Rico, Mayagüez campus (UPRM) to gather and summarize new information on *C. glandulosa* var. *mirabilis*. Botanists from UPRM, Drs. Duane A. Kolterman and Jesús D. Chinea, reviewed available literature, consulted with specialists, and examined herbarium data, including specimens from the University of Puerto Rico at Mayagüez (MAPR), Río Piedras Botanical Garden (UPR), University of Puerto Rico at Río Piedras (UPRRP), Puerto Rico Department of Natural and Environmental Resources (PRDNER - SJ), New York Botanical Garden (NY), U.S. National Herbarium (US), and University of Illinois (UIL).

Drs. Kolterman and Chinea prepared a draft 5-year review with the information they gathered. Then, the USFWS completed the 5-year review, and assessed and determined the appropriate status recommendation for the species. The USFWS did not seek additional peer review on this 5-year review since Dr. Duane A. Kolterman, Dr. Jesús D. Chinea and USFWS biologist Omar Monsegur are considered the leading experts on the species.

B. Reviewers:

Lead Region: Kelly Bibb, Recovery Coordinator, Southeast Region, Atlanta, Georgia, (404) 679-7132.

Lead Field Office: Omar A. Monsegur, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico, (787) 851-7297, extension 217.

C. Background

1. Federal Register Notice citation announcing initiation of this review:

75 FR 18232, April 9, 2010.

2. Species Status:

As of the date of this review, we believe the status of *C. glandulosa* var. *mirabilis* is uncertain. The previous *C. glandulosa* var. *mirabilis* population survey was conducted in 1992 and its distribution was limited to the area of Tortuguero Lagoon. A rapid assessment was conducted by the USFWS in 2013 to determine the overall status of the species population, and to evaluate its threats. We identified threats such as habitat loss due to the intrusion of exotic plant species, and the unauthorized use of the area by ATVs, among others. However, we were not able to conduct an adequate survey or obtain an estimate of the number of individuals during the assessment. Thus, in the absence of a long term monitoring and uncertainty about population trends, we deem the status of the population as uncertain.

3. Recovery Achieved:

1 (1-25%) of species recovery objectives achieved for *C. glandulosa* var. *mirabilis*.

4. Listing History

Original Listing
FR notice: 55 FR 12788
Date listed: April 5, 1990
Entity listed: species
Classification: endangered

5. Associated rulemakings: Not Applicable.

6. Review History:

Chamaecrista glandulosa var. *mirabilis* is a member of the Fabaceae and was first collected by Dr. Agustin Stahl in the mid-nineteenth century. In 1899, Mr. Edward Heller collected the species in the municipality of Vega Baja (USFWS 1994). Liogier (1988) placed the taxon as a variety in his Descriptive Flora of Puerto Rico and Adjacent Islands.

The final listing rule and the Recovery Plan for *Chamaecrista glandulosa* var. *mirabilis* (hereafter the "Plan")(USFWS 1994), are the most comprehensive analyses of the status of the species and are used as the baseline references documents for this 5-year review. In 1990, we reviewed the best available scientific and commercial information, analyzed the five listing factors and their application to the species, and listed *Chamaecrista glandulosa* var. *mirabilis* as endangered (55 FR 12788). We identified Factor A (present or threatened destruction, modification, or curtailment of its habitat or range), Factor D (the inadequacy of existing regulatory mechanisms), and Factor E (other natural or manmade factors affecting its continued existence) as the main threats to the species. Examples of these threats included clearing of

vegetation for white (siliceous) sands extraction, urban development, dumping of trash within the plant's habitat, the species limited distribution, and hurricanes. The 1994 recovery plan included the description of the species and information about its distribution, habitat characteristics, reproductive biology, and conservation. Thus, the information included in the plan will not be repeated in this review.

Every year, the USFWS reviews the status of listed species and update their information in the Recovery Data Call (RDC). The last RDC for *Chamaecrista glandulosa* var. *mirabilis* was completed in 2014. Recovery Data Call: 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013 and 2014.

7. Species' Recovery Priority Number at start of review (48 FR 43098):

The species recovery priority number is 5. At the time of listing, *C. glandulosa* var. *mirabilis* was recognized as a species with a high degree of threat and a low recovery potential.

8. Recovery Plan:

Name of plan: *Chamaecrista glandulosa* var. *mirabilis* Recovery Plan
Date issued: May 12, 1994

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

The Act defines species to include any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the DPS policy is not applicable to this species, it is not addressed further in this review.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

The species has an approved recovery plan establishing delisting as the recovery objective. The Plan establishes that at least 3 new populations capable of self-perpetuation within protected areas are needed to delist the species. However, the Plan does not contain specific measurable recovery criteria for delisting as it does not indicate the minimum number of individuals to establish a self-sustainable population.

2. Adequacy of recovery criteria.

a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

No. The plan does not include up-to-date information about the species' reproductive biology, its ecology, the actual number of individuals and habitat conditions.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

Yes. All listing factors that were considered threats at the time of listing are addressed in recovery criteria.

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

The species will be considered for delisting when the following criteria are met:

1. The known populations are given protected status.

2. At least 3 new populations capable of self-perpetuation are established within protected areas. These should be minimum requirements, and could be expanded upon if the regenerative or propagative potential of natural and ex situ populations proves to be insufficient. On the other hand, if new populations of the species are discovered, it may be preferable to place greater emphasis on protection, rather than on propagation, in order to achieve a minimum number of plants.

Criterion 1 has been partially met. The Tortuguero Lagoon Natural Reserve is a protected area managed by the PRDNER and encompasses at least two of the known natural populations of the species. However, some historical localities lie on private lands subject to urban development and do not have protected status.

Criterion 2 has not been initiated. We are not aware of any comprehensive propagation effort for the species, or any reintroduction project. No new population of *C. glandulosa* var. *mirabilis* has been established.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Species' abundance, population trends (e.g. increasing, decreasing, stable), demographic features, or demographic trends

Chamaecrista glandulosa var. *mirabilis* is a rare perennial herb or subshrub, up to 3 feet tall, native to Puerto Rico (Liogier 1988). It is known from the coastal

white or siliceous sands in north central Puerto Rico in areas adjacent to the Tortuguero Lagoon Natural Reserve. The species is commonly considered as endemic to mainland Puerto Rico (Axelrod 2011).

In 1994 when the Recovery Plan was released, we knew of 120-150 individuals from the Tortuguero Lagoon Natural Reserve area (municipalities of Manatí and Vega Baja), and an additional population was known from the municipality of Dorado. The USFWS visited an area along the southern shore of the Tortuguero Lagoon on August 20, 2013, to assess the status and current threats to the species, and found that the plant was still present in the southern portion of the reserve. However, the USFWS was able to conduct a comprehensive assessment of the population and estimate the number of individuals. Otherwise, population trends, demographic features, phenology, and demographic trends remain unknown.

López-Colon et al. (2007) found that the species does not depend on autogamy for pollination. Moreover, López-Colon et al. (2007) reported various pollinators for the species (i.e., Hymenopterans), suggesting that the species reproduction is dependent on interaction with pollinators. They also reported a low fruit (32%) set and highlighted the importance of natural pollinators for the long term conservation of the species. In addition, Marrero-Solís et al. (2007) reported higher flower buds production during October and February, with flower and fruit peaking in February and March. However, while the number of buds was high, the number of flowers and fruits was low, suggesting poor reproductive success, although this response might have been related to poor environmental conditions. López-Colon recommended further pollinations studies and an increase in the sample size to address the interactions with pollinators (López-Colon, UMET, pers comm., 2013).

b. Genetics, genetic variation, or trends in genetic variation

There is no new information on the genetics, genetic variation, or trends in genetic variation of the species.

c. Taxonomic classification or changes in nomenclature

No recent taxonomic or nomenclatural changes are known for the species. *Chamaecrista glandulosa* var. *mirabilis* is the name that is accepted in the recent treatments the flora of Puerto Rico (Axelrod 2011, Acevedo-Rodríguez and Strong 2012).

The genus *Chamaecrista* has sometimes been included in *Cassia*. The variety *mirabilis* was originally described as a distinct species, so the names *Chamaecrista mirabilis* (Pollard 1902), and *Cassia mirabilis* (Pollard, Urban 1905) have been used for this taxon in the past. Also, for convenience it is referred to as a "species" in this document.

d. Spatial distribution, trends in spatial distribution, or historic range

Chamaecrista glandulosa var. *mirabilis* is historically known from the main island of Puerto Rico (Figure 1). This taxon was reported from Vieques Island by Dr. George Proctor, former curator of the PRDNER herbarium, as he collected the species near Bahía Corcho in Vieques Island, east of Puerto Rico. However, Dr. Gary Breckon (former director of the MAPR herbarium) excluded it from his work on the Flora of Vieques, as he considers the specimen by Proctor as a misidentification. An additional specimen from Raunkiaer dated 1905-1906, collected in the U.S. Virgin Islands is cited by Axelrod (2011). However, based on the best available information this taxon remains endemic to white sand (siliceous) soils in northern Puerto Rico.

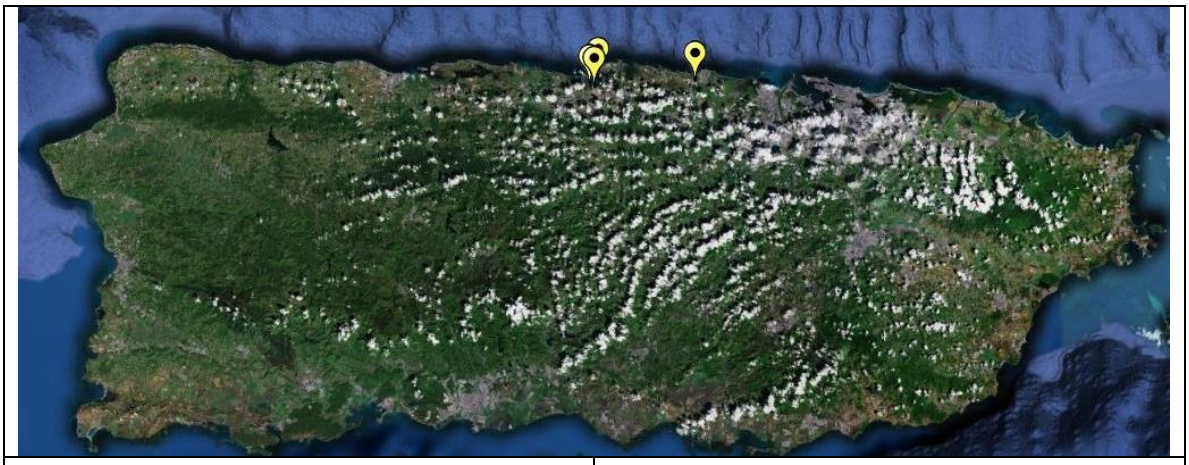


Figure 1. Reported known populations of *Chamaecrista glandulosa* var. *mirabilis* within northern Puerto Rico.

e. Habitat or ecosystem conditions

Chamaecrista glandulosa var. *mirabilis* occurs in the north central coastal plain within the subtropical moist forest life zone, where rainfall ranges from 1,100 to 2,200 mm (44-88 in) per year (Ewel and Whitmore 1973). As a coastal species, it is found in the lower rainfall range of this life zone in well-drained substrate.

The species has previously been reported as only occurring on white silica sands (Vivaldi and Woodbury 1980, USFWS 1994).

f. Other information

The Service is not aware of any other relevant information about *Chamaecrista glandulosa* var. *mirabilis.*

2. Five Factor Analysis

(a) Present or threatened destruction, modification or curtailment of its habitat or range:

At the time of listing, habitat modification for urban development and sand mining were identified as the main threats to the species. The northern coast of Puerto Rico between San Juan and Arecibo represents perhaps the most developed and disturbed area on the Island. This zone includes areas that harbors suitable habitat for the species. A variety of development activities (e.g., residential, commercial, highways, etc.) are ongoing, and protected areas on the northern coast are few and most are small. Moreover, other than the Tortuguero Lagoon Natural Reserve, there is no other natural reserve that includes siliceous sands habitat. Therefore, the limited distribution of *C. glandulosa var. mirabilis* and its substrate (suitable habitat), makes the species vulnerable to habitat destruction and modification. For example, one of the historical localities in the vicinity of Dorado is currently occupied by urban developments and a golf course. The little habitat available at this site is now encroached by urban development.

The fact that most known individuals of this taxon occur within the Tortuguero Lagoon Natural Reserve does not imply that these populations are fully protected. On June 26 and 27, 2013, a fire within this reserve burned about 200 individuals of the species (Valentín 2012). This kind of habitat modification not only directly affects individuals of *C. glandulosa var. mirabilis*, but also generates conditions favorable for the establishment of exotic plant species (See Factor E). The USFWS visited an area along the southern shore of the Tortuguero Lagoon on August 20, 2013, to assess the status and current threats to the species, and found that the plant was still present in the southern portion of the reserve. During this site visit, USFWS biologists were able to locate individuals of *C. glandulosa var. mirabilis*. However, ATV and mountain bikes tracks were found along the habitat of the species. These activities impact the species directly as bikers frequently ride out of the trails. These findings certainly indicate that the species is threatened by habitat destruction or modification due to improper use of the reserve by the public.

We believe the present or threatened destruction, modification, or curtailment of the species' habitat or range remains as a threat to *C. glandulosa var. mirabilis* since we have evidence of direct impacts to known natural populations within the Tortuguero Lagoon Natural Reserve, and other populations outside the reserve are subject to urban development.

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

Overutilization for commercial, recreational, scientific, or educational purposes was not identified as a threat to the species in the final listing rule. The USFWS

has no evidence that *C. glandulosa var. mirabilis* is being threatened by this factor. Therefore, this factor is not considered a current threat to the species.

(c) Disease or predation:

Disease or predation was not identified as a threat to the species at the time of listing. Based on the best available information, this Factor is not a current threat to *C. glandulosa var. mirabilis.*

(d) Inadequacy of existing regulatory mechanisms:

Tortuguero Lagoon Natural Reserve is a designated Critical Wildlife Area (CWA) for the the Commonwealth of Puerto Rico (protected by the PRDNER). The CWA designation constitutes a special recognition by the Commonwealth with the purpose of providing information to Commonwealth and Federal agencies about the conservation importance and needs of CWAs, and assisting permitting agencies in precluding negative impacts as a result of permit approvals or endorsements (Ventosa et al., PRDNER 2005).

The Commonwealth of Puerto Rico also approved Law No. 241 in 1999, known as *Nueva Ley de Vida Silvestre de Puerto Rico* (New Wildlife Law of Puerto Rico). The purpose of this law is to protect, conserve, and enhance both native and migratory wildlife species, declare as the property of Puerto Rico all wildlife species within its jurisdiction, regulate permits, hunting activities, and exotic species, among other activities. This law also has provisions to protect habitat for all wildlife species, including plants. In 2004, the PRDNER approved Regulation 6766, *Reglamento para Regir el Manejo de las Especies Vulnerables y en Peligro de Extinción en el Estado Libre Asociado de Puerto Rico* (Regulation 6766 to Regulate the Management of Threatened and Endangered Species in the Commonwealth of Puerto Rico). Article 2.06 of this regulation prohibits collecting, cutting, and removing, among other activities, listed plant individuals within the jurisdiction of Puerto Rico. *C. glandulosa var. mirabilis* was listed under Regulation 6766 as endangered.

Based on the existence of Commonwealth and Federal laws and regulations protecting listed species, we believe the inadequacy of existing regulatory mechanisms is no longer a threat to the species. However, as previously mentioned, *C. glandulosa var. mirabilis* extends to private lands. It is the Service's experience that enforcement of laws and regulations within private properties continues to be a challenge as accidental damage or extirpation of individuals has occurred due to lack of knowledge of the species by private landowners and law enforcement officers. Moreover, as mentioned under factor A, the populations within the Tortuguero Lagoon Natural Reserve are being affected by lack of enforcement within the reserve boundaries (i.e., unauthorized use of ATVs).

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

Flooding and Climate change. *Chamaecrista glandulosa* var. *mirabilis* is limited to coastal habitats consisting on white siliceous sands adjacent to wetland areas. Climate change is predicted to increase the frequency and strength of tropical storms and also to lead to a gradual rise in sea level. Vulnerability to climate change impacts is a function of sensitivity and exposure to those changes, and the adaptive capacity of the species (Glick et al. 2011). Therefore, shifts of vegetation communities are expected as temperatures and moisture regimes are altered by climate change. Under this scenario, the populations of *C. glandulosa var. mirabilis* may be displaced or outcompeted by native or exotic species with wider environmental plasticity. Even a small rise in sea level could represent a very serious threat to the taxon. The known populations and suitable habitat occurs adjacent to coastal wetlands adjacent to the Tortuguero Lagoon.

Sea level rise will also compromise natural recruitment by affecting seed germination and/or the survival of seedlings. Due to its limited range and limited substrate availability, flooding and climate change could likely have an adverse impact on the species as there may not be other areas that harbors suitable habitat for the displacement or colonization by the species. As previously mentioned under Factor A, some historical sites are now encroached by urban development, thus limiting the ability of the species to migrate or colonize other areas.

Despite the low number of populations and individuals of *C. glandulosa var. mirabilis*, at this time the Service considers flooding and climate change as moderate and non-imminent threats to the species. Climate change is occurring gradually and the frequency of severe hurricanes in Puerto Rico is low.

Invasive Plant Species. In 2013, the USFWS documented areas that harbor habitat for the taxon, are being lost due to changes in the structure of the vegetation. For example, areas that were open white sands with herbaceous vegetation in the 1990s are currently covered by tree species (i.e., *Anacardium occidentale* and *Chrysobalanus icaco*). *Chrysobalanus icaco* is a native species characteristic of coastal vegetation (including sand dunes). However, *A. occidentale* is native to northern South America and Brazil, and is showing an invasive pattern within *C. glandulosa var. mirabilis* habitat in Tortuguero Lagoon. *Melaleuca quiquenervia* is another exotic tree species that is already established on the reserve and poses a risk for the ecosystem (Hamilton 2013).

Based on the above, we consider invasive plant species as a high and imminent threat to *C. glandulosa var. mirabilis* and its habitat.

Human-Induced Fires. Fire is not a natural event in subtropical dry or moist forests in Puerto Rico. The vegetation in the Caribbean is not adapted to fires, because this disturbance does not naturally occur on these islands (Brandeis and Woodall 2008, Santiago-García et al. 2008). Human-induced fires could modify

the landscape by promoting nonnative trees and grasses, and by diminishing the seed bank of native species (Brandeis and Woodall 2008). In some cases, fires may maintain extensive areas of young forest and grasslands, slowing the recovery (regeneration) of ecosystems, and therefore, impairing the delivery of ecosystem services (Brandeis and Woodall 2008). Furthermore, the presence of non-native grasses increases the amount of fuel and the intensity of fires. It has been found that seedling mortality after fires is related to the differences on fuel loads and the different fire intensities (Santiago-García et al. 2008). Therefore, damage caused by fires to the ecosystems, particularly to juvenile plants, might be irreversible.

As previously mentioned under Factor A, on June 26 and 27, 2013 a fire at the Tortuguero Lagoon Natural Reserve burned about 200 individuals of *C. glandulosa* var. *mirabilis* (Valentín 2012). Due to the low number of populations and individuals of the species, we consider human-induced fires as high and non-imminent a threat to the species. A single fire event may extirpate an entire population.

Overall, climate change, invasive plant species, and human-induced fires are threats to *C. glandulosa* var. *mirabilis*. Due to the small number of populations, the cumulative effects by these threats are high in magnitude and imminent for this species.

3. Synthesis

In 1994 when the Recovery Plan for the *C. glandulosa var. mirabilis* was approved, 120-150 individuals were known from the Tortuguero Lagoon Natural Reserve area (Manatí and Vega Baja) in northern Puerto Rico. The occurrence of this taxon in this Reserve has been corroborated. However, there is no accurate estimate on the current number of individuals and populations trends of *C. glandulosa var. mirabilis.*

The Service has evidence of direct impacts to known natural populations within the Tortuguero Lagoon Natural Reserve due to the unauthorized use of ATVs within the Reserve. Moreover, in 2013 a fire within this reserve burned an estimated 200 individuals of the species in one of the known populations within Tortuguero Lagoon Natural Reserve. Due to the low number of populations and individuals of *C. glandulosa var. mirabilis,* the Service considers the threat by flooding and climate change as high in magnitude and imminent for this species. Moreover, in 2013, we documented that areas that harbor habitat for the taxon, are being lost due to changes in vegetation (i.e., invasion of habitat by *A. occidentale*).

In the absence of accurate data about the number of individuals and no long term monitoring of the populations, we believe the current status of *C. glandulosa* var. *mirabilis* is uncertain. We believe the species remains in danger of extinction due

to the small size of their populations and the above mentioned threats, particularly due to exotic invasive plants and human induced fires.

IV. RECOMMENDATIONS FOR FUTURE ACTION

1. The recovery of the species should focus primarily on the protection of natural known populations and its habitat. Studies and surveys should be conducted to locate and determine the current status of additional wild populations.

2. Efforts should be made to identify existing fragments of siliceous sands and to ensure their preservation and ecological restoration (i.e., through USFWS funded projects via the Coastal Program and Partners for Fish and Wildlife Program) should also be undertaken if appropriate sites are found.

3. A long term monitoring program should be established to determine population trends of the known populations.

4. Since the population dynamics of the species are poorly known, and we do not have enough information to determine what constitutes a viable population. Additional studies should be conducted on the species' phenology, reproductive biology and population structure.

5. Studies should be conducted on the patterns of genetic variation, in order to develop a plan to preserve the species' germplasm.

6. A signage and outreach program should be implemented to educate the users of the Tortuguero Lagoon Natural Reserve about the species and its habitat.

V. REFERENCES:

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Chamaecrista glandulosa* var. *mirabilis*

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change needed

Review Conducted By: Omar A. Monsegur, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 20 NOV 2014

REGIONAL OFFICE APPROVAL:

for

Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 1-7-15