# *Nesogenes rotensis*
# (No common name)

## 5-Year Review
## Summary and Evaluation

**U.S. Fish and Wildlife Service**
**Pacific Islands Fish and Wildlife Office**
**Honolulu, Hawaii**

# 5-YEAR REVIEW

**Species reviewed:** *Nesogenes rotensis* (No common name)

## TABLE OF CONTENTS

# 5-YEAR REVIEW
# *Nesogenes rotensis* (No common name)

## 1.0 GENERAL INFORMATION

### 1.1 Reviewers

**Lead Regional Office**:
Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia, (503) 231-2071

**Lead Field Office**:
Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808) 792-9400

**Cooperating Field Office(s)**:
N/A

**Cooperating Regional Office(s)**:
N/A

### 1.2 Methodology used to complete the review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on April 8, 2010. The review was based on the recovery plan for two plants from Rota (*Nesogenes rotensis* and *Osmoxylon mariannense*) (USFWS 2007), as well as a review of current, available information. The Bernice Pauahi Bishop Museum provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of Samuel Aruch, biological consultant, was reviewed by a recovery biologist and the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before submission to the Field Supervisor for approval.

### 1.3 Background:

#### 1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; 5-year review status of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth

of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

### 1.3.2 Listing history

Original Listing
**FR notice:** USFWS. 2004. Endangered and threatened wildlife and plants; determination of endangered status and prudency determination for designation of critical habitat for two plant species from the Commonwealth of the Northern Mariana Islands. Federal Register 69(68):18499-18507.
**Date listed:** April 08, 2004
**Entity listed:** Species
**Classification:** Endangered

Revised Listing, if applicable
**FR notice:** N/A
**Date listed:** N/A
**Entity listed:** N/A
**Classification:** N/A

### 1.3.3 Associated rulemakings:

USFWS. 2004a. Endangered and threatened wildlife and plants; determination of endangered status and prudency determination for designation of critical habitat for two plant species from the Commonwealth of the Northern Mariana Islands. Federal Register 69(68):18499-18507.

The designation of critical habitat for *Nesogenes rotensis* was prudent but not determinable at the time of listing due to a lack of information regarding the physical and biological features or specific areas essential to the conservation of the species (USFWS 2004a).

### 1.3.4 Review History:

Species status review [FY 2011 Recovery Data Call (August 2011)]: Declining

**Recovery achieved:**
1 (0-25%) (FY 2007 Recovery Data Call)

### 1.3.5 Species' Recovery Priority Number at start of this 5-year review:

2

### 1.3.6 Current Recovery Plan or Outline

**Name of plan or outline**: USFWS. 2007. Recovery plan for two plants from Rota (*Nesogenes rotensis* and *Osmoxylon mariannense*). U.S. Fish and Wildlife Service, Portland, Oregon. 86 pages. Available online at <http://pacific.fws.gov/ecoservices/endangered/recovery/default.htm>
**Date issued**: May 3, 2007
**Dates of previous revisions, if applicable**: N/A

## 2.0 REVIEW ANALYSIS

### 2.1 Application of the 1996 Distinct Population Segment (DPS) policy

#### 2.1.1 Is the species under review a vertebrate?

____ ***Yes***
__X__ ***No***

#### 2.1.2 Is the species under review listed as a DPS?

____ ***Yes***
__X__ ***No***

#### 2.1.3 Was the DPS listed prior to 1996?

____ ***Yes***
____ ***No***

##### 2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

____ ***Yes***
____ ***No***

##### 2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

____ ***Yes***
____ ***No***

#### 2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

____ ***Yes***
__X__ ***No***

### 2.2 Recovery Criteria

#### 2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

__X__ ***Yes***
____ ***No***

**2.2.2 Adequacy of recovery criteria.**

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

__X_ ***Yes***
____ ***No***

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

__X_ ***Yes***
____ ***No***

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

A synthesis of the threats (Listing Factors A, B, C, D, and E) affecting this species is presented in Section 2.3.2 and Table 2.

Downlisting and delisting objectives are provided in the recovery plan for two plants from Rota (USFWS 2007), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Nesogenes rotensis* is a short-lived perennial (USFWS 2007). *Nesogenes rotensis* will be considered for downlisting to threatened status when all of the following criteria are achieved and maintained for a minimum of 10 consecutive years: 1) A total of two populations of *Nesogenes rotensis* are naturally reproducing and stable, or increasing in numbers. Each population of *N. rotensis* must consist of at least 300 mature, reproducing individuals; 2) Sufficient habitat is protected and managed to achieve criterion 1 above; 3) Management and control of nonnative species by local, regional, Commonwealth, and Federal authorities are demonstrated to be successful and sufficient to achieve criterion 1 above.

This recovery objective has not been met.

*Nesogenes rotensis* may be considered for removal (delisting) from the Federal list of endangered and threatened wildlife and plants when all of the following criteria are achieved and maintained for a minimum of 10 consecutive years: 1) A total of four populations of *Nesogenes rotensis* are naturally reproducing and stable, or increasing in numbers. Each population of *N. rotensis* must consist of at least 300 mature, reproducing individuals; 2) Sufficient habitat is protected and managed

to achieve criterion 1 above; 3) Management and control of nonnative species by local, regional, Commonwealth, and Federal authorities are demonstrated to be successful and sufficient to achieve criterion 1 above.

This recovery objective has not been met.

## 2.3 Updated Information and Current Species Status

### 2.3.1 Biology and Habitat

#### 2.3.1.1 New information on the species' biology and life history:

*Nesogenes rotensis* is a perennial herbaceous species that typically produces several stems, but which can exhibit considerable annual dieback (Fosberg and Herbst 1983; USFWS 2007). Laura Williams (Naval Facilities Engineering Command Pacific, formerly from CNMI Division of Fish and Wildlife) reportedly observed the species flowering in November and May (Koob 2005), later reports have confirm flowering from March through May and in November (USFWS 2007). Fruiting has been confirmed for January, March, and November (USFWS 2007). The manner by which seeds are dispersed has not yet been documented (Koob 2005). The occasional upright habit of this species, which typically is more prostrate to somewhat ascending, may aid in pollen and seed dispersal (USFWS 2007).

#### 2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

*Nesogenes rotensis* is a low-growing herbaceous plant endemic to Rota. The species was originally described from Rota in Fosberg and Herbst (1983) not long after the small genus of approximately eight species (Mabberley 2008) was revised by Marais (1980). This species was known from a single collection at Haaniya Point (Poña Point Fishing Cliff), Palie area, Rota, when it was first collected and described by Fosberg and Herbst (1983). At the time of its collection, Herbst believed that fewer than 100 individuals were in the population (USFWS 2007). The next population count of about 20 individuals at Poña Point Fishing Cliff by Raulerson and Rinehart in 1994, likely was

from the same population that the type specimen was collected from, although this remains uncertain (USFWS 2007).

Biannual surveys of *Nesogenes rotensis* were commenced in 2000 at Poña Point Fishing Cliff, on the south-central part of Rota, and in June 2000 a population of 80 individuals was counted in an area of 800 square meters (960 square yards) (USFWS 2004a). Counts in May and November 2001 for this same population yielded 458 and 579 mature individuals, respectively. No individuals were observed in May or November 2003, following super typhoon Pongsona, which struck Rota in December of 2002. However, 34 mature individuals were observed in December 2003 by Laura Williams (USFWS 2007).

USFWS (2004a) noted that no surveys for *Nesogenes rotensis* had been undertaken in other coastal habitats on Rota that might provide similar habitat. Koob (2005) relocated the population at Poña Point Fishing Cliff and discovered a second population at Puntan Fina Atkos on the northeast edge of Rota in March 2005 (USFWS 2007), but has not revisited the site since (Gregory Koob, U.S. Department of Agriculture, pers. comm. 2010). Numerical counts for those populations were reported in USFWS (2007), and included an estimated 20 individuals from Poña Point Fishing Cliff (adults and seedlings) and about 15 to 20 individuals from Puntan Fina Atkos (also including adults and seedlings). Recent collecting activities in Micronesia by staff from the National Tropical Botanical Garden (Kauai) have not yielded new records (National Tropical Botanical Garden 2010). Population counts for *Nesogenes rotensis* have not been made since 2005.

**2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.)**:

No new information.

**2.3.1.4 Taxonomic classification or changes in nomenclature**:

The familial placement of *Nesogenes* has shifted between Verbenaceae, Chloanthaceae (Dicrastylidaceae, an illegitimate name), Nesogenaceae, and Orobanchaceae (Marais 1980; Fosberg and Herbst 1983; USFWS 2004a; Bennett and Matthews 2006). Considering that the stems and leaves are

green and photosynthetic, and because of molecular evidence for its inclusion in Orobanchaceae, a family of parasitic or hemiparasitic plants (Bennett and Matthews 2006), this species is almost assuredly hemiparasitic. Hemiparasitic species sequester nutrients from host species by means of haustoria, root-like extensions that penetrate the root system of the host species. Considering this and the reasons why *Nesogenes rotensis* occurs in such low numbers is unknown (USFWS 2007), determining what species it parasitizes is of high importance.

**2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.)**:

No new information.

**2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem)**:

*Nesogenes rotensis* is only known from two coastal sites on Rota, on rough karst (limestone) substrates on exposed cliffs that arise approximately 7.5 to 30.5 meters (about 25 to 100 feet) above the shoreline (Koob 2005; USFWS 2007). This species experiences scouring winds during stronger storms but likely are adapted to withstand such winds. The recovery plan (USFWS 2007) stressed the importance of determining more specific habitat requirements for this species.

At the type locality (Fosberg and Herbst 1983), the associated species were *Scaevola taccada* (*S. sericea*; nanoso), *Terminalia samoensis* (talisai ganu), *Hedyotis strigulosa* (paodedo), *Pogonatherum paniceum*, and *Bikkia tetrandra* (gausali) (common names from USFWS 2004b). Koob (2005) noted this species growing among *Scaevola taccada* and *Excoecaria agallocha* var. o*rthostichalis*.

**2.3.1.7 Other**:

No new information.

### 2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

#### 2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

**Threats:**

- Established ecosystem-altering invasive plant species degradation of habitat (USFWS 2007; Williams [in Koob 2005])
    - *Cassytha filiformis* (devil's gut)
    - *Casuarina equisetifolia* (iron wood)
- Agricultural and urban development – Considerable past alteration of the coastal habitat of *N. rotensis* by humans and anticipated future development (USFWS 2007).

#### 2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

No new information.

#### 2.3.2.3 Disease or predation:

None noted.

#### 2.3.2.4 Inadequacy of existing regulatory mechanisms:

**Threats:**

- *Nesogenes rotensis* is not yet protected under the Commonwealth of the Northern Mariana Islands (CNMI) Division of Fish and Wildlife list of protected wildlife and plant species as stated within the hunting regulations (CNMI Division of Fish 2012; P. Radley, CNMI Division of Fish and Wildlife, pers. comm. 2012). The species was federally listed as endangered in 2004 (USFWS 2004a).

#### 2.3.2.5 Other natural or manmade factors affecting its continued existence:

**Threats:**

- Human disturbance – Koob (2005) suggested that the habitat of *Nesogenes rotensis* is likely free of immediate

threats in light of its restricted occurrence on rough karst substrates, an area of little evident value for human use. However, the Poña Point Fishing Cliff population is located in a public park, where threats from humans include trampling from foot traffic and bonfires set by tourists or fisherman (USFWS 2007).

- Typhoons (USFWS 2007)
- Climate change may pose a threat to this species. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative (PICCC) has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

**Current conservation efforts:**

- Captive propagation for genetic storage and reintroduction – Attempts to propagate *Nesogenes rotensis* on Rota from seeds, cuttings, or transplanting have been unsuccessful (USFWS 2007). Seedlings transplanted from the wild into a nursery did not survive, even when they were sprayed with salt water (Koob 2005). A simple explanation for the lack of success in propagation may be that the species is hemiparasitic and requires a host species.
- Existing population management and restoration – The Puntan Fina Atkos population occurs in the I Chenchon Park conservation area, which was designated in 1994. Regulations are in place to limit human use and prohibit the removal of any plant life in the area.

## 2.4 Synthesis

The downlisting goals for this species have not been met, as there are only two populations of *Nesogenes rotensis* known to exist, with a current total population size estimated to be 30 to 40 individuals (Table 1). None of the populations contains more than 300 mature individuals. In addition, sufficient habitat has not been protected and managed, and management and control of nonnative species is not being conducted (Table 2). Therefore, *Nesogenes rotensis* meets the definition of endangered as it remains in danger of extinction throughout its range.

**Table 1. Status of *Nesogenes rotensis* from listing through 5-year review**.

| Date | No. wild individuals | No. outplanted | Downlisting Criteria identified in Recovery Plan | Downlisting Criteria Completed? |
|---|---|---|---|---|
| 2004 (listing) | 34 | 0 | 2 populations with 300 mature individuals each | No |
| | | | Sufficient habitat is protected and managed to achieve criterion | No |
| | | | Management and control of nonnative species | No |
| 2007(recovery plan) | 35-40 | 0 | 2 populations with 300 mature individuals each | No |
| | | | Sufficient habitat is protected and managed to achieve criterion | No |
| | | | Management and control of nonnative species | No |
| 2012 (5-year review) | 30-40 | 0 | 2 populations with 300 mature individuals each | No |
| | | | Sufficient habitat is protected and managed to achieve criterion | Partially (see Table 2) |
| | | | Management and control of nonnative species | No |

**Table 2. Threats to *Nesogenes rotensis* and ongoing conservation efforts.**

| Threat | Listing factor | Current Status | Conservation/ Management Efforts |
|---|---|---|---|
| Established ecosystem-altering invasive plant species degradation of habitat | A | Ongoing | No |
| Agricultural and urban development | A | Ongoing | No |
| Inadequacy of existing regulatory mechanisms | D | Ongoing | No |
| Human disturbance | E | Ongoing | Partially: Existing population management and restoration at Puntan Fina Atkos |
| Typhoons | E | Ongoing | No |
| Climate change | A, E | Increasing | No |

## 3.0 RESULTS

### 3.1 Recommended Classification:

**____ Downlist to Threatened**
**____ Uplist to Endangered**
**____ Delist**
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
**__X__ No change is needed**

### 3.2 New Recovery Priority Number:

**Brief Rationale:**

### 3.3 Listing and Reclassification Priority Number:

**Reclassification (from Threatened to Endangered) Priority Number: ____**
**Reclassification (from Endangered to Threatened) Priority Number: ____**
**Delisting (regardless of current classification) Priority Number: ____**

**Brief Rationale:**

## 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Captive propagation for genetic storage and reintroduction:
    - Continue to collect cuttings or seed from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation.
    - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation and storage.
- Captive propagation protocol development – Conduct studies to determine how to propagate the species and maintain the species in nurseries.
- Reintroduction / translocation protocol development – Maximize the genetic variation among individuals at each reintroduction site, based on microsatellite data and detailed information from crossing records.
- Reintroduction / translocation site identification – While surveying for new populations, determine which sites are least invaded by invasive introduced plant species and which appear to have the highest likelihood of maintaining new reintroductions.
- Population biology research:
    - Conduct research on the possible hemiparasitic nature of the species and determine its host species.
    - If the host species is determined, then reseed areas of suitable habitat where the host species is present, but where *Nesogenes rotensis* is lacking.
- Surveys / inventories – Conduct intensive surveys for *Nesogenes rotensis* in potentially suitable habitat on Rota to determine if additional populations exist.
- Population viability monitoring – Monitor annually the number of individuals in the Poña Point Fishing Cliff and Puntan Fina Atkos populations.
- Ecosystem-altering invasive plant species control – Monitor and control invasive nonnative plant species in the vicinity of both populations, paying particular attention to species not previously documented or those whose numbers appear to be increasing.
- Habitat requirements research – Conduct research on *Nesogenes rotensis* habitat requirements.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impact of urban development, typhoons, and human disturbance.
- Hunting regulation revisions – Revise the hunting regulations of CNMIs Division of Fish and Wildlife to add *Nesogenes rotensis* to the list of protected wildlife and plant species.

- Revise recovery criteria – Revise recovery plan and recovery criteria with any updated information.
- Alliance and partnership development – Work with Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Threats research – Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

## 5.0 REFERENCES


Bennett, J.R., and S. Mathews. 2006. Phylogeny of the parasitic plant family Orobanchaceae inferred from phytochrome A. American Journal of Botany 93:1039–1051.

Fosberg, F.R., and D. Herbst. 1983. A *Nesogenes* (Chloanthaceae) from Micronesia. *Micronesica* 19(1–2):11–15.

Koob, G.A. 2005. Mariana trip report. Memorandum dated 28 March 2005 and submitted to Christa Russell, Plant Conservation Coordinator, U.S. Fish and Wildlife Service. 15 pages. Unpublished.

Mabberley, D.J. 2008. Mabberley's plant-book: a portable dictionary of plants, their classification and uses. Third edition. Cambridge University Press, Cambridge. 1,021 pages.

Marais, W. 1980. Two new gamopetalous families, Cyclocheilaceae and Nesogenaceae, for extra-Australian 'Dicrastylidaceae'. Kew Bulletin 35(4):797–812.

National Tropical Botanical Garden. 2010. Herbarium database. Available online at <http://ntbg.org/herbarium/>. Accessed November 2010.

[USFWS] U.S. Fish and Wildlife Service. 2004a. Endangered and threatened wildlife and plants; determination of endangered status and prudency determination for designation of critical habitat for two plant species from the Commonwealth of the Northern Mariana Islands. Federal Register 69(68):18499-18507.

[USFWS] U.S. Fish and Wildlife Service. 2004b. Recovery outline for two plants from Rota, Commonwealth of the Northern Mariana Islands. U.S. Fish and Wildlife Service, Portland, Oregon. 11 pages.

[USFWS] U.S. Fish and Wildlife Service. 2007. Recovery plan for two plants from Rota (*Nesogenes rotensis* and *Osmoxylon mariannense*). U.S. Fish and Wildlife Service, Portland, Oregon. 86 pages. Available online at <http://pacific.fws.gov/ecoservices/endangered/recovery/default.htm>

**Personal communications:**

Koob, Gregory. 2010. State Biologist, U.S. Department of Agriculture-Natural Resources Conservation Service, Honolulu, Hawaii. E-mail to Neil Snow, Bishop Museum, dated December 6, 2010. Subject: *Nesogenes rotensis*.

Radley, Paul. 2012. Wildlife Biologist / Ornithologist, CNMI Division of Fish and Wildlife, Saipan, MP (CNMI). E-mail to Chelsie Javar, USFWS, Pacific Islands Fish and Wildlife Service, dated April 24, 2012. Subject: CNMI DFW hunting regulations.

**Signature Page**
**U.S. FISH AND WILDLIFE SERVICE**
**5-YEAR REVIEW of *Nesogenes rotensis* (No common name)**

Pre-1996 DPS listing still considered a listable entity? __N/A_____

Recommendation resulting from the 5-Year Review:

_____ Delisting
_____ Reclassify from Endangered to Threatened status
_____ Reclassify from Threatened to Endangered status
__X__ No Change in listing status

**Appropriate Listing/Reclassification Priority Number, if applicable**:_____

**Review Conducted By**:
Chelsie Javar, Fish and Wildlife Biologist
Marie Bruegmann, Plant Recovery Coordinator
Jess Newton, Endangered Species Recovery Program Leader
Kristi Young, Assistant Field Supervisor for Endangered Species

**Field Supervisor, Pacific Islands Fish and Wildlife Office**

for

Jess Newton Date 8/28/2012