

## **5-YEAR STATUS REVIEW**

Short Form Summary

**Species Reviewed:** *Pteropus tokudae* (little Mariana fruit bat)

**Current Classification:** Endangered

### **Federal Register Notice announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2018. Initiation of 5-year status reviews for 156 species in Oregon, Washington, Hawaii, Palau, Guam, and the Northern Mariana Islands. Federal Register 83:20088-20092.

### **Lead Region/Field Office:**

Interior Region 12/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawaii

### **Name of Reviewer(s):**

Mike Richardson, Fish and Wildlife Biologist, PIFWO

Megan Laut, Animal Recovery Coordinator and Conservation and Restoration Team Manager, PIFWO

Gregory Koob, Deputy Field Supervisor for Programmatic Operations

Grant Canterbury, Sarah Hall, and Marilet Zablan, Regional Office

### **Methodology used to complete this 5-year status review:**

The staff of the PIFWO of the U.S. Fish and Wildlife Service (Service, USFWS) conducted this review beginning on December 19, 2018. We based the review on an analysis of current, available information since the last 5-year status review for the little Mariana fruit bat (USFWS 2015). The document was reviewed for PIFWO approval by the Animal Recovery Coordinator and Conservation and Restoration Team Manager; it was reviewed by staff in the Regional Office Ecological Services program prior to being signed by the Assistant Regional Director - Ecological Services.

### **Background:**

For information regarding the species' listing history and other facts, please refer to the USFWS Environmental Conservation On-line System (ECOS) database for threatened and endangered species at: [http://ecos.fws.gov/tess\\_public](http://ecos.fws.gov/tess_public).

### **Review Analysis:**

Please also refer to the previous 5-year status review for the little Mariana fruit bat (*Pteropus tokudae*) published on June 30, 2015 (available at: [https://ecos.fws.gov/docs/five\\_year\\_review/doc4544.pdf](https://ecos.fws.gov/docs/five_year_review/doc4544.pdf)) for additional information regarding the species' status, threats, and management efforts. The Mariana Fruit Bat (Guam Population) and Little Mariana Fruit Bat Recovery Plan (USFWS 1990) remains the foundational source of information for this 5-year status review.

Although no new information specifically about the little Mariana fruit bat's biological status has come to light since the 2015 5-year status review, we reassessed all available resources about the species and related bats, including research published in 2013 and

2014 regarding its taxonomy. We also evaluated the likely impact of predation by the brown treesnake (*Boiga irregularis*).

Because of a lack of recent or new biological information about this species, we also consulted past literature and recent updates regarding the larger and related Mariana fruit bat (*Pteropus mariannus mariannus*) (or fanihi in the Chamorro language) and the general biology of bats in the *Pteropus* genus (also known as flying foxes) (Wilson and Graham 1992, pp. 1-8). Given the life history homogeneity within the genus, we expect that the little Mariana fruit bat and the Mariana fruit bat exhibited similar behavior and biology including foraging and roosting, care of young, slow population growth (based on low fecundity, late reproductive age, etc.), among other behavior and traits. (To help distinguish between the two species from this point forward in this document, we will refer to the extant Mariana fruit bat as the fanihi.) Because of likely similar biological traits, and particularly as the fanihi still exists on Guam albeit in low numbers, we believe data on fanihi population trends and threats provide important context for the historical decline and extinction of the little Mariana fruit bat.

### **Summary species status information:**

#### *Historical observations*

The little Mariana fruit bat was first described by Tate (1934, p. 1) from a male type specimen collected in August 1931. Its original scientific name, *Pteropus tokudae*, remains current. According to Tate (1934, p. 2), Perez (1972, p. 146), and Buden *et al.* (2013, pp. 109-110), the little Mariana fruit bat, was much smaller than the related fanihi. Measurements of the adults ranged from 5.51 to 5.94 inches (in) (140 to 151 millimeters (mm)) in head-body length; 3.7 to 3.74 in (94 to 95 mm) in forearm length; 25.6 to 27.9 in (650 to 709 mm) in wingspan; and 5.36 ounces (152 grams) in weight. The abdomen and wings were brown to dark brown with a few whitish hairs; the mantle and sides of the neck varied from brown to pale gold; the top of the head was grayish to yellowish brown; and the throat and chin, dark brown. Because of their small size and the various challenges in surveying for *Pteropus* spp. bats in general (O'Shea and Bogan 2003, pp. 49, 254; USFWS 2009, p. 55), it is possible that adult little Mariana fruit bats were historically confused with juvenile fanihi (Perez 1972, p. 143; Wiles 1987, p. 15).

Two relatively recent studies have confirmed the taxonomic validity of the little Mariana fruit bat. Buden *et al.* (2013, entire) examined cranial measurements and the external morphology of several Micronesian *Pteropus* spp., including all three known little Mariana fruit bat specimens. The authors concluded that the little Mariana fruit bat is an authentic taxon and suggested it was most closely related to *Pteropus pelagicus* of the Caroline Islands within Micronesia (Buden *et al.* 2013, p. 109). Subsequently, Almeida *et al.* (2014, entire) conducted a genetic analysis of skin samples from 50 of the 63 described *Pteropus* species as well as 11 species from 7 related genera as part of an overall study of the group's phylogenetic tree. In addition to confirming its taxonomic authenticity and relationship to *P. pelagicus*, the study's results suggested a split at the base of the phylogenetic tree between the little Mariana fruit bat and a few related species from most species in the *Pteropus* genus (Almeida *et al.* 2014, pp. 85, 93).

Researchers have only collected three specimens of little Mariana fruit bat ever: two males in 1931 (Tate 1934, p. 3), and a female in 1968 (Perez 1972, p. 146), all from the island of Guam, where it was presumably endemic. Because so few specimens were collected and we know so little of its specific life history (USFWS 1990, p. 7), it is difficult to generalize about the species' population characteristics or the process of its decline and apparent extinction (Wiles 1987, p. 154). Aside from one possible unconfirmed sighting at Ritidian Point in June 1979 (Wiles 1987, p. 154), no confirmed captures or observations of this species have been made since 1968. We lack sightings of the little Mariana fruit bat despite intensive field surveys of Guam's fruit bats (*fanihi*) substantially increasing in frequency since the 1970s through the present (Wheeler and Aguon 1978, pp. 3-4; Wiles 1987, entire; USFWS 1990, p. 7; USFWS 2009 entire; USFWS 2017, p. 54-56; Mildenstein and Johnson 2017, entire).

We lack records prior to the 1900s regarding historical populations of either bat species in the Marianas or Guam (USFWS 2009, p. 6). The earliest available scientific literature based on anecdotal information collected from residents of Guam and its original scientific collectors (Baker 1948, p. 54; Perez 1972, pp. 145-146; Wiles 1987, p. 154), indicated that the little Mariana fruit bat was likely rare and certainly considered rare when written accounts of the species were first recorded in the early 20<sup>th</sup> century. When the little Mariana fruit bat was listed as endangered (USFWS 1984), the Service noted that the species was on the verge of extinction (USFWS 1984, p. 33885), and had not been verifiably observed after 1968 (USFWS 1984, p. 33883). When we published a joint recovery plan for it and the *fanihi* in 1990, the Service considered the little Mariana fruit bat likely extinct at that time, based upon the available literature (USFWS 1990, p. 7).

*Assessing the historical status of fanihi to understand decline of the little Mariana fruit bat*

In addition to the species possibly having been inherently rare as suggested by the literature, a concurrent decline in the little Mariana fruit bat population likely occurred during the well-documented decrease in *fanihi* abundance on Guam in the 20<sup>th</sup> century. As cited in Wiles 1987 (p. 150), Crampton (1921), without clarifying whether he actually saw both species, recorded the first written account regarding the abundance of fruit bats on Guam. Following his visit to the island in 1920, he noted that bats were "not an uncommon sight as they flew over forest during the daytime." However, just 10 years later during a 2-month visit to Guam in 1931 (the same year the first two little Mariana fruit bat specimens were collected), Coultas (1931) wrote that [all] fruit bats were uncommon on the island (Wiles 1987, p. 150). While noting that bats were most abundant in northern Guam, Coultas (1931) also wondered in his writings whether improved hunting efficiency with recently introduced firearms may have contributed to their decline (Wiles 1987, p. 150).

By the end of the second World War in 1945, Baker (1948, p. 54) reported difficulty in locating fruit bats even in the northern half of Guam where they appeared both uncommon and largely confined to forested cliffines along the coasts. Concurrently,

fruit bats became scarce in southern Guam as well, according to reports Baker obtained from residents in the 1940s.

Based upon Guam Division of Aquatic and Wildlife Resources (GDAWR) surveys and analyses between 1963 and 1968, Perez (1972, p. 144) confirmed that bats appeared to be declining across much of Guam, particularly in the south. It was also during these same field studies that the last little Mariana fruit bat was collected in 1968 (Perez 1972, p. 146), regarding which Perez suggested that both species appeared to occupy the same habitat. Perez also noted that scientific literature to date reported different species within the *Pteropus* genus integrating in shared colonies (Perez 1972, p. 146), indicating that the little Mariana fruit bat and the fanihi may have been roosting together in colonies (see also Wiles 1987, p. 154).

Bat survey efforts increased during the late 1970s and early 1980s, continuing to document steep declines in numbers of fanihi with no confirmed sightings of the little Mariana fruit bat (Wheeler 1979, entire; Wheeler and Aguon 1978, entire; and Wiles 1987, pp. 153-154). Likewise, during the 1990s, recorded bat numbers decreased with some fluctuations; in particular, researchers noted unusually high mortality of immature bats and suggested brown treesnake predation could be a contributing factor (Wiles *et al.* 1995, pp. 33-34, 39-42). Guam fanihi abundance continued to fluctuate and decline in the 2000s, and researchers estimate the island's population currently fluctuates between 15 and 45 individuals (Mildenstein and Johnson 2017, p. 24; USFWS 2017, p. 54). It is highly likely that the Mariana little fruit bat experienced a similar pattern of decline, assuming that it persisted at undetectable numbers for some time after its last confirmed collection in 1968. While confusion between little Mariana fruit bat and juvenile fanihi could have resulted in occasional error in historical surveys, the small size of the remaining fanihi population on Guam combined with substantial ongoing survey effort in recent decades make it highly unlikely that little Mariana fruit bats remain extant and undetected among the fanihi population.

### **Threats Evaluation**

Like the majority of bat species in the genus *Pteropus* (Wilson and Graham 1992, pp. 1-8), particular biological traits likely exacerbated the little Mariana fruit bat's susceptibility to impacts from both human activities and natural events. For example, traits such as low fecundity in the genus due to late reproductive age and small broods (one to two young annually) inhibit population response from catastrophic events such as typhoons, or even the slow progression of habitat loss and hunting pressure that occurred over time. *Pteropus* tend to roost together in sizeable groups or colonies in large trees rising above the surrounding canopy (Wilson and Graham 1992, p. 4). Additionally, *Pteropus* show a strong tendency for roost-site fidelity, often returning to the same roost tree year after year to raise their young (Wilson and Graham 1992, p. 4; Mildenstein and Johnson 2017, pp. 54, 68). These characteristics likely increased its susceptibility to the effects of hunting, and later illegal poaching, by allowing poachers to easily locate bats and with the introduction of firearms, kill them more efficiently (Wiles 1987, pp. 151, 154; USFWS 2009, p. 24-25; Mildenstein and Johnston 2017, p. 41-42). Highlighting the fact of their vulnerability, 6 of the 62 described species of *Pteropus* (including the little

Mariana fruit bat) have become extinct in the last 150 years. The IUCN categorizes an additional 37 species of *Pteropus* as at risk of extinction (Almeida *et al.* 2014, p. 84).

In discussing survey results for fruit bats in the 1980s (only fanihi were recorded), Wiles (1987, p. 154) wrote that the level of illegal poaching of bats on Guam remained extremely high. High levels of poaching continued despite legal protections afforded to the species by the Guam government beginning in 1966 with official hunting restrictions, followed by an outright hunting ban in 1973, designation of endangered status in 1981 by the Government of Guam, and finally following Federal listing in 1984 (Wiles 1987, p. 154).

Following Savidge's seminal publication (1987, entire) announcing the effects of brown treesnake predation upon the avifauna of Guam, Wiles was the first to report upon the effects of this new threat to Guam's fruit bats (Wiles 1987, pp. 155-156). Immature *Pteropus* pups are particularly vulnerable to predators between approximately 3 weeks of age until 3 months of age. During this timeframe, the mother bats stop taking their young with them while they forage in the evenings, leaving them alone to wait at their roost tree. However, to date there is only one documented instance of brown treesnake actually preying on fanihi: three young bats were found within the stomach of a snake examined by a Guam resident in 1981 (Wiles 1987, p. 155).

**New management actions:**

None. Since the 1970s, bat surveys and related management actions on Guam have only been conducted for the fanihi.

**Synthesis:**

As noted previously, only three specimens of little Mariana fruit bat have ever been collected (all from the island of Guam), and aside from one possible unconfirmed sighting in northern Guam in 1979, no other confirmed captures or observations of this species exist. Based upon the earliest reports, the species was already rare in the early 1900s before biologists began to take note. Therefore, during at least recorded history, the little Mariana fruit bat likely experienced greater susceptibility to a variety of factors because of its small population size. Alteration and loss of habitat, increased hunting pressure, and possibly competition with the fanihi for the same resources under increasingly challenging conditions contributed to the species' decreased ability to persist.

As early as the 1970s, the scientific literature noted that the fanihi and native forest birds had declined and become restricted to the northern portion of the Guam. Within the northernmost tip of Guam, nine forest bird species disappeared in the short span of 2 years even as wildlife managers developed plans to take some of them into captivity. These last confirmed detections on Guam of several native forest birds occurred between 1982 and 1984 (Beck 1984, pp. 148-149; Wiles *et al.* 2003, entire), all within the general vicinity of the last sighting of the little Mariana fruit bat in 1968 and the last remaining roost site of fanihi. Decades of monthly, and later, annual surveys for the related fanihi by qualified personnel within this same area of northern Guam have failed to detect the

little Mariana fruit bat. It is highly likely the brown treesnake, the primary threat thought to be the driver of multiple bird and reptile species extirpations and extinctions on Guam, has been present through most of the little Mariana fruit bat's range for at least the last half century, and within this last northern refuge since the 1980s.

Because of its life history and the challenges presented by its small population size, we believe the little Mariana fruit bat was already extremely susceptible to predation by the brown treesnake. We conclude that the species is most likely extinct. We base this upon the lack of detections during surveys and searches conducted throughout the species' range since the little Mariana fruit bat was last observed in 1968, and the pervasive range-wide threat to the species from habitat loss, poaching, and predation by the brown treesnake.

### **Recommendations for Future Actions:**

#### **Captive propagation for reintroduction and genetic storage**

- There are instances where rare animals have been rediscovered after they were presumed extinct or have been found in larger populations than expected (Reynolds and Snetsinger 2001, p. 142; Scott *et al.* 2008, entire). Should the little Mariana fruit bat be rediscovered, we recommend the development of procedures similar to the Rare Bird Discovery Protocol contained in the Revised Recovery Plan for Hawaiian Forest Birds (USFWS 2006, pp. 3-17 to 3-21). Having a similar strategy in place could better inform a variety of decisions, including whether to establish a captive population for propagation and reintroduction, or to manage rediscovered population(s) *in situ*.
- Additionally, the successful translocation or propagation of several other listed species on Guam requires that the following efforts be undertaken: (1) continue efforts to develop and refine brown treesnake control techniques to support large-scale control and/or eradication efforts; (2) implement large-scale brown treesnake control and/or eradication efforts; (3) initiate efforts for large-scale ungulate control on Guam to support native forest regeneration.

**Table 1. Trends in status of the little Mariana fruit bat prior to and since listing.**

| <b>Date</b>                                    | <b>Number wild individuals</b> | <b>Number released</b> | <b>Key Recovery Actions</b>                                                                                                                   | <b>Actions Accomplished</b>                                                                                                                                  |
|------------------------------------------------|--------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1931                                           | 2 known                        | 0                      |                                                                                                                                               |                                                                                                                                                              |
| 1968                                           | 2 known                        | 0                      |                                                                                                                                               |                                                                                                                                                              |
| 1984<br>(listing rule)<br>(USFWS 1984)         | Unknown                        | 0                      | See below                                                                                                                                     |                                                                                                                                                              |
| 1990<br>(recovery plan)<br>(USFWS 1990)        | Unknown                        | 0                      | Improve habitat conditions;<br>decrease threat of brown treesnake and avian disease;<br>systematically search area of suitable forest habitat | Improve habitat conditions – Yes<br>Decrease threat of brown treesnake and avian disease – No<br>Systematically search area of suitable forest habitat – Yes |
| 2009<br>(5-year status review)<br>(USFWS 2009) | Unknown                        | 0                      | Improve habitat conditions;<br>decrease threat of brown treesnake and avian disease;<br>systematically search area of suitable forest habitat | Improve habitat conditions – Yes<br>Decrease threat of brown treesnake and avian disease – No<br>Systematically search area of suitable forest habitat – Yes |
| 2015<br>(5-year status review)<br>(USFWS 2015) | Unknown                        | 0                      | Improve habitat conditions;<br>decrease threat of brown treesnake and avian disease;<br>systematically search area of suitable forest habitat | Improve habitat conditions – Yes<br>Decrease threat of brown treesnake and avian disease – No<br>Systematically search area of suitable forest habitat – Yes |

| Date                           | Number wild individuals | Number released | Key Recovery Actions                                                                                                                          | Actions Accomplished                                                                                                                                         |
|--------------------------------|-------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2019<br>(5-year status review) | Extinct                 | 0               | Improve habitat conditions;<br>decrease threat of brown treesnake and avian disease;<br>systematically search area of suitable forest habitat | Improve habitat conditions – Yes<br>Decrease threat of brown treesnake and avian disease – No<br>Systematically search area of suitable forest habitat – Yes |

### References:

- Almeida, F.C., N.P. Giannini, N.B. Simmons, and K.M. Helgen. 2014. Each flying fox on its own branch: A phylogenetic tree for *Pteropus* and related genera (Chiroptera: Pteropodidae). *Molecular Phylogenetics and Evolution* 77:83-95. <https://doi.org/10.1016/j.ympev.2014.03.009> PMID.
- Baker, R.H. 1948. Comments on conservation problems in Micronesia, p. 53-55. In Coolidge, H.J. (Ed.). *Conservation in Micronesia*. National Research Council, Washington, D.C. 70 pages.
- Beck, R. 1984. Survey and inventory of native land birds on Guam. Pages 139-150 in Guam Division of Aquatic and Wildlife Resources Annual Report, FY 1984. Department of Agriculture, Guam.
- Buden, D.W., K.M. Helgen, and G.J. Wiles. 2013. Taxonomy, distribution, and natural history of flying foxes (Chiroptera, Pteropodidae) in the Mortlock Islands and Chuuk State, Caroline Islands. *ZooKeys* 345:97-135.
- Mildenstein, T. and N. Johnson. 2017. Mariana Fruit Bat Management Plan for Andersen Air Force Base, Guam. Report prepared for Naval Facilities Engineering Command Marianas, Guam, Cooperative Agreement Number N40192-15-2-8001. 98 pages.
- O'Shea, T.J. and Bogan, M.A., Eds. 2003. Monitoring trends in bat populations of the United States and territories: problems and prospects. U.S. Geological Survey, Biological Resources Discipline, Information and Technology Report, USGS/BRD/ITR--2003--0003, 274 pages.
- Perez, G.S.A. 1972. Observations of Guam bats. *Micronesica* 8:141-149.

- Reynolds, M.H. and T.J. Snetsinger. 2001. The Hawaii rare bird search 1994-1996. *Studies in Avian Biology* 22:133-143.
- Savidge, J.A. 1987. Extinction of an island avifauna by an introduced snake. *Ecology* 68:660-668.
- Scott, J.M, F.L. Ramsey, M. Lammertink, K.V. Rosenberg, R. Rohrbaugh, J.A. Wiens, and J.M. Reed. 2008. When is an “extinct” species really extinct? Gauging the search efforts for Hawaiian forest birds and the Ivory-billed Woodpecker. *Avian Conservation and Ecology – Écologie et conservation des oiseaux* 3(2):3, 17 pages. Available on line at: <http://www.ace-eco.org/vol3/iss2/art3/>.
- Tate, G.H.H. 1934. Bats from the Pacific Islands, including a new fruit bat from Guam. *American Museum Novitates*, No. 713.
- [USFWS] U.S. Fish and Wildlife Service. 1984. Endangered and threatened wildlife and plants; determination of endangered status for seven birds and two bats on Guam and the Northern Mariana Islands. *Federal Register* 49:33881-33885.
- [USFWS] U.S. Fish and Wildlife Service. 1990. Mariana Fruit Bat and the Little Mariana Fruit Bat Recovery Plan. Portland, Oregon. 63 pages.
- [USFWS] U.S. Fish and Wildlife Service. 2006. Revised recovery plan for Hawaiian forest birds. Region 1, Portland, Oregon. 622 pages.
- [USFWS] U.S. Fish and Wildlife Service. 2009. Draft Revised Recovery Plan for the Mariana Fruit Bat or Fanihi (*Pteropus mariannus mariannus*). U.S. Fish and Wildlife Service, Portland, Oregon. xiv + 83 pages.
- [USFWS] U.S. Fish and Wildlife Service. 2017. Reinitiation of the 2015 Biological Opinion on the Department of the Navy’s Relocation of U.S. Marine Corps from Okinawa to Guam and Associated Activities on Guam. Honolulu, Hawaii. 168 pages.
- Wheeler, M.E. 1979. The Marianas fruit bat: management history, current status and future plans. *Cal-Neva, Wildlife Transactions*. 1979: Pp. 149-165.
- Wheeler, M.E. and C.F. Aguon. 1978. The current status and distribution of the Marianas fruit bat on Guam. Technical Report No. 1. Aquatic and Wildlife Resources Division. Agana, Guam. 29 pages.
- Wiles, G.J. 1987. The status of fruit bats on Guam. *Pacific Science* 41:148-157.
- Wiles, G.J., C.F. Aguon, G.W. Davis, and D.J. Grout. 1995. The status and distribution of endangered animals and plants in northern Guam. *Micronesica* 28:31-49.

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.

Wilson, D.E. and G.L. Graham, (Eds). 1992. *Pacific Island Flying Foxes: Proceedings of an International Conservation Conference*. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service, 1992. 186 pages.

**U.S. FISH AND WILDLIFE SERVICE  
SIGNATURE PAGE for 5-YEAR REVIEW of  
Little Mariana fruit bat (*Pteropus tokudae*)**

**Pre-1996 DPS listing still considered a listable entity?** N/A

**Recommendation resulting from the 5-year review:**

- ☒ Delisting
- ☐ Reclassify from Endangered to Threatened status
- ☐ Reclassify from Threatened to Endangered status
- ☐ No Change in listing status

**Appropriate Listing/Reclassification Priority Number, if applicable:** \_\_\_\_\_

**PACIFIC ISLANDS FISH AND WILDLIFE OFFICE APPROVAL:**



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**Field Supervisor**

**REGIONAL OFFICE APPROVAL:**

ACTING



**Assistant Regional Director, Ecological Services**

Date 12/18/19