

U.S. Fish and Wildlife Service

Recovery Outline for 23 Mariana Island Species



Bulbophyllum guamense (No common name)
Photo by: Guam Plant Extinction Prevention Program



Emoia sleveni (Slevin's skink)
Photo by: S. Medina/Guam Department of Agriculture



Partula gibba (Humped tree snail)
Photo by: J. Kwon, USFWS



Eugenia bryanii (No common name)
Photo by: L. Gutierrez

Scientific Name/ Common Name/ Chamorro Name/ Carolinian Name

INVERTEBRATES

Hypolimnas octocula marianensis/ Mariana eight-spot butterfly/ ababbang/ Libweibwogh

Vagrans egistina/ Mariana wandering butterfly/ ababbang/ Libweibwogh

Ischnura luta/ Rota blue damselfly/ dulalas Luta/ dulalas Luuta

Samoana fragilis/ Fragile tree snail/ akaleha dogas/ denden

Partula radiolata/ Guam tree snail/ akaleha/ denden

Partula gibba/ Humped tree snail/ akaleha/ denden

Partula langfordi/ Langford's tree snail/ akaleha/ denden

PLANTS

Eugenia bryanii/ No common name (NCN)

Hedyotis megalantha/ NCN/ pau dedu/ pao doodu

Heritiera longipetiolata/ NCN/ ufa halumtanu/ ufa halom tano

Phyllanthus saffordii/ NCN

Psychotria malaspinae/ aplokating palaoan (Chamorro and Carolinian name)

Solanum guamense/ Biringenas halumtanu/ birengenas halom tano

Tinospora homosepala/ NCN

Bulbophyllum guamense/ wild onion/ siboyas halumtanu/ siboyan halom tano

Dendrobium guamense/ NCN

Cycas micronesica/ fading/ faadang

Maesa walker/ NCN

Nervilia jacksoniae/ NCN

Tabernaemontana rotensis/ NCN

Tuberolabium guamense/ NCN

MAMMALS

Emballonura semicaudata rotensis/ Pacific sheath-tailed bat (Mariana subspecies)

/ paye'ye'/ paischeey

REPTILES

Emoia sleveni/ Slevin's skink/ gualiik halumtanu/ gholuuf

Listing Status and Date Endangered and Threatened; Oct. 1, 2015 (80 FR 59423)

Lead Agency/Region U.S. Fish and Wildlife Service, Pacific Region

Lead Field Office Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96850
808-792-9400

Purpose of the Recovery Outline: This document describes a preliminary course of action for the survival and recovery of 1 endangered mammal, 7 endangered plant, 1 endangered reptile, 7 endangered invertebrate, and 7 threatened plant taxa (hereafter 23 listed species) in the Mariana archipelago listed in 2015 (USFWS 2015) under the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 *et seq.*) (Table 1). Recovery outlines include background information about the species, previous conservation efforts, and a list of recovery actions needed to meet recovery criteria. This outline will address the recovery needs of 23 listed species found in the Mariana Islands, an archipelago of 15 main islands comprising 2 political entities, Guam and the Commonwealth of the Northern Mariana Islands, both U.S. Territories. To achieve recovery of these species, a recovery plan will be developed that will designate management units encompassing all or portions of the habitat on which the species depend. Recovery actions within these management units will be necessarily prioritized, as limited funding does not allow for management of all units or threats simultaneously. These species will be included in a comprehensive recovery plan addressing their needs.

This outline serves as interim guidance directing recovery efforts and informing consultation and permitting activities until a comprehensive recovery plan is completed. Recovery outlines are intended primarily for internal use by the U.S. Fish and Wildlife Service (Service); formal public participation will be invited with release of a draft recovery plan and the Service will consider any new information during the recovery planning process. For more information on Federal recovery efforts for the 23 listed species, or to provide comments, interested parties may contact the lead field office for these species at the above address and telephone number.

Table 1. Listing status, current status (*i.e.*, number of populations [# pops] and the estimated number of individuals [# individuals]), and distribution of the 23 listed species from the Mariana Islands.

Taxon	Listing Status	# Pops	# Individuals	Distribution ⁺
Plants				
<i>Bulbophyllum guamense</i>	Threatened	12	1,021 ^{1,2}	G, R, S, P
<i>Cycas micronesica</i>	Threatened	15	900,000 ³	G, R, P,*
<i>Dendrobium guamense</i>	Threatened	21	1,598 ^{1,4}	G, R, T, Agu, S, Agr
<i>Eugenia bryanii</i>	Endangered	5	2,420 ^{2,3}	G
<i>Hedyotis megalantha</i>	Endangered	1	1,000 ³	G
<i>Heritiera longipetiolata</i>	Endangered	10	1,394 ^{2,4,5,6}	G, S, T, R
<i>Maesa walkeri</i>	Threatened	5	738 ^{2,3,6}	G, R
<i>Nervilia jacksoniae</i>	Threatened	15	724 ^{2,3}	G, R
<i>Phyllanthus saffordii</i>	Endangered	4	1,400 ³	G
<i>Psychotria malaspinae</i>	Endangered	1	3	G
<i>Solanum guamense</i>	Endangered	1	1	G, R, S, T, Asu, Gug, M
<i>Tabernaemontana rotensis</i>	Threatened	7	22,413 ^{4,6}	G, R
<i>Tinospora homosepala</i>	Endangered	3	30 ³	G
<i>Tuberolabium guamense</i>	Threatened	7	8,770 ^{1,4,7}	G, R, T, Agu
Mammals				
<i>Emballonura semicaudata rotensis</i>	Endangered	1	359	Agu, G, R, T, S, Ana, M
Reptiles				
<i>Emoia slevini</i>	Endangered	9	unknown	C, Sar, Gug, P, Ala, Asu, G, R, T, Agu
Invertebrates				
<i>Hypolimnus octicula marianensis</i>	Endangered	6	unknown	G, S
<i>Ischnura luta</i>	Endangered	1	unknown	R
<i>Partula gibba</i>	Endangered	8	112 ⁸	G, R, Agu, Ala, P, Sar, S, T, Ana
<i>Partula langfordi</i>	Endangered	1	unknown	Agu
<i>Partula radiolata</i>	Endangered	20	645 ⁸	G
<i>Samoana fragilis</i>	Endangered	3	3 ⁸	G, R
<i>Vagrans egistina</i>	Endangered	1	unknown	R, G

Distribution: G = Guam; C = Cocos Island; R = Rota; Agu = Aguiguan; T = Tinian; S = Saipan; Agr = Agrihan; Ana = Anatahan; Ala = Alamagan; Asu = Asuncion; Gug = Guguan; M = Maug; Sar = Sarigan; P = Pagan

¹Zarones et al. 2015, ²JRM 2016, ³USFWS 2015, ⁴DON 2017, ⁵NAVFAC PAC 2018, ⁶GPEPP 2015, ⁷DON 2016, ⁸GPEPP 2015.

⁺Bolded islands indicate historical range (*i.e.*, taxa have been extirpated from islands in bold).

*Outplanted population of *Cycas micronesica* on Tinian.

Scope of Recovery and Available Information: The scope of this effort is at the island level. This recovery outline is based on the best available scientific data contained in the listing decision (USFWS 2015) and the proposed listing rule (USFWS 2014), as well as information in our files. Many of the threats to these species and their habitats are well understood and include habitat loss and degradation due to nonnative invasive plants, feral ungulates and other nonnative mammals, and predation by the nonnative brown treesnake (*Boiga irregularis*; BTS), predatory snails (*Euglandina rosea* and *Gonaxis* spp.) and a predatory flatworm (*Platydemus manokwari*). While some research has been conducted on the 23 listed species, little information beyond current status and existing threats is available. Additional research is needed to fully understand what is required for the recovery of these species, especially with regard to the effects of climate change on their distribution and habitats. Uncertainties associated with specific habitat needs and biology of these species will be resolved to the extent possible through the recovery process, and the recovery plan may need to be periodically updated. The recovery strategy will include recommendations to address these uncertainties with specific habitat needs and the biology of the species, and will contribute to adaptive management.

I. Overview

A. BIOLOGICAL ASSESSMENT

1. Species Description and Life History

The species descriptions and life history for the 23 listed species are contained in the final listing decision (USFWS 2015) and the proposed listing rule (USFWS 2014).

2. Historical and Current Population Status

Historical and current population status also are contained in the final listing decision (USFWS 2015) and the proposed listing rule (USFWS 2014) for the 23 species (Table 1). The location of Mariana Islands relative to each other is shown in Appendix 1.

3. Habitat Description and Landownership

The 23 listed species are known from 4 terrestrial ecosystems found in the Mariana Islands: forest, savanna, stream, and cave (Table 2). These species and their habitats occur on Federal, Territorial, and private lands. Of the 23 species, only the Pacific sheath-tailed bat is found in more than one habitat type (*i.e.*, forest and cave). Based on the best available data at the time of the listing decision, delineation of critical

habitat was not determinable (USFWS 2015); thus there is no critical habitat designated for these species.

4. Summary Biological Assessment

The 23 listed threatened and endangered species in this recovery outline face a variety of threats throughout their range. The current viability assessment for 19 of the 23 newly listed Mariana Islands species is moderate to low and 4 are highly vulnerable to extinction. The management of ecosystem-level threats such as development, ungulates, and invasive species remain challenging across the Mariana Islands.

Resiliency, Representation, and Redundancy:

Representation, Resiliency, and Redundancy (the 3Rs) comprise key characteristics that collectively contribute to a species' ability to sustain secure populations over the long term. When combined across populations, they measure the health of the species as a whole. The more we can identify and break down the constituent elements contributing to resiliency, representation, and redundancy, the better we can understand what contributes to, and is necessary for, the long-term health of a species. Representation contributes to the adaptability and evolutionary capacity of a species over time, to accommodate long-term issues like climate change. Resiliency speaks to an individual population's ability to tolerate environmental and demographic stochasticity, such as fluctuations in temperature or genetic drift. Redundancy contributes to the ability of population types to withstand catastrophic events (*e.g.*, hurricanes, wildfires). The 3Rs are interconnected and overlapping. For example, populations must be resilient to contribute to redundancy or representation. Likewise, redundant populations within a representative genotype or ecological setting contribute to the maintenance of the representation contributing to the species' adaptive and evolutionary capacities. Evaluation of the 3Rs for any species must be considered in the context of the species' life history and ecology.

- **Low to Moderate Resiliency**

With unregulated habitat destruction and modification by development and introduced plants and animals, as well as uncontrolled predation by introduced animals, most species occur in populations that have low resiliency to overcome environmental changes and stochastic events. Many of the species exist in small populations that exhibit low to moderate resilience, and remain vulnerable to extirpation. *Tabernaemontana rotensis* and *Cycas micronesica* exist in multiple populations with moderate numbers of individuals, and therefore exhibit moderate resilience. Additionally, climate change is likely to exacerbate typhoons and flooding (as a result of moderate increases in rainfall and increased intensity of storms), and will continue to threaten populations with extirpation.

- **Low to Moderate Redundancy**

With a current known distribution on only one island, the following plant species have low redundancy: *Eugenia bryanii*, *Hedyotis megalantha*, *Phyllanthus saffordii*, *Psychotria malaspinae*, *Solanum guamense*, and *Tinospora homosepala*. Plant species with moderate redundancy and current populations occurring on two islands include *Bulbophyllum guamense*, *Maesa walker*, *Nervilia jacksoniae*, *Tabernaemontana rotensis*, and *Tuberolabium guamense*. The sheath-tailed bat as well as the following invertebrate species only occur on one island and have low redundancy: *Hypolimnas octocula marianensis*, *Ischnura luta*, *Partula langfordi*, *Partula radiolata*, and *Vagrans egistina*. *Samoana fragilis* is considered to have moderate redundancy as it is found on two islands, Guam and Rota. For all species, populations are small and isolated and have a low to moderate probability of persistence.

- **Low Representation**

Low genetic diversity is known or assumed for the Rota blue damselfly, *Tinospora homosepala*, and the Pacific sheath-tailed bat. Other species assumed to be suffering from consequences of small population sizes, including inbreeding depression and low genetic diversity, include *Psychotria malaspinae*, *Solanum guamense*, Mariana eight-spot and wandering butterflies, and the Langford's, Guam, and fragile tree snails. Deforestation and invasive species have contributed to habitat loss and fragmentation, resulting in limited habitat on each island for these species. Overall representation is low due to the species having single populations with low to moderate resiliency and limited habitat.

The endangered Mariana wandering butterfly is considered extirpated on Guam and was last seen on Rota in 1995, although no recent surveys have specifically targeted the species. The endangered Langford's tree snail was last observed on the island of Aguiguan in 1995. On Guam, there is only one known individual of *Solanum guamense*, and one purported population of three individuals of *Psychotria malaspinae* (*P. malaspinae* is very difficult to differentiate from *P. hombroniana* and some experts question the identification of these individuals). Without active management (*i.e.*, habitat protection and predator control) and improved biosecurity measures, these four species are highly vulnerable to extinction.

While the best scientific information indicates the current and known historical distribution of many of these species is relatively small, it is very likely that many were much wider ranging prior to human colonization of the Mariana Islands. Systematic surveys are needed to assess the current distribution of these species and their habitat requirements; results may indicate that recovery areas for species should be expanded beyond their current distributions.

B. THREATS ASSESSMENT

1. Listing Factors/Primary Threats to the Species

As identified in the final listing rule (USFWS 2015), the threats to the 23 species and their habitats are deforestation, habitat modification and predation by introduced ungulates, habitat modification and competition by nonnative plant species, predation by rats and BTS, typhoons, effects related to small population dynamics, and effects due to climate change (Table 2). Species-specific threats include; ordnance, recreational vehicles, and water extraction. The non-native cycad aulacaspis scale insect (*Aulacaspis yasumatsui*) also threatens *Cycad micronesica* by causing mortality of all life stages, preventing reproduction. Climate change may exacerbate the effects of typhoons and flooding on the 23 species. Nonnative invertebrates are a threat to the four snail species. For all species, populations are small and isolated and genetic diversity is low or assumed to be low. A description of each of these threats is presented in the final listing rule (USFWS 2015); each is classified according to the five listing/delisting factors identified in section 4 of the ESA.

2. Summary Threats Assessment

No new threats have been identified since the listing rule was published (see Table 2).

Our analyses includes consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). “Climate” refers to the mean and variability of meteorological conditions (*e.g.*, temperature, precipitation) in a particular region over time, with 30 years being a typical period, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term “climate change” refers to a change in the mean or variability of one or more measures of climate that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Changes in climate can have direct or indirect effects on species and the effects can be positive, neutral, or negative and may change over time, depending on the species and other factors, such as potential interaction of climate and other variables (*e.g.*, habitat fragmentation) (IPCC 2007, pp. 8–14 and 18–19). Our analyses utilize expert judgment to weigh relevant information, including uncertainty, in considering how various aspects of climate change threaten the recovery of the species herein.

Most of these species are habitat specialists, have small ranges, and/or have limited dispersal abilities or opportunities. Together these traits make these species vulnerable to climate change. Several species are undergoing range contractions consistent with warming temperatures. Thus, it will be important to consider climate change as part of the threat analyses for the covered species. Applying climate modeling

and other tools to recovery planning will identify climate refugia and dispersal corridors between current and future habitat. This information will help identify management priorities for areas necessary for recovery in a warming climate.

Table 2. Summary of the ecosystems used by, and the threats affecting, the 23 listed species in the Marianas. Factor A = The present or threatened destruction, modification, or curtailment of the species habitat or range. Factor B = Over-utilization for commercial, recreational, scientific, or educational purposes. Factor C = Disease or predation. Factor D = Inadequacy of existing regulatory mechanisms. Factor E = Other natural or manmade factors affecting the species' continued existence.

Species	Ecosystem	Factor A					Factor B	Factor C			Factor D	Factor E	
		Development, military training, urbanization	Non-native animals	Non-native plants	Fire	Typhoons	Over-utilization	Predation / herbivory by ungulates	Predation / herbivory by nonnative vertebrates	Predation / herbivory by nonnative invertebrates	Inadequate existing regulatory mechanisms	Other Species-specific threats	Climate Change
<i>Bulbophyllum guamense</i>	FR	✓	R, BT	✓	✓	✓				S	✓		✓
<i>Cycas micronesica</i>	FR	✓	R, P, B, D, BT	✓	✓	✓		P, D		CAS	✓	O	✓
<i>Dendrobium guamense</i>	FR	✓	R, BT	✓	✓	✓				S	✓		✓
<i>Eugenia bryanii</i>	FR	✓	R, D, BT	✓		✓		D			✓		✓
<i>Hedyotis megalantha</i>	SV	✓	R, P, BT	✓	✓	✓					✓	RV	✓
<i>Heritiera longipetiolata</i>	FR	✓	R, P, B, D, BT	✓		✓		P, D			✓	O	✓
<i>Maesa walkeri</i>	FR	✓	R, P, B, D, BT	✓	✓	✓					✓		✓
<i>Nervilia jacksoniae</i>	FR	✓	P, B, D, R, BT	✓	✓	✓				S	✓		✓
<i>Phyllanthus saffordii</i>	SV	✓	R, P, BT	✓	✓	✓					✓	RV	✓
<i>Psychotria malaspinae</i>	FR	✓	R, P, B, D, BT	✓		✓		P, D			✓	L, O	✓
<i>Solanum guamense</i>	FR	✓	R, P, D, BT	✓		✓		P, D			✓	L	✓
<i>Tabernaemontana rotensis</i>	FR	✓	R, P, B, D, BT	✓	✓	✓					✓	O	✓

Table 2. continued.

Species	Ecosystem	Factor A				Factor B	Factor C			Factor D	Factor E		
		Development, military training, urbanization	Non-native animals	Non-native plants	Fire	Typhoons	Over-utilization	Predation / herbivory by ungulates	Predation / herbivory by nonnative vertebrates	Predation / herbivory by nonnative invertebrates	Inadequate existing regulatory mechanisms	Other Species- specific threats	Climate Change
<i>Tinospora homosepala</i>	FR		R, BT	✓		✓				✓	L	✓	
<i>Tuberolabium guamense</i>	FR	✓	R, BT	✓	✓	✓			S	✓		✓	
<i>Emballonura semicaudata rotensis</i>	FR, CA	✓	R, G			✓			R, BT, ML	✓	L	✓	
<i>Emoia slevini</i>	FR	✓	R, G, P,			✓			R, BT, ML	✓	O	✓	
<i>Hypolimnas octocula marianensis</i>	FR	✓	R, P, B, D, BT	✓		✓			A, W	✓	L, O	✓	
<i>Vagrans egistina</i>	FR		R			✓			A, W	✓	L	✓	
<i>Ischnura luta</i>	ST	✓		✓		✓				✓	L, WE	✓	
<i>Partula gibba</i>	FR	✓	R, G, P, B, C, D, BT	✓	✓	✓	✓		R	F	✓	O	✓
<i>Partula langfordi</i>	FR	✓	R, G	✓		✓	✓		R	F	✓	L	✓
<i>Partula radiolata</i>	FR	✓	R, P, B, D, BT	✓	✓	✓	✓		R	F	✓	L	✓
<i>Samoana fragilis</i>	FR	✓	R, P, B, D, BT	✓		✓	✓		R	F	✓	L	✓

Abbreviations used above: A = ants; B = water buffalo; BT = brown treesnake; C = cattle; CA = cave; CAS = scale; D = deer; F = Manokwari flatworm; FR = forest; G = goats; L = limited numbers; ML = monitor lizard; O = ordnance; P = pigs; R = rats; RV = recreational vehicles; S = slugs; ST = stream; SV = savanna; W = parasitic wasps; WE = water extraction.

C. CONSERVATION ASSESSMENT

1. Conservation Efforts

Conservation actions for the 23 newly listed species are summarized in the final listing decision (USFWS 2015) and the proposed listing rule (USFWS 2014). The University of Guam (UOG) has two programs that conduct recovery actions for endangered and threatened plant species on Guam, the Guam Plant Extinction Prevention Program (GPEPP) and the Center for Island Sustainability (CIS). The GPEPP is an island-wide program dedicated to preventing the extinction of Guam's plant species that have fewer than 200 individuals remaining in the wild by working with conservation partners to protect populations, preserve their genes off-site, and outplant plants to protected natural habitats. The CIS works with the UOG and government agencies to encourage responsible use of resources through educational campaigns to reduce waste, create green rooftops, encourage local food production, and support less destructive off-road driving. They also have worked with National Oceanic and Atmospheric Administration to replant badland areas in Guam's savanna to protect listed plants such as *Phyllanthus saffordii* and *Hedyotis megalantha*.

The Commonwealth of the Northern Mariana Islands (CNMI) Department of Land and Natural Resources is propagating *Tabernaemontana rotensis*, *Heritiera longipetiolata*, and *Serianthes nelsonii* for reintroduction on Rota. *Cycas micronesica* has been introduced to the island of Tinian, which is free of the cycad scale insect (*Aulacaspis yasumatsui*) and is outside of the species' current range.

The Department of Defense has agreed to implement a number of conservation actions associated with various ESA section 7 Biological Opinions or the Joint Region Marianas Draft Integrated Natural Resources Management Plan, which include:

- Proposed construction of 2,608 acres (ac) (1,055 hectares (ha)) of ungulate fencing on Guam and ungulate eradication in the area;
- Proposed construction of BTS/snake-proof fences to exclude BTS from up to 553 ac (224 ha) on Guam;
- Salvage of listed species to date including *Tuberolabium guamense* (6,257 individuals), *Bulbophyllum guamense* (71), *Dendrobium guamense* (20), *Cycas micronesica* (8), *Tabernaemontana rotensis*, *Heritiera longipetiolata*, eight-spot butterfly host plants, and all three listed snail species (100) that occur in areas to be developed and translocate to protected areas;
- Build a native plant nursery for the propagation of native and listed plants; and
- Ungulate control followed by *Lantana camara* management (*i.e.*, clearing areas of lanatana monoculture and planting native overstory or allowing native trees to regenerate naturally) on Aguiguan.

Multiple agencies are responsible for control of BTS where they already occur, and the prevention of snakes being transported to islands where they currently do not occur, including: the Service, USDA Wildlife Services, Guam Division of Aquatic and Wildlife Resources, and CNMI Division of Fish and Wildlife. Trapping, toxicants, hand-capture, canine detection, and exclusion by snake-proof barriers on both Guam and CNMI, all contribute to reducing snake populations in high-risk areas and to prevent snakes being accidentally transported to snake-free islands. These efforts are intended to reduce the effects of BTS as an ecosystem-altering invasive species which has directly or indirectly affected multiple listed species in the Mariana Islands. The BTS has been responsible for the extinction or extirpation of eight of Guam's 12 native forest birds and two of three of the island's native bat species (Savidge 1987, Rodda *et al.* 1997, Wiles *et al.* 2003). The Mariana crow (*Corvus kubaryi*), Guam Micronesian kingfisher (*Todiramphus c. cinnamominus*), and Guam rail (*Gallirallus owstoni*) only survive in captivity or on islands free of snakes; the Mariana swiftlet (*Aerodramus vanikorensis*) and Mariana fruit bat (*Pteropus mariannus mariannus*) still persist on Guam as well as on other islands in the archipelago.

2. Summary Conservation Assessment

Since the 2015 listing of the 23 species, new information has indicated that some species' populations (*e.g.*, orchids, *P. radiolata*, etc.) may be larger than originally thought, but threats remain. A lack of thorough information about distributions of all species and population sizes prevents effective recovery planning for these species. Additionally, many species-specific threats (*e.g.*, cycad scale, lack of dispersal, predatory flatworm, etc.) have been, and remain, difficult to adequately quantify and assess. However, some general conservation management efforts, such as ungulate fencing and eradication, and invasive plant and predator control, are likely to promote species recovery but will not negate all threats. Refining management protocols to minimize disturbance to sensitive areas, developing cost-effective conservation strategies, coordinating efforts among partners, and obtaining sufficient funding are critical to the recovery of all 23 listed species. Overall, the recovery prognosis is better for those species for which we have more thorough information, and for which we have learned about new populations or individuals since the listing.

II. Preliminary Recovery Strategy

A. RECOVERY PRIORITY NUMBERS

Recovery priority numbers (RPN) are assigned to species or subspecies based on the degree of threat, the potential for recovery, and their taxonomic status (*i.e.*, full species vs. subspecies) and range from 1C (highest, “C” indicating the potential for conflict with human economic activities) to 18 (lowest) (USFWS 1983a, 1983b). All of the species addressed herein have a high degree of threat to their habitat and continued existence (Table 2 above), and their associated RPNs are shown in Table 3 below.

Table 3. Summary of RPNs for each of the 23 listed species and the justification for each RPN based on the threat and recovery potential of each species.

Taxa	Species	RPN	Threat and Recovery Potential
Plant	<i>Psychotria malaspinae</i>	2	Full species with a high degree of threat and a high degree of recovery potential.
Plant	<i>Solanum guamense</i>	2	
Plant	<i>Tinospora homosepala</i>	2	
Plant	<i>Cycas micronesica</i>	5	Full species with a high degree of threat and a low degree of recovery potential.
Plant	<i>Heritiera longipetiolata</i>	5	
Invertebrate	<i>Ischnura luta</i>	5	
Invertebrate	<i>Partula landfordi</i>	5	
Invertebrate	<i>Partula radiolata</i>	5	
Invertebrate	<i>Samoana fragilis</i>	5	
Invertebrate	<i>Vagrans egistina</i>	5	
Invertebrate	<i>Ischnura luta</i>	5C	Full species with a high degree of threat and a low degree of recovery potential plus (C): anticipated conflict with development.
Mammal	<i>Emballonura semicaudata rotensis</i>	6	Subspecies with a high degree of threat and low recovery potential.
Invertebrate	<i>Hypolimnus octicula marianensis</i>	6	
Plant	<i>Bulbophyllum guamens</i>	8	Full species with a moderate degree of threat and a high recovery potential.
Plant	<i>Dendrobium guamense</i>	8	
Plant	<i>Eugenia bryanii</i>	8	
Plant	<i>Hedyotis megalantha</i>	8	
Plant	<i>Maesa walkeri</i>	8	
Plant	<i>Phyllanthus saffordii</i>	8	
Plant	<i>Tabernaemontana rotensis</i>	8	
Plant	<i>Tuberolabium guamense</i>	8	
Reptile	<i>Emoia slevini</i>	8	
Invertebrate	<i>Parula gibba</i>	8	

B. RECOVERY GOAL AND OBJECTIVES

The goal of the recovery program is to establish a framework within which recovery actions are undertaken to ensure the long-term survival of these 23 listed species, and to control or reduce the threats to the species to the extent that they no longer require the protections afforded by the ESA and therefore warrant delisting. Although subject to change, full recovery of the 23 species is currently envisioned as follows: viable populations will persist on protected and managed habitat throughout the species’ historical range in the Mariana Islands. Habitat loss and degradation and predation by nonnative species will be sufficiently mitigated to ensure a high probability of survival for at least 100 years. In fitting with the island-wide approach to recovery for these 23 species, the Service also will develop recovery objectives for each forthcoming management unit. The recovery plan will identify how a recovered island system will look on the landscape.

C. INITIAL RECOVERY ACTION PLAN

The goal of the initial phase of recovery will be to reverse the general population declines and increase the range of the 23 species. The objectives of the recovery plan will be to:

<i>Preliminary Recovery Actions</i>		
<i>Recovery Actions</i>	<i>Threats Addressed</i>	<i>Contributions to Recovery</i>
1. Protect habitats and control habitat-modifying threats		
1.1. Identify and survey remaining extant populations for all species and the habitats in which they occur	<ul style="list-style-type: none"> ● Habitat destruction and degradation ● Low numbers of individuals and populations 	Support viable populations and promote resiliency; prevent further declines in species’ demographic trends
1.2. Identify and prioritize areas necessary for recovery, including identifying critical habitat	<ul style="list-style-type: none"> ● Habitat destruction and degradation ● Low population numbers of individuals and populations 	Protect and maintain suitable habitat to support viable populations and promote resiliency, redundancy, and representation
1.3.1. Ensure long-term protection of species habitat - Control habitat-modifying invasive plant species	Habitat destruction and degradation by nonnative plant species	Protect and maintain suitable habitat to support viable populations and promote resiliency, redundancy, and representation
1.3.2. Ensure long-term protection of species habitat - Develop and implement control for ungulates	Habitat destruction and degradation by ungulates	Protect and maintain suitable habitat to support viable populations and promote resiliency, redundancy, and representation
1.3.3. Ensure long-term protection of species habitat - Protect priority recovery areas from human disturbance as necessary	Habitat destruction and degradation by agriculture/urban development	Protect and maintain suitable habitat to support viable populations and promote resiliency, redundancy, and representation

Recovery Outline for 23 Mariana Island Species • 2020

<i>Preliminary Recovery Actions</i>		
<i>Recovery Actions</i>	<i>Threats Addressed</i>	<i>Contributions to Recovery</i>
1.3.4. Ensure long-term protection of species habitat - Control BTS and other threats as appropriate	Habitat destruction and degradation by BTS; other	Protect and maintain suitable habitat to support viable populations and promote resiliency, redundancy, and representation
2. Control species-specific threats		
2.1. Implement ungulate control	Predation by ungulates	Increase individual survival and population resiliency
2.2. Implement nonnative vertebrate control	Predation by nonnative vertebrates	Increase individual survival and population resiliency
2.3. Implement nonnative invertebrate control for	Predation by nonnative invertebrates	Increase individual survival and population resiliency
2.4. Monitor success of predator control actions and use results to adapt management	Predation by ungulates, nonnative vertebrates and nonnative invertebrates	Increase individual survival and population resiliency
3. Conduct additional research essential for the management of threats from nonnative organisms		
3.1. Conduct studies on the range, demography, and dispersal of each nonnative species	<ul style="list-style-type: none"> ● Habitat destruction and degradation by BTS, ungulates and nonnative plants ● Predation by ungulates, nonnative vertebrates and nonnative invertebrates 	Protect and maintain suitable habitat to support viable populations and promote resiliency, redundancy, and representation
3.2. Evaluate research results and implement adaptive management as necessary	<ul style="list-style-type: none"> ● Habitat destruction and degradation by BTS, ungulates and nonnative plants ● Predation by ungulates, nonnative vertebrates and nonnative invertebrates 	Protect and maintain suitable habitat to support viable populations and promote resiliency, redundancy, and representation
4. Expand existing wild populations and establish additional populations to increase resilience, redundancy, and representation		
4.1. Conduct an assessment or feasibility study on translocation and controlled propagation for appropriate species	Low numbers of individuals and populations	Identify recovery options for the future
4.2. Select current populations for augmentation or sites for reintroduction	Low numbers of individuals and populations	Identify recovery options for the future
4.3. Prepare reintroduction sites within recovery areas	<ul style="list-style-type: none"> ● Habitat destruction and degradation by BTS, ungulates and nonnative plants ● Predation by ungulates, nonnative vertebrates and nonnative invertebrates 	Conserve recovery options for the future

Recovery Outline for 23 Mariana Island Species • 2020

<i>Preliminary Recovery Actions</i>		
<i>Recovery Actions</i>	<i>Threats Addressed</i>	<i>Contributions to Recovery</i>
4.4. Release genetically appropriate individuals	Low numbers of individuals and populations	Maintain or increase representation
4.5. Monitor success of releases and adapt management actions as appropriate	<ul style="list-style-type: none"> ● Habitat destruction and degradation by BTS, ungulates and nonnative plants ● Predation by ungulates, nonnative vertebrates and nonnative invertebrates ● Low population numbers 	Support viable populations and promote resiliency, redundancy, and representation
5. Develop regulations and policy essential to recover the species and their habitats		
5.1. Develop legislation to ensure protection of endangered species under Territorial law	Inadequacy of existing regulatory mechanisms	Protect suitable habitat to support viable populations and promote resiliency, redundancy, and representation
5.2. Develop and implement biosecurity plan to prevent the influx of new pests and invasive species into the Territory and inter-island movement of pests and invasive species	Inadequacy of existing regulatory mechanisms	Protect suitable habitat to support viable populations and promote resiliency, redundancy, and representation
6. Conduct additional research essential to recover the species and their habitats		
6.1. Conduct studies on the range, demography, and dispersal of each species	Low numbers of individuals and populations	Support viable populations and promote resiliency, redundancy, and representation
6.2. Evaluate research results and implement adaptive management as necessary	Low numbers of individuals and populations	Support viable populations and promote resiliency, redundancy, and representation
7. Develop and implement a detailed monitoring plan for each species	<ul style="list-style-type: none"> ● Habitat destruction and degradation by BTS, ungulates, nonnative plants ● Overcollection ● Predation by ungulates, nonnative vertebrates and nonnative invertebrates ● Inadequacy of existing regulatory mechanisms ● Low population numbers 	Protect suitable habitat to support viable populations and promote resiliency, redundancy, and representation
8. Improve stakeholder awareness and engagement through the development of a public information program for the 23 species	<ul style="list-style-type: none"> ● Habitat loss ● Habitat destruction and degradation by BTS, ungulates and nonnative plants ● Overcollection ● Predation by ungulates, nonnative vertebrates and nonnative invertebrates ● Inadequacy of existing regulatory mechanisms ● Low population numbers 	Protect suitable habitat to support viable populations and promote resiliency, redundancy and representation

<i>Preliminary Recovery Actions</i>		
<i>Recovery Actions</i>	<i>Threats Addressed</i>	<i>Contributions to Recovery</i>
9. Identify and work with stakeholders to achieve recovery actions	<ul style="list-style-type: none"> ● Habitat loss ● Habitat destruction and degradation by BTS, ungulates, nonnative plants ● Overcollection ● Predation by ungulates, nonnative vertebrates and nonnative invertebrates ● Inadequacy of existing regulatory mechanism ● Low population numbers 	Protect suitable habitat to support viable populations and promote resiliency, redundancy, and representation
10. Develop downlisting and delisting criteria at the species level as necessary to validate recovery objectives	Not applicable at this time (will be done during the development of the recovery plan)	

D. RECOVERY ACTIONS

The recovery effort for the 23 listed species should build on the conservation and monitoring efforts described above. Specific actions that should be taken or at least initiated early in the process include:

- Initiate control of habitat-modifying threats, such as ungulates and invasive nonnative plants, within the highest priority management units.
- Assess or confirm the distribution, current status, and potential future distribution of existing habitats and determine the most intact sites for management. Make use of landscape modeling, spatial analysis, remote sensing technology, and existing survey data to better understand species distributions and priority areas for targeting future surveys.
- Conduct systematic, island-wide surveys for additional populations of all 23 species.
- Protect all remaining extant populations by controlling species-specific threats as indicated in section C, Initial Recovery Action Plan, #2.
- Prevent the influx of new invasive species into recovery areas. Increase the efforts of the Guam Invasive Species Advisory Committee and Micronesia Regional Invasive Species Council (RISC) and improve border security.
- Prioritize research that will provide information and tools that will aid in ameliorating known threats and limiting factors of the species and habitats.
- Secure propagules for captive propagation for genetic storage and reintroduction.
- Increase outreach efforts and coordination with Territorial agencies, private landowners, and the military regarding habitat conservation. Promote

opportunities to assist in the recovery of these species through habitat conservation plans, safe harbor agreements, Federal action agency Section 7(a)(1) and 7(a)(2) consultation obligations under the ESA, and through various conservation partnerships funded by Territorial and Federal agencies and private organizations.

III. Preplanning Decisions

A. PLANNING APPROACH

A recovery plan for the 23 species in the Mariana archipelago that were listed in 2015 will be prepared pursuant to section 4(f) of the ESA. The Pacific Islands Fish and Wildlife Office will prepare the recovery plan.

B. INFORMATION MANAGEMENT

All information relevant to the recovery of the 23 species listed in 2015 will be housed in the Pacific Islands Fish and Wildlife Office's administrative files. The Recovery Program will be responsible for maintaining a complete administrative record for the recovery planning and implementation process for the species.

C. RECOVERY PLAN SCHEDULE

Public Review of Draft Recovery Plan	September 2021
Public Comment Period	60 days
Final Recovery Plan	September 2022

D. STAKEHOLDER INVOLVEMENT

Key stakeholders include:

- CNMI Department of Land and Natural Resources staff,
- Conservation organizations,
- Guam Aquatic and Wildlife Resources staff,
- Local entities and Federal agencies that own or manage lands occupied currently or historically by any of the 23 species or with habitat types suitable for establishing new populations,
- Native Chamorro and Carolinian groups,
- Outdoor sports and recreation organizations,
- Private landowners that own property currently or historically occupied by any of the 23 species or with habitat types suitable for establishing new populations, and
- University of Guam researchers.

E. STAKEHOLDER INVOLVEMENT STRATEGY

Landowners and land managers that may be affected by the listing and recovery of the 23 listed species will be invited to participate in the recovery planning process. A mailing list will be maintained and the Pacific Islands Fish and Wildlife Office will foster open and ongoing communications with all interested parties. Service biologists working on these species as well as other Mariana resource management issues will continue to develop strong working relationships with interested parties. Early in the recovery planning process, a meeting with interested stakeholders will be held to exchange status information, identify recovery issues, and to identify additional cooperators. Information from this meeting will provide the initial foundation to proceed with recovery planning and help identify private landowners who could participate in recovery efforts. Interested stakeholders will be asked to participate on an ongoing basis, in the recovery planning and implementation effort. All opportunities to work with stakeholders in a productive and meaningful way will be explored to develop the recovery planning process. Stakeholders will be afforded an opportunity to review and comment on a draft of the recovery plan per the ESA. Stakeholders also may be asked to contribute directly in developing recovery implementation strategies. Strong working relationships with experts and stakeholders will be developed and maintained.

Approved:

ACTING



Regional Director
U.S. Fish and Wildlife Service

3 Feb 2020
Date

Citation

U.S. Fish and Wildlife Service. 2020. Recovery outline for 23 Mariana Island Species. Portland, Oregon. 22 pp. + appendices.

References:

- [DON] Department of the Navy. 2016. Pre-construction High Value Tree (HVT) Surveys of J-001B Utilities and Site Improvements Phase I, Naval Base Guam Telecommunication Site, Guam. 11 pp.
- [DON] Department of the Navy. 2017. Revised Biological Assessment for the Marine Corps Relocation from Okinawa to Guam. Prepared for: U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii. 190 pp. Honolulu, HI.
- [GPEPP] Guam Plant Extinction Prevention Program. 2015. PROGRESS REPORT PIFWO Consolidated Funding FY 2014 and 2015 Reporting period 02-01-2014 until 07-31-2015. 24 pp.
- Myounghee Noh and Assoc. 2014. Final report for Haputo Partulid snail predation study. Haputo Ecological Reserve Area. Finegayan, Guam. 50 pp.
- [NAVFAC PAC] Naval Facilities Engineering Command, Pacific. 2018. Final Survey Report. Endangered Species Act-listed Plant Surveys on Tinian in Support of the Commonwealth of the Northern Mariana Islands Joint Military Training Environmental Impact Statement/ Overseas Environmental Impact Statement. 170 pp.
- [JRM] Joint Region Marianas. 2016. Plant surveys: Joint Region Marianas, University of Guam. 95 pp.
- Rodda, G. H., T. H. Fritts, and D. Chiszar. 1997. The Disappearance of Guam's wildlife. *BioScience* 47:565-574.
- Savidge, J. A. 1987. Extinction on an island forest avifauna by an introduced snake. *Ecology* 68:660-668.
- [USFWS] U.S. Fish and Wildlife Service. 1983a. Endangered and threatened species listing and recovery priority guidance. *Federal Register* 48:43,098-43,105.
- [USFWS] U.S. Fish and Wildlife Service. 1983b. Endangered and threatened species listing and recovery priority guidelines correction. *Federal Register* 48:51,985.
- [USFWS] U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Proposed Endangered Status for 21 Species and Proposed Threatened Status for 2 Species in Guam and the Commonwealth of the Northern Mariana Islands; Proposed Rule. *Federal Register* 79: 59363-59413.
- [USFWS] U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Endangered Status for 16 Species and Threatened Status for 7 Species in Micronesia. Final Rule. *Federal Register* 80:59423- 59497.

- Wiles, G. J., J. Bart, R. E. Beck, Jr., and C. F. Aguon. 2003. Impacts of the brown tree snake: patterns of decline and species persistence in Guam's avifauna. *Conservation Biology* 17:1350-1360.
- Zarones, L., J. Liske-Clark, T. Willsey, and R. Ulloa. 2015. Preliminary survey of three Mariana Island endemic epiphytic orchids *Dendrobium guamense*, *Bulbophyllum guamense* and *Tuberolabium guamense* on Rota, CNMI. Saipan Division of Fish and Wildlife and Department of Lands and Natural Resources, Commonwealth of the Northern Mariana Islands. 16 pp.

Appendix 1. Map of the Mariana Islands

