

Biological Opinion for Brown Treesnake Control within Mariana Swiftlet (*Aerodramus bartschi*) Occupied Caves, Naval Base Guam



Photo Credit: U.S. Fish and Wildlife Service



**February 22, 2024
(2023-0133592)**



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
2023-0133592

February 22, 2024

Mr. Edward E. Moon
Installation Environmental Program Director
U.S. Naval Base Guam
PSC 455 Box 152
FPO AP 96540-1000

Subject: Biological Opinion for Brown Treesnake Control within Mariana Swiftlet
(*Aerodramus bartschi*) Occupied Caves, Naval Base Guam

Dear Mr. Moon:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) based on our review of the U.S. Department of the Navy's proposed brown treesnake (*Boiga irregularis*) visual surveys and removal efforts in three caves on Naval Base Guam and their effects to the federally endangered Mariana swiftlet (yâyaguak, *Aerodramus bartschi*), in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your request for formal consultation was received on October 12, 2023.

This biological opinion is based on information provided in your informal consultation request dated September 26, 2023, a Microsoft Teams call of August 17, 2023, and email correspondence of August 18, 2023, and November 2, 2023, between Mariana Islands Team Manager Jacqueline Flores and Biologists Dawn Bruns and Lauren Taylor of the Service, and Brown Treesnake Program Project Manager Leanne Obra and Conservation Resources Program Manager Coralie Cobb of Naval Facilities Engineering Command (NAVFAC) Marianas, and other sources of information. A complete administrative record of this consultation is on file at our office.

On July 5, 2022, the U.S. District Court of the Northern District Court of California vacated the 2019 regulations implementing section 7 of the Endangered Species Act. On September 21, 2022, the Ninth Circuit Court of Appeals granted a request to stay the U.S. District Court of Northern California's July 5, 2022, order that vacated the 2019 Act's regulations. As a result, the

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2019 regulations are again in effect, and the Service has relied upon the 2019 regulations in rendering this biological opinion. However, because the outcome of the legal challenges to the 2019 Act regulations is still unknown, we considered whether our substantive analyses and conclusions in this consultation would have been different if the pre-2019 regulations were applied. Our analysis included the prior definition of “effects of the action,” among other prior terms and provisions. We considered all the “direct and indirect effects” and the “interrelated and interdependent activities” when determining the “effects of the action.” As a result, we determined the substantive analysis and conclusions would have been the same, irrespective of which regulations applied.

Consultation History

October 12, 2023: The U.S. Department of the Navy requested initiation of formal consultation.

November 8, 2023: The Service transmitted a letter to the U.S. Department of the Navy acknowledging initiation of formal consultation and confirming all information required to initiate consultation was provided in the consultation request or otherwise accessible for consideration and reference. ECOSphere number 2023-0133592 was assigned to the project.

January 22, 2024: The Service transmitted the draft biological opinion to the Department of the Navy.

February 13, 2024: The Department of the Navy provided the Service with comments on the draft biological opinion.

BIOLOGICAL OPINION

Description of the Proposed Action

The Department of the Navy proposes to conduct brown treesnake visual surveys and removal efforts inside three Mariana swiftlet-occupied caves—Mahlac Cave, Maemong Cave, and Fachi Cave—as a management action to reduce brown treesnake predation of the swiftlet population on Naval Base Guam. Data collected from the proposed brown treesnake removal efforts will be used as part of a larger research program aimed at understanding the swiftlet’s response to brown treesnake control, swiftlet population dynamics, and factors affecting swiftlet cave occupancy.

The proposed action will consist of in-cave brown treesnake visual surveys and removal efforts performed by a two-person team entering each cave once per week, for a total of up to 52 visits per cave, per calendar year (365 days). The project is scheduled to begin March 1, 2024, and will continue for up to ten years until March 1, 2034. Visual surveys will begin 30 minutes after sunset and work will last approximately 60 to 90 minutes per visit. The biologists will scan the cave opening, walls, ceilings, and floors using binocular night vision goggles (model ATN PS15-4) fitted with an infrared light emitting diode (LED) video light (model Sima SL-IOOIR) to

reduce light disturbance to swiftlets while surveys are conducted. Because brown treesnakes are nocturnal, work will occur at night, when the Mariana swiftlets are at their cave roosts and nests.

Headlamps with red filters/lenses will be used when capturing snakes. No white light will be used near cave entrances or within caves. When a brown treesnake is detected, the biologists will record its behavior, capture location, height above ground, and distance from the nearest swiftlets, using the methods in Klug and Yackel Adams (2017, pp. 7–9). Reasonable efforts will be made to capture any brown treesnakes detected, but data on individuals that escape capture will also be collected. Snakes will be captured using an extendable pole. The maximum height of snake captures will be the length of the extendable pole, up to approximately 25 feet (7.6 meters) above ground. Captured brown treesnakes will later be necropsied offsite to evaluate gut contents.

The following measures will be taken to reduce project disturbance to roosting and nesting Mariana swiftlets:

1. Only qualified biologists will conduct in-cave brown treesnake visual surveys and removal efforts. Qualified biologists will have conducted at a minimum five 90-minute in-cave visual surveys, accompanied by a NAVFAC or U.S. Geological Survey (USGS) biologist with at least one year of experience conducting visual surveys and removal efforts in swiftlet-occupied caves.
2. The number of people inside the cave during surveys will be limited to two.
3. Biologists will conduct activities outside the cave entrances as appropriate (i.e., preparation of equipment, etc.) and keep their voices down, speaking in a light whisper when near the caves.
4. Upon arrival at the caves, the biologists will sit quietly outside the cave for five minutes to minimize disturbance created during the approach.
5. Approaching the cave, the biologists will move slowly and quietly and position themselves at a location that provides optimal view of the birds, cave walls, and the floor, prior to entering.
6. Entering the cave, biologists will mute communication, move cautiously, and remove any snail shells, rocks, or debris on the cave floor or walls, to limit sound production when walking and moving in the cave.
7. Only night vision scopes, headlamps, and flashlights with red filters/lenses will be used while inside the cave.
8. Biologists will communicate using hand signals and minimize movement by moving cautiously and slowly during the up to 90-minute survey, carefully watching their footing so as not to make loud noises by stepping on or knocking over debris and rocks.
9. When a brown treesnake is observed in a cave where it is accessible for capture, and can be reached with minimal sound production (i.e., no climbing or moving of objects), one biologist will use the extendable pole to capture and collect the snake, while the other biologist will provide the bag for the captured snake.
10. Biologists will monitor the response of the Mariana swiftlets when humans are near or

within swiftlet-occupied caves. This may include, but is not limited to, biologists compiling and describing behaviors they observe in the swiftlets and counting the number of times a certain behavior is exhibited.

If disturbance beyond minor flushing of swiftlets within the cave is observed, project activities will be put on hold and the Service will be contacted to determine if project activities should be adapted.

Action Area

The action area is defined at 50 CFR 402.02 as “all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action.” The Service has determined that the action area for this proposed project is the entrances and interior areas of the Mahlac, Maemong, and Fachi caves on Guam. The specific locations of the caves are withheld to conserve the Mariana swiftlets and protect culturally important sites from vandalism.

Analytical Framework for the Jeopardy Analysis

In accordance with regulation (see 84 FR 44976), the jeopardy determination in this biological opinion relies on the following four components:

1. The *Status of the Species*, which evaluates the species’ current range wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species’ current range wide population is likely to persist while retaining the potential for recovery or is not viable;
2. The *Environmental Baseline*, which evaluates the current condition of the species in the action area relative to its reproduction, numbers, and distribution absent the consequences of the proposed action; the factors responsible for that condition; and the relationship of the action area to the survival and recovery of the species;
3. The *Effects of the Action*, which evaluates all future consequences to the species that are reasonably certain to be caused by the proposed action, including the consequences of other activities that are caused by the proposed action, and how those impacts are likely to influence the survival and recovery role of the action area for the species; and
4. *Cumulative Effects*, which evaluates the consequences of future, non-federal activities reasonably certain to occur in the action area on the species, and how those impacts are likely to influence the survival and recovery role of the action area for the species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the consequences of the proposed federal action in the context of the species’ current range wide

status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The key to making this finding is clearly establishing the role of the action area in the conservation of the species as a whole, and how the effects of the proposed action, taken together with cumulative effects, are likely to alter that role and the continued existence (i.e., survival) of the species.

Status of the Mariana Swiftlet

Species description

The Mariana swiftlet was listed as endangered in 1984 (49 FR 33881, August 27, 1984). No critical habitat has been designated for the species.

The Mariana swiftlet is a small swift with dark grayish brown plumage that is sooty black on the upper parts and paler on the underparts and rump. Some white is present at the base of the feathers in the loreal region, and the plumage of both sexes is alike. The face is marked by a dark line through the eye, and the irises are dark hazel. The tarsi are naked and average 0.4 inches (in [10.4 millimeters]) long and the tail is squared without spines. The wing averages 4.3 in (108 millimeters [mm]) long, the tail, 2.1 in (52.3 mm) long, and the exposed culmen (bridge of beak), only 0.2 in (4 mm) long. The wingspan reaches 9.2 in (233 mm) wide and the wing and tail lengths are greater than 94 percent of the adult size at fledging (ECOS 2023). The birds weigh between 6.4 and 9 grams, with an average weight of 7.4 grams.

The Mariana swiftlet is a member of the Apodidae family, and the only resident swift in the Mariana Islands. The species was first described as *Collocalia fuciphaga* by Oustalet in 1895 (Johnson 2015, p. 5) and has since received many changes in taxonomy and nomenclature in the literature. Notable variations include the Guam island swiftlet (*C. bartschi*) by Mearns in 1909, the edible nest swiftlet (*C. inexpectata bartschi*) by Mayr in 1945, the Guam swiftlet (*C. vanikorensis bartschi*) by Sibley and Monroe in 1990, and the gray swiftlet (*A. vanikorensis bartschi*) by Jenkins in 1983 (Johnson 2015, pp. 5–6). While the Service originally listed the species as the Vanikoro swiftlet (*A. vanikorensis bartschi*) following Medway's 1966 taxonomic approach, it adopted the common name Mariana gray swiftlet in 2019 (USFWS 2019, entire). In 2023, the Service recognized the species as the Mariana swiftlet (*Aerodramus bartschi*), which remains the accepted taxonomy (USFWS 2023, entire). The Mariana swiftlet is endemic to Guam, Rota, Aguiguan, Tinian, and Saipan in the Mariana Islands.

Life history

The species is colonial and belongs to a genus of swiftlets with the unusual ability to echolocate, enabling them to navigate, roost, and nest as groups in dark caves. Echolocating swiftlets make an audible monotonic, rapid clicking signal (USFWS 1991, p. 2). Mariana swiftlets generally depart their caves at sunrise to forage and return to the caves at sunset, but may return to roost periodically during the daytime. The swiftlets feed on a diet of small insects caught while flying over a variety of terrain and vegetation types and can be observed foraging over ridge crests,

forest edges, emergent trees, open grassy areas, and near streams (USFWS 1991, p. 6; Morton and Amidon 1996, p. 3). A study of the Mariana swiftlet's diet compared to the relative abundance of prey insects in Saipan suggested the swiftlets may seek out concentrations of pulsing flying insects as a foraging strategy at different times of the year (Kershner et al. 2007, p. 21). Morton and Amidon (1996, p. 7) observed swiftlets in Guam to "feed into the wind" and then return to the cave on the downwind, and noted seasonal shifts in foraging habitat. Cave guano in Saipan and Aguiguan has shown the swiftlets commonly eat flying ants (Formicidae), parasitoid wasps (Chalcidoidea), beetles (Coleoptera), and aphids (Homoptera) (Kershner et al. 2007, p. 12; Valdez et al. 2011, pp. 304–305).

The Mariana swiftlet occupies caves naturally formed from solution cavities in limestone. All known occupied caves have fresh, breathable air and one or two entrances of at least 6.5 feet (2 meters) high. Caves are occupied by the colony year-round. Outside of the caves the swiftlets have not been observed to alight on trees or other perches. At sunset, flocks of swiftlets circle over the cave entrances, twittering excitedly. At first a few birds will dive into the cave, passing others that are flying out for a last foraging flight. At twilight, the flock begins streaming into the entrance emitting a "deafening chorus" of clicks as each bird searches for a nocturnal roost by echolocating (USFWS 1991, p. 6). Most swiftlets have returned to their caves by the time the night sky is completely dark, although the birds may enter or exit the cave during the night (Johnson 2015, p. 45). The species roosts and nests in the highest, darkest parts of the cave, usually in clefts in the roof, overhanging walls, or stalactites (USFWS 1991, p. 2), areas difficult to access by predators (see Figure 1). Mariana swiftlets may go into torpor as sleeping swiftlets have been observed to be slow to awaken (USFWS 1991, p. 6).

Population dynamics

Breeding occurs year-round, with the peak breeding season between May and September in Saipan, and February and October in Guam (Johnson et al. 2017, p. 368). The cup shaped nests of the swiftlet are made of plant material held together and glued to the cave walls or roof with the birds' sticky saliva. In Guam the primary nest material is *Neckeropsis lepiniana* moss (Jenkins 1983 in Reichel et al. 2007, p. 688) which grows near the caves. Swiftlet nests can also be made of ferns and liverworts (Johnson 2015, p. 81). Female Mariana swiftlets lay a single white egg on average 0.72 in (18.21 mm) in length which is incubated for approximately 17 to 30 days, after which a naked nestling hatches, devoid of any natal down (Reichel et al. 2007, p. 687; Johnson 2015, p. 67). The nestlings grow slowly, and fledging occurs after nearly seven weeks (Reichel et al. 2007, p. 687; Johnson 2015, p. 67). Both adults care for the nestling which is fed between one and four times per day; once fledged, some fledglings roost near their natal nest for an extended period of time (Morton and Amidon 1996, p. 9). Nest success is approximately 63 percent, with over half of nest failures attributed to eggs knocked to the cave floor (Johnson 2015, p. 67). The swiftlets re-lay on average between 11 and 18 days after a fledged or failed nest (Johnson 2015, p. 83).

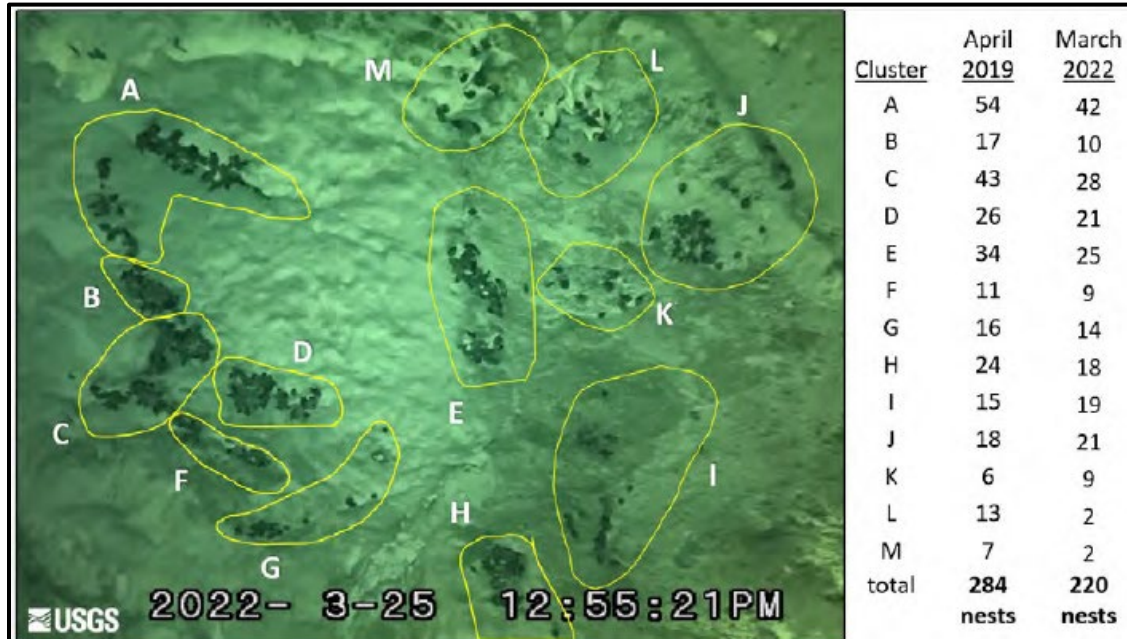


Figure 1. Mariana swiftlet nests on the walls and roof of a limestone cave (USGS-PIERC in Obra 2023, in litt., p. 6).

The natural lifespan of the Mariana swiftlet is unknown, but other swiftlet species are long-lived, with lifespans of 9 to 12 years recorded (Reichel et al. 2007, p. 689).

Status and distribution

The current range wide population estimate for the Mariana swiftlet is approximately 5,155 swiftlets comprised of 3,817 individuals in 9 colonies on Saipan, up to 1,000 individuals in 3 colonies on Guam, and 338 individuals in 3 colonies on Aguiguan (Johnson et al. 2018, pp. 28–31; USFWS 2020, p. 6). While the Mariana swiftlet is endemic to Guam, Rota, Aguiguan, Tinian, and Saipan, the species has declined on all islands and is believed extirpated from Rota and Tinian (USFWS 1991, pp. 7–19; Cruz et al. 2008, entire; Valdez et al. 2011, p. 301).

Table 1. Trends in status of the Mariana swiftlet (adapted from Table 1 in USFWS 2020 and all references herein).

Year	Number of Individuals
1984 (listing)	50 on Guam, numbers on Aguiguan may be stable, and declining on Saipan
1991 (recovery plan)	400 on Guam, 970 on Aguiguan, and 3,160 on Saipan
2010 (5-year review)	>5,000 individuals, with the majority on Saipan (>5,000), <500 on Aguiguan, and 900–1,150 birds on Guam

2015 (5-year review)	Approximately 6,750 individuals, >5,000 on Saipan, 1,000 on Guam and 300-400 on Aguiguan
2020 (5-year review)	Approximately 5,200 individuals, over 3,817 on Saipan, 1,000 on Guam, and 338 on Aguiguan

At the time of listing most historical information on the Mariana swiftlet came from Guam, and data from the Northern Mariana Islands was absent or lacking. Prior to 1965, the species was common in Guam, and roadside counts in 1945 found the Mariana swiftlet to be the third most abundant species (USFWS 1991, p. 7 and all references herein). The species began a precipitous decline in the mid-1960s continuing through the early 1970s, and “all known swiftlet caves were deserted by the late 1970s” in Guam (USFWS 1991, p. 7). Through the 1980s occasional sightings were made mainly in southern Guam and more rarely at northern Guam coastlines, and surveys by the Guam Department of Agriculture, Division of Aquatic and Wildlife Resources (DAWR) found only Mahlac Cave to be occupied, with another 8 caves of the 24 surveyed showing evidence of former occupation (USFWS 1991, p. 8). In 1987 the population at Mahlac Cave was estimated to be 400 individuals. In 2010, 900 swiftlets were estimated on Guam, increasing to 1,549 swiftlets in the three now-occupied caves, and subsequently decreasing to approximately 1,000 swiftlets in 2020 (Johnson et al. 2018, pp. 29–30; USFWS 2020, p. 2). Obra (2023, in litt., p. 5) reports that during this time, from 2005 to 2016, an increasing population trend was observed at the three swiftlet occupied caves, as well as an expansion of the nesting areas on cave roofs and walls, correlating with the outlay of brown treesnake control at the caves. Trapping continued through 2019; from 2019 to 2022 there was a decrease in both the swiftlet population and number of nests.

Numbers of swiftlets have steadily declined on Aguiguan from the time of listing. In 1982 an estimated 1,022 inhabited the small island at the highest density in the Marianas. The species was observed throughout the island but most commonly along the cliffs at the island’s summit (USFWS 1991, p. 11). Five known occupied caves were identified in 1985: Aguijan, Guano, Pillar, Cliff, Landing, and Black Noddy Caves. At the largest cave, Guano Cave, the Pacific sheath-tailed bat (*Emballonura semicaudata rotensis*) coexisted with the Mariana swiftlet. A resurvey of the five caves in 2000 detected 408 swiftlets. At least seven caves have historically been occupied in Aguiguan; in 2016, three of these caves were surveyed for a population estimate of 338 swiftlets (Johnson et al. 2018, pp. 28–29).

Saipan’s population of Mariana swiftlets was estimated at 9,100 birds in 1982, and counts (by a different method) at five occupied caves detected approximately 3,160 birds between 1983 and 1985 (USFWS 1991, p. 14). In 1986, counts at the same caves yielded an estimated population of 2,155 birds, with evidence of movement among the caves. Mariana swiftlets were reported to inhabit the mountainous center of the island near to five caves—Takpochao, Hour Glass, Tin

Can, Navy Hill, and Celis Caves—occasionally appearing along the coastal or northern parts of the island (USFWS 1991, pp. 14–18). Population counts later decreased from over 5,000 in 2010 to 3,817 in 2020 (USFWS 2020, pp. 5–6). Nine caves are currently known to be occupied on Saipan (Johnson et al. 2018, p. 28).

The swiftlet population on Rota exhibited a similar trend to Guam and the species was abundant on the island until at least the 1940s, after which it declined. The last sightings of small numbers of birds occurred in 1976 at three widely separated caves, though evidence exists that the species inhabited at least six caves (Johnson et al. 2018, p. 31). The former population at the large Vampire Bat Cave was estimated to be in the thousands and to coexist with the Pacific sheath-tailed bat. In 1984 only abandoned nests (one with the remains of a fledgling) and large quantities of guano remained at the cave, and by 1985 the birds were no longer detected on Rota (USFWS 1991, pp. 8–11).

Swiftlets were reported sporadically on Tinian from 1945 but no longer detected by 1983, though it has been suggested that any swiftlets on the island may have been temporary residents flying between islands from Aguiguan or Saipan (USFWS 1991, p. 14; Johnson et al. 2018, p. 31).

Surveys are sporadic on all islands except Guam, where quarterly counts are performed at the three swiftlet occupied caves. The challenge of determining reliable population numbers of swiftlets is well documented in the literature due to the difficulties of accessing caves and counting the dark colored birds clustered in nests or crevices in dark cave conditions or “on the wing,” and the tendency of the birds to flush (Morton and Amidon 1996, p. 2; Cruz et al. 2008, p. 235; Johnson et al. 2018, p. 23 and all references herein). Similarly, differences in survey methodologies may result in overestimates (variable circular-plot method) or underestimates (nest count method) of swiftlet abundance, the results of which are often not comparable (Cruz et al. 2008, p. 235; Johnson et al. 2018, pp. 32–34). The most common method is to perform evening arrival surveys of swiftlets by counting the birds in groups or singles against the twilight sky as they fly into the caves (USFWS 1991, p. 6). Until recently, radiotracking technology was not feasible for the swiftlet because of its small body size (Morton and Amidon 1996, p. 2), and movement among caves has not yet been evaluated. Inconsistencies in survey methods should be considered when assessing population trends for the Mariana swiftlet.

Threats

The restricted distribution and small range wide population size of the Mariana swiftlet, along with its dependence on suitable caves, impact the ability of the species to recover in response to the following threats.

Loss and degradation of habitat: The Mariana swiftlet is vulnerable to loss and degradation of habitats used for foraging and collecting nest materials (e.g., moss, fern, liverwort) from development, conversion to agriculture, the encroachment of invasive plants and animals, wildfire, pesticide use, and climate change. The quality of cave habitats for roosting and nesting is further degraded by the presence of invasive predators and human disturbance in and about the caves. Economic development has particularly caused habitat loss and fragmentation on Guam,

while native forests on Saipan and Aguiguan were broadly cleared for sugarcane production prior to World War II (Cruz et al. 2008, p. 234). While the Mariana swiftlet uses a variety of habitat types for foraging, 21 percent of Guam and 23 percent of Saipan is now developed land unsuitable for the species (Spies et al. 2019, p. 6).

Invasive animals including ungulates, brown treesnakes, rodents, and ants, and invasive plants such as *Leucaena leucocephala* (tangan-tangan) degrade native forest, savanna, and stream habitats, which provide foraging resources for the Mariana swiftlet. Invasive plants obscure the entrances to swiftlet occupied caves and can be utilized by brown treesnakes; at Mahlac and Maemong Caves, monocultures of *Pimenta racemosa* (known as bay leaf or bay rum trees) have been observed to affect the flight passage of birds flying in and out of the caves (Colt 2021, in litt., p. 1).

Wildfires are both intentionally set (e.g., arson) or caused by altered fire regimes from alien species. On Guam, Rota, and Saipan, fires are set by hunters in grasslands to lure deer (Minton 2006, p. 77; Liske-Clark 2015, p. 6-17), which can spread to adjacent forested areas. Wildfires are not considered part of the natural environment in the Mariana Islands (Minton 2006, p. 21). Fire is a human-exacerbated threat to native species and native ecosystems throughout the Mariana Islands, particularly on the island of Guam, where most recently in 2022, there were a total of 193 wildfires which burned 4,745 acres (FSRD 2023, p. 3).

Heavy use of pesticides such as dichlorodiphenyltrichloroethane (DDT) has been suspected of causing decline in swiftlet populations on Guam, and samples analyzed in 1975 showed the presence of pesticides in the species' body tissue and guano (Drahos 1977 and Jenkins 1983, in USFWS 1991, p. 21). A subsequent study in 1985 by Grue rejected this hypothesis (USFWS 1991, p. 21). Although the physiological tolerance of pesticides is not known for the Mariana swiftlet, pesticide use can cause a decline in insect prey abundance, which can affect energy supply and be a limiting factor in nestling growth (Reichel et al. 2007, p. 690).

The habitat needed to support the Mariana swiftlet is susceptible to the anticipated effects of climate change. Altered precipitation regimes and increased temperatures expected as a result of climate change may lead to the loss of native species that comprise the swiftlet's foraging habitats, and exacerbate the effects of other threats. More extreme El Nino events (Grecni et al. 2020, p. 23) may exacerbate wildfire threat, and change microclimate and suitability of sites for persistence of plants used for nest materials (e.g., moss, fern, liverwort). Further, should climate change result in an increase in typhoon intensity in the Mariana Islands, an increase in destruction of vegetation is expected, which will modify light availability and create space for invasion by nonnative pest and plant species (Grecni et al. 2020, pp. 5, 21). It should be noted that climate change has also been projected to cause a poleward migration of typhoon tracks (Lin et al. 2023, entire), which may result in decreased typhoon frequency in the Mariana Islands.

Nonnative snake predation: On the island of Guam the invasive brown treesnake predated on the Mariana swiftlet (USFWS 1991, p. 20; Morton and Amidon 1996, p. 9). Klug et al. (2021, p.

1086) captured 151 brown treesnakes from the three swiftlet occupied caves from 2011 to 2017 (no brown treesnakes were found in three caves unoccupied by swiftlets during this time). Sixty-three percent of the captured brown treesnakes with gut contents contained swiftlet remains, and the snakes in the swiftlet occupied caves had greater fat mass compared to snakes in the surrounding forests (Klug et al. 2021, pp. 1086–1090). Similarly, Morton and Amidon (1996, pp. 9–11) found a decrease in the number and body condition of brown treesnakes captured in the caves as trapping efforts progressed. Brown treesnakes have been observed at perch heights of 0 to 33 feet (0 to 10 meters) in caves, from 0 to 164 feet (0 to 50 meters) from roosting swiftlets, and from 3 feet (1 meter) from, but not within, swiftlet nesting areas (Klug et al. 2021, p. 1083). The lack of snake predation on nests is likely due to the inaccessible nest locations in the roofs, overhanging walls, or smooth stalactites (USFWS 1991, p. 2). From a perch a snake will catch swiftlets flying by, prey on roosting swiftlets, and consume nestlings, fledglings, or eggs that have fallen to the cave floor (USFWS 1991, p. 20; Morton and Amidon 1996, pp. 9–11).

The brown treesnake became established on Guam in the 1940s but does not occur on the other Mariana Islands. While brown treesnake predation is a threat to the Mariana swiftlet in Guam, it is not responsible for the simultaneous decline of the species throughout the Mariana Islands.

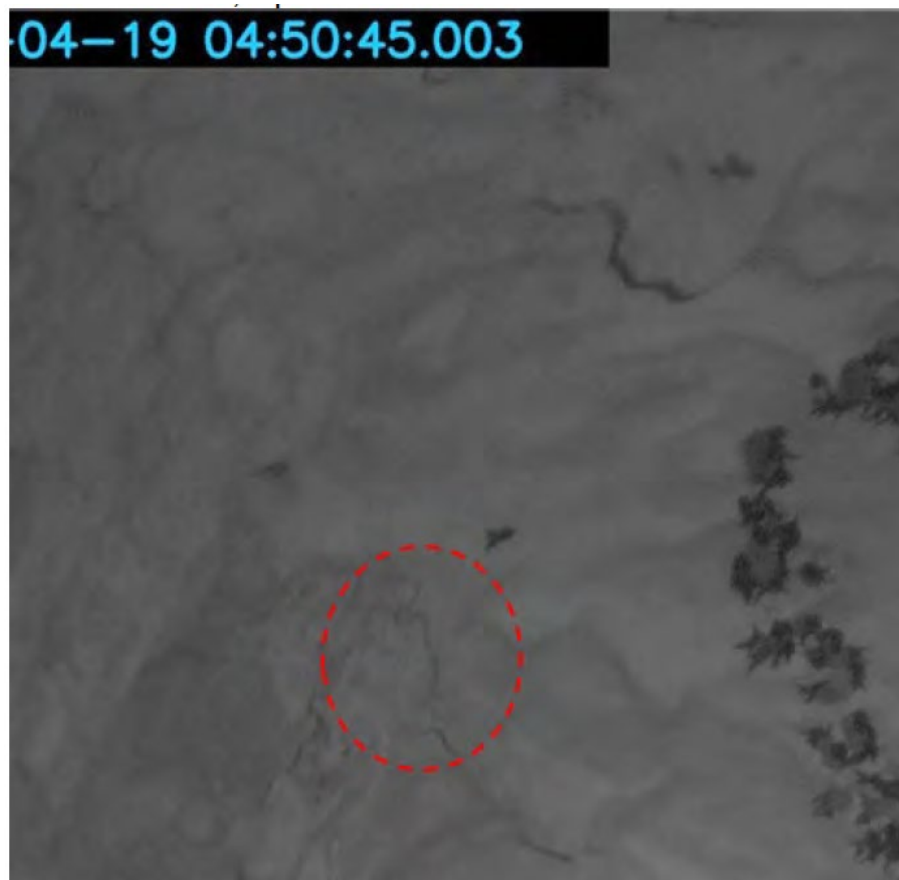


Figure 2: Brown treesnake (circled in red) near roosting and nesting swiftlets in Mahlac Cave, 2022 (Photo credit: USGS in NAVFAC Marianas 2023, p. 168).

Other direct nonnative species impacts: Nest damage is known to occur from American cockroaches (*Periplaneta americana*), which consume the swiftlet's saliva holding the nests to the walls or roof of the caves (Cruz et al. 2008, p. 242), and mud dauber wasps (*Vespula* sp.), which build their nests onto swiftlet nests (Johnson et al. 2018, p. 24), both of which can result in nests falling to the cave floor. Other nonnative or predatory species documented within swiftlet caves include feral cats, rats (*Rattus* sp.), and ungulates (which can disturb guano on the cave floor and upset the quality of the cave air) (USFWS 1991, p. 19; Morton and Amidon 1996, pp. 9–10; USFWS 2019, p. 2). Monitor lizards (*Varanus* sp.) have been detected in swiftlet caves in Guam (Morton and Amidon 1996, p. 10), though their status as a nonnative species has recently come into question based on fossil records.

Human disturbance: Swiftlets are observed to flush when humans enter or approach their caves. Observations from this type of human disturbance range from most birds leaving the cave (USFWS 1991, p. 6; Wiles and Woodside 1999, pp. 58, 61) and on one known occasion colliding with the humans (Wiles and Woodside 1999, p. 61), to some birds flushing within (but not departing) the cave before returning to roost or nest (Obra 2023, in litt., p. 4), to fledglings attempting flight and either flying into a wall or falling to the floor (Morton and Amidon 1996, p. 9; Wiles and Woodside 1999, p. 61). Sensitivity to human presence has been suggested to result in eggs being damaged or knocked from nests by startled swiftlets, but evidence of this phenomenon has not been confirmed (Morton and Amidon 1996, pp. 9, 14; Wiles and Woodside 1999, p. 61). Human disturbance from noise and human movement can cause stress reactions, including increases in active thermoregulation, maintenance, locomotion, and alertness (Price 2008, entire and all references herein).

Sources of human disturbance have included war, guano mining, hunters, hikers, wildlife biologists, and vandalism (USFWS 1991, p. 19). Before and during World War II, swiftlet-occupied caves in Saipan and Aguiguan were inhabited by Japanese soldiers and others as bomb shelters, refuges, and military fortifications, and the caves were cleared of hostile occupants using explosives (Cruz et al. 2008, p. 234). Of the eight caves that were entered by biologists in the Northern Mariana Islands between 1983 and 1985, seven contained abundant human refuse dating from the Japanese occupation of the islands, and two caves were being exploited for guano (USFWS 1991, p. 5). Guano mining for fertilizer, mainly in the Northern Mariana Islands, also likely affected air quality in the caves. Vandalism is rare, but has been reported to directly kill Mariana swiftlets (USFWS 1991, p. 20).

Recovery criteria

The Mariana swiftlet may be considered for downlisting from endangered to threatened when the following recovery criteria are met (USFWS 2019, entire).

Criterion 1: Over a minimum 15-year period, Mariana swiftlet population data on Saipan, Aguiguan, and Guam show a stable or increasing trend (i.e., finite rate of annual population increase, or Lambda, greater than or equal to 1) that is statistically significant, as determined through quantitative surveys of abundance or an index of abundance derived from quantitative

surveys or demographic monitoring; and the average population throughout that time period is estimated to be at least 2,000 birds on Guam, 2,000 on Saipan, and 1,000 on Aguiguan.

Criterion 2: Sufficient Mariana swiftlet roosting and nesting habitat (i.e., occupied and potentially occupied caves) is protected and managed to achieve Criterion 1 above, with the populations distributed among at least five caves on each island. On Guam, at least two of the five occupied caves should be in northern Guam.

Criterion 3: Threats to the species, including predation by introduced predators, nest damage, and pesticide impacts, are effectively managed so as to minimize mortality and to meet Criterion 1 above, and are expected to continue to be so for the foreseeable future.

Survival and recovery needs

Recommended actions for Mariana swiftlet recovery implementation have been identified as: population biology research; predator control research, particularly for the brown treesnake on Guam; protection and management of active and historic swiftlet caves on Guam, Rota, and Saipan; acoustic monitoring to find new colonies; research to determine the best reintroduction sites; translocation/reintroduction protocol and plan development for Rota and northern Guam; and population viability monitoring and analysis, including genetic analysis (USFWS 2020, p. 4).

Environmental Baseline

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated and/or ongoing impacts of all proposed federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

Status of the species within the action area

The current estimate of the Mariana swiftlet population on Guam is approximately 1,000 birds, comprised of the populations at the three caves in the action area. Despite some periods of increase (Figure 3), the swiftlet population within the action area has overall declined significantly since the mid-1960s. The three colonies have been monitored by the Department of the Navy, DAWR, and the Service for over 30 years. The colony at Mahlac Cave declined from approximately 1,400 birds in 2010 to approximately 700 birds in 2022; the colony at Maemong Cave declined from 400 birds in 2010 to 200 birds in 2022; and the colony at Fachi Cave declined from 200 birds in 2010 to 60 birds in 2022 (NAVFAC Marianas 2019, p. 6-31; Obra 2023, in litt., p. 5).

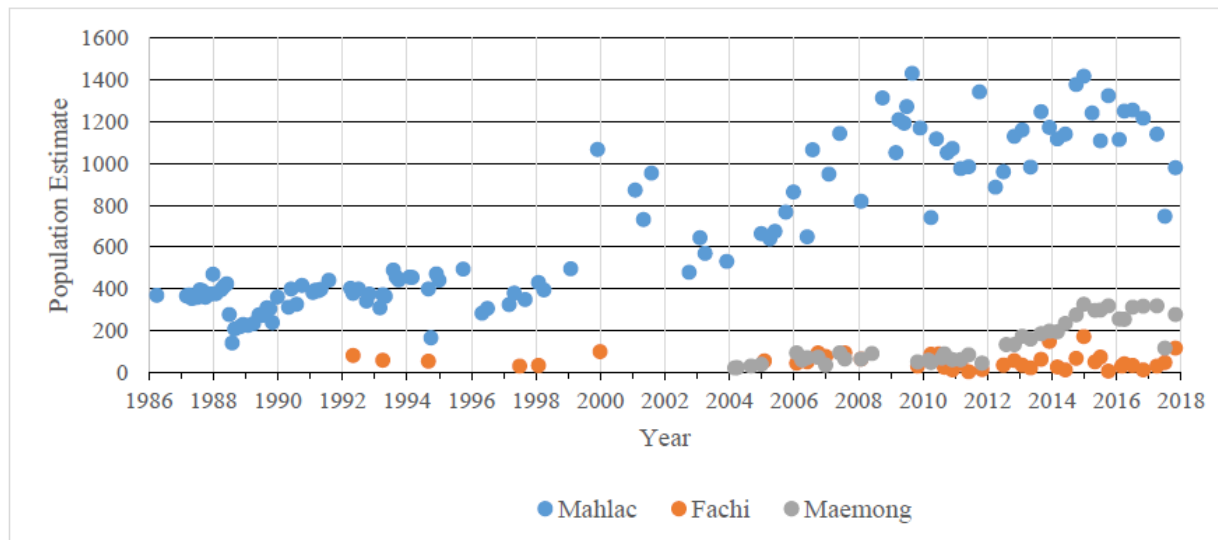


Figure 3: Individual Mariana swiftlet population estimates recorded at Mahlac (blue), Fachi (orange), and Maemong (gray) Caves from 1986 to 2017 (Figure 6-11 in NAVFAC Marianas 2019, p. 6-32).

Factors affecting species environment within the action area

The primary factors affecting Mariana swiftlets occupying the three caves in the action area are encroachment of nonnative plants and animals and predation by the brown treesnake. Because the caves are today protected on undeveloped land within a military installation, human disturbance is limited to ongoing projects in the action area intended to reduce these factors affecting the swiftlet's environment. The Department of the Navy currently performs once yearly clearing of invasive *Pimenta racemosa* trees immediately in front of the entrances to Mahlac and Maemong Caves to reduce collision hazards for the swiftlets, and eliminate the use of the trees by the brown treesnake (Colt 2021, in litt., entire). Ongoing brown treesnake control and research via the use of bait tubes laden with toxicant-laced dead mouse and chick baits is ongoing along transects spaced 33 feet (10 meters) apart around the caves (Figure 4). Brown treesnake control efforts by the Department of the Navy began at Mahlac Cave in 2000, Maemong Cave in 2011, and Fachi Cave in 2012 (NAVFAC Marianas 2019, p. 6-31; NAVFAC Marianas 2023, p. 58). During the period of in-cave snake control efforts from 2011 through 2016, an increase in Guam's swiftlet population was recorded (Figure 5).

Quarterly swiftlet counts by the Department of the Navy, DAWR, and the Service to monitor population numbers at Mahlac, Maemong, and Fachi Caves consist of at least two observers at the entrances of the caves. Before each count begins, the observers enter the caves and document active nests. After nest counts, right before sunset, observers passively count the ingress of swiftlets flying into the caves using clickers, until the observers are no longer able to see the birds.

Additional research being performed by the USGS in support of the Department of the Navy is the deployment of camera systems in the caves to document spatial and temporal interactions of brown treesnakes and swiftlets and better estimate roosting population sizes, and the use of

lightweight radio transmitters on swiftlets for tracking movement patterns around caves and the wider landscape. The project is permitted to tag up to 90 birds per year and has tagged and tracked 60 swiftlets in total between 2022 and 2023 (NAVFAC Marianas 2023, pp. 166–167).

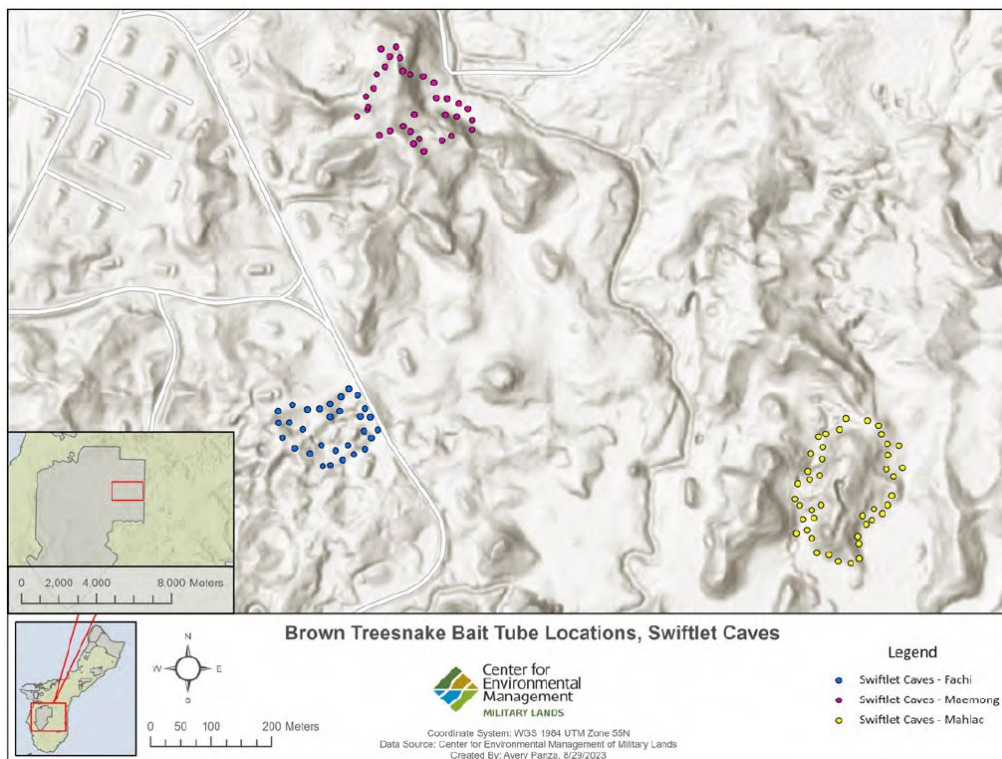


Figure 4: Brown treesnake bait tube location around Fachi Cave (blue), Maemong Cave (pink), and Mahlac Cave (yellow) (Figure 29 in NAVFAC Marianas 2023, p. 59).

The swiftlet nests are believed to be restricted to areas of the cave walls and roof that are inaccessible to climbing brown treesnakes (Klug et al. 2021, p. 1087) but the snakes wait in other areas of the cave where they strike out to capture roosting swiftlets or birds flying by (USFWS 1991, p. 20). Mahlac Cave, with the highest swiftlet population and most accessible natural structure for snakes, was found to have the shortest distance between brown treesnakes and swiftlets (Klug et al. 2021, p. 1088).

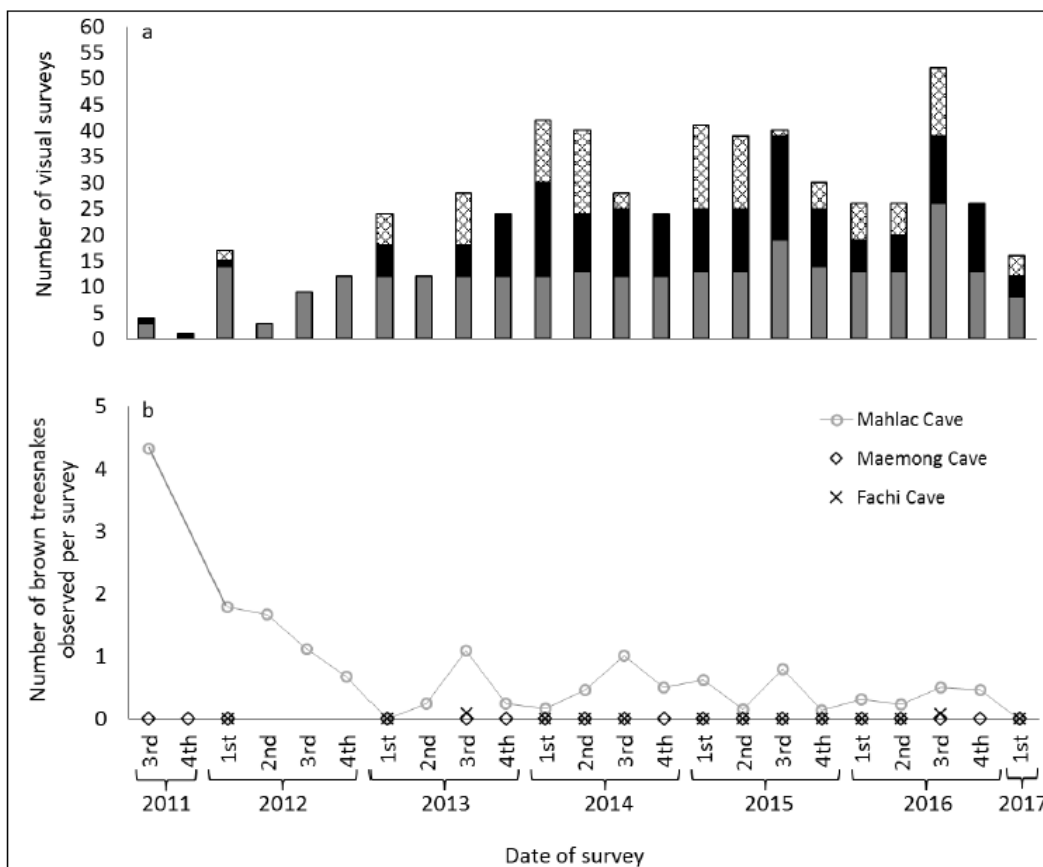


Figure 5: (a) Number of surveys conducted per quarter at Mahlac Cave (gray), Maemong Cave (black), and Fachi Cave (crosshatched). (b) Number of brown treesnakes observed at Mariana swiftlet caves as a function of survey date. 1st quarter: January–March; 2nd quarter: April–June; 3rd quarter: July–September; 4th quarter: October–December (Figure 6-12 in NAVFAC Marianas 2019, p. 6-32).

Effects of the Action to the Mariana Swiftlet

All Mariana swiftlets within Mahlac, Maemong, and Fachi Caves may be startled or alarmed by human disturbance from unavoidable project-related noise and human movement within, approaching, and immediately outside the entrances to the caves. Entry to the caves by two biologists will begin 30 minutes after sunset, when most swiftlets will have returned to the caves from daytime foraging, and project actions will continue for 60 to 90 minutes per visit, once per week, for a total of 52 visits per calendar year for a duration of 10 years. The capture of snakes may entail unavoidable movements in close proximity to nesting or roosting Mariana swiftlets or project-related footfall noises on the cave floor. Most snake capture activities are expected to occur without disturbing any Mariana swiftlets.

Human disturbance such as the footfall noise and human movement are known to cause stress

reactions, including increases in active thermoregulation, maintenance, locomotion, and alertness in bird species. Swiftlets disturbed by similar human activity have taken flight from their nests or roosts within the interior of the cave for up to approximately five minutes before settling back on their nests or roosts, based on the observations of biologists performing in-cave work using the same methods from 2011 to 2019 (Mosher 2023, pers. comm.; Obra 2023, in litt., p. 4). This flight is likely to increase energetic demands and temporarily disrupt hormonal balance, including hormones associated with the stress response, adversely affecting the swiftlets. In total, the Mariana swiftlets may be adversely affected during the snake capture activities 52 times a year, for 10 years, due to the unavoidable activities associated with brown treesnake capture while the birds are roosting and nesting in the caves. However, if swiftlets are found to indeed go into torpor while sleeping, then their roosting in caves takes on additional significance; it would be essential that birds are not disturbed later in the night while in such a highly vulnerable state (USFWS 1991, p. 6).

Artificial light used during project actions is not expected to adversely affect the swiftlets because only lights fitted with red filters/lenses or night vision goggles will be used when capturing snakes and performing surveys. No white light will be used near cave entrances or within caves.

A beneficial consequence of the action is the Mariana swiftlet population on Guam is expected to increase as a result of a result of increased survival and reproductive success of swiftlets from the reduction of brown treesnake predation pressure. Prior observations on in-cave nest counts have shown an expansion of the nesting areas on cave roofs and walls during periods of brown treesnake control at the caves (Obra 2023, in litt., p. 5). The proposed project addresses two of the recovery criteria in the Amendment to the Recovery Plan for Mariana Islands Population of the Vanikoro Swiftlet (*Aerodramus vanikorensis bartschi*) (USFWS 2019, p. 4) as the project will protect and manage roosting and nesting habitat by effectively controlling predatory brown treesnake. Additionally, outcomes of the project actions will inform survival and recovery research needs for the species.

Brown treesnake predation of Mariana swiftlets is expected to be reduced for ten years as a result of the proposed action. Although the human movement and noise that may be unavoidably occurring during the capture of brown treesnakes may temporarily result in stress reactions to all of the birds living in the caves, the project is expected to result in a considerable net conservation benefit to the Mariana swiftlet.

Cumulative Effects

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

Because the Department of the Navy restricts public access to the three caves occupied by the Mariana swiftlet, no non-federal actions are expected to affect the species within the project action area. The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

Conclusion

After reviewing the current status of the Mariana swiftlet, the environmental baseline for the action area, the effects of the proposed brown treesnake visual surveys and removal efforts in three caves on Naval Base Guam, and the cumulative effects, it is the Service's biological opinion that the action is not likely to jeopardize the continued existence of the Mariana swiftlet. The Service reached this conclusion based on the following information, which is detailed in the **Effects of the Action** section, above.

Adverse effects to the Mariana swiftlet are likely as a result of human disturbance from project-related noise and human movement. The action is expected to result in up to one instance of human disturbance per week to one or all of the Mariana swiftlets (currently estimated at 1,000 individuals) occupying the three caves, up to 52 weeks per year, during the ten-year project period. Stress reactions caused by project-related human disturbance will adversely affect the swiftlets by increasing energetic demands and disrupting hormonal balance. The birds are expected to respond to the stressor by lifting off their nests and flying around within the cave. The stress response is expected to last for no more than five minutes in each instance. The caves are protected from the public, so non-federal human disturbance to the swiftlets is not expected to occur. Project disturbance, taken together with cumulative effects, will result in reduced time sheltering on their roost or nest. Survival, reproductive effort, and reproductive success are not expected to be reduced as a result of the disturbance caused by the proposed action and the cumulative effects. Brown treesnake control at the three swiftlet caves is expected to increase survival and reproductive success of the Mariana swiftlet.

INCIDENTAL TAKE STATEMENT

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

intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the Department of the Navy so that they become binding conditions of any grant or permit issued to any applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Department of the Navy has a continuing duty to regulate the activity covered by this incidental take statement. If the Department of the Navy (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Department of the Navy must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take Anticipated

Based on our analysis presented in this biological opinion, the Service anticipates the following take may occur as a result of the proposed action:

1. The adverse effects of the project to the Mariana swiftlet are not expected to rise to the level that would constitute take. One or all Mariana swiftlets within the three project caves are expected to exhibit a stress response, taking flight from their roost and flying within the caves, for a period of fewer than five minutes, once per week, for the ten years of project implementation.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the Mariana swiftlet in the wild. Because control of the brown treesnake is an important conservation action for the persistence of the Mariana swiftlet, the proposed action is expected to result in immediate and long-term benefits for the species.

Reasonable and Prudent Measures

Because no take is anticipated, reasonable and prudent measures are not warranted.

Terms and Conditions

Because no take is anticipated, terms and conditions are not warranted.

Conservation Recommendations

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

Conservation Recommendations

Implement biosecurity measures to avoid the spread of the little fire ant (*Wasmannia auropunctata*) and other nonnative species to the swiftlet caves.

Collect and report data on flushing or other responses by the swiftlet to human disturbance observed during the implementation of the action at the caves for each visit.

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

Reinitiation Notice

This concludes formal consultation on the action outlined in this biological opinion. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law and: (1) if the amount or extent of taking specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

We appreciate your cooperation and assistance in helping us prepare this biological opinion. If you have any questions about this consultation, please contact Mariana Islands Geographic Team Manager Jacqueline Flores of my staff at jacqueline_flores@fws.gov.

Sincerely,

FOR

Michelle D. Bogardus
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Pacific Islands Fish and Wildlife Office

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