5-YEAR REVIEW

Short Form Summary

Species Reviewed: Picture-wing Fly (*Drosophila substenoptera*)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

U.S. Fish and Wildlife Service. 2022. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 167 species in Oregon, Washington, Idaho, Montana, California, Hawai‘i, Guam, and the Northern Mariana Islands. Federal Register 87 (90): 28,031–28,034.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer(s):

Charmian Dang, Fish and Wildlife Biologist, PIFWO
John Vetter, Animal Recovery Coordinator, PIFWO
Megan Laut, Recovery Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the PIFWO of the U.S. Fish and Wildlife Service (USFWS), beginning in October of 2023. The review was based on a review of current, available information since the last 5-year review for *Drosophila substenoptera* (USFWS 2019, entire). The evaluation by Charmian Dang, Fish and Wildlife Biologist, was reviewed by John Vetter, the Animal Recovery Coordinator, and Megan Laut, the Recovery Team Manager.

Background:

For information regarding the species' listing history and other facts, please refer to the USFWS Environmental Conservation Online System (ECOS) database for threatened and endangered species (*https://ecos.fws.gov/ecp/species*).

Review Analysis:

Please refer to the previous 5-year reviews for *Drosophila substenoptera* published on August 28, 2012 and July 15, 2019 (available at https://ecos.fws.gov/ecp/species/2243), for a complete review of the species' status, threats, and management efforts. No new information regarding the species' biological status has come to light since listing to warrant a change in the Federal listing status of *D. substenoptera* as endangered.

This picture-wing fly is an endangered endemic species found only on the island of O‘ahu. The current status and trends for *Drosophila substenoptera* are provided in the tables below.

New status information:

Endemic to the island of O‘ahu, *Drosophila substenoptera* is a picture-wing fly that is currently known on lands managed by the Army Natural Resources Program (ANRP) at three population units: Palikea, Ka‘ala-Kalena, and ‘Ōpae‘ula. Palikea is monitored regularly;

numbers have fluctuated between three and twelve individuals between 2018–2023 (ANRP 2018, p. 187; ANRP 2019, p. 192; ANRP 2020, p. 182; ANRP 2021, p. 172; ANRP 2022, p. 178; ANRP 2023, p. 193). A maximum of 12 individuals were observed in one day between 2017–2018; a maximum of four individuals were observed in one day between 2018–2019; a maximum of three individuals were observed in one day between 2019–2020; a maximum of four individuals were observed in one day between 2020–2021; a maximum of 11 individuals were observed in one day between 2021–2022; and a maximum of four individuals were observed in one day between 2022–2023. This species is highly sporadic, typically occurring as single individuals observed only once during a day at Ka‘ala-Kalena and ‘Ōpae‘ula (OANRP 2014, p. 207; OANRP 2015, p. 129; Magnacca 2018, in litt.) and has not been noted in these two locations by the ANRP since 2015 (ANRP 2018, p. 187; ANRP 2019, p. 192; ANRP 2020, p. 182; ANRP 2021, p. 172; ANRP 2022, p. 178; ANRP 2023, p. 193).

New Threats:
Western yellowjackets, *Vespula pensylvanica*, has been monitored at Palikea and Hāpapa, but monitoring was stopped due to their consistently low numbers, and consequently low expected impact (ANRP 2019, p. 197; ANRP 2020, p. 179). The thief ant, *Solenopsis papuana*, has been found to exert a significant negative impact on *Drosophila* reproductive success, and work is currently underway on the best way to manage them on the landscape (ANRP 2020, p. 179).

New management actions:
One of *Drosophila substenoptera*’s host plants, *Cheirodendron trigynum* (‘ōlapa), has been outplanted at Palikea between 2018–2021 (ANRP 2018, pp. vxii, 105–106, 187; ANRP 2019, p. xvi; ANRP 2020, pp. xvi, 96; ANRP 2021, p. 87) and at ‘Ōpae‘ula Lower between 2019–2021 (ANRP 2019, pp. xvi, 114; ANRP 2020, pp. xvi, 94; ANRP 2021, p. 89) by ANRP as part of their habitat restoration plan with successful establishment. *Polyscias oahuensis* (‘ōhe mauka), another endemic host plant species of *D. substenoptera,* has been outplanted at Kahanahāiki in 2019 and 2021 (ANRP 2019, p. 106; ANRP 2021, p. 79). However, *Drosophila substenoptera* has not been observed at this location.

The DLNR-DOFAW is actively managing the Honouliuli Forest Reserve with fence maintenance, construction of ungulate exclosures, and ungulate control. It also maintains the fire break and water catchment tanks in this forest reserve (Peralta 2022, in litt., entire).

Drosophila yeast trials are in its beginning stage and are being conducted by the State of Hawai‘i Division of Forestry and Wildlife (DOFAW) to assess the attractiveness of wild yeasts associated with *Drosophila* host plants. Since the 1970s the primary method of attracting Hawaiian picture-wing flies has been through sponges baited with fermented mushroom juice and a banana mash containing baker’s yeast (*Saccharomyces cerevisiae*). In the decades since these baits were developed, many studies have been conducted, focusing on the mutualistic relationships between *Drosophila* and various yeast species. Some of the benefits highlighted in such trials include increased survivorship, faster physical development, higher fecundity in adults, and higher rates of attraction to certain species of yeast (ANRP 2023, p. 201).

These yeast trials focused on the hypothesis that highly host specific *Drosophila* species, such as *Drosophila substenoptera*, are also highly specific in their relationship to the yeast species found within their host plants. If *Drosophila substenoptera* is more attracted to the chemical signals of the yeasts found in rotting materials of its host plants, these yeast species may be used in bait traps instead of baker's yeast to attract more flies during monitoring and help the ANRP acquire a more accurate population estimate of this species (ANRP 2023, p. 201).

In January of 2023 the ANRP conducted a trial eDNA survey for picture-wing flies. The sampling that was used is based on current monitoring techniques using baited sponges but were conducted over several days. This is intended to detect the presence of very low-density populations of *Drosophila* in their habitat, which will prompt further monitoring of an area (ANRP 2023, p. 204).

Synthesis:
Drosophila substenoptera is an O'ahu endemic picture-wing fly species that is still regularly observed in small numbers in a few locations. A Draft Recovery Outline that included *Drosophila substenoptera* was published in August of 2006. No Final Recovery Plan for *D. substenoptera* has been written, and, thus, recovery criteria and goals have not been identified for this species. Threats identified in the Final Listing Rule and Draft Recovery Outline are not sufficiently managed throughout the range of the species (Table 2). Therefore, *D. substenoptera* meets the definition of endangered as it remains in danger of extinction throughout its range.

Table 1. Status and trends of *Drosophila substenoptera* from listing through current 5-year review.

Date	No. wild individuals	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria completed?
2006 (Listing)	No recent sightings	Not yet established	N/A
2006 (Draft Recovery Outline)	No recent sightings	Not yet established	N/A
2008 (Critical Habitat)	No recent sightings	Not yet established	N/A
2012 (5-year review)	16 individuals were sighted during bait surveys	Not yet established	N/A
2019 (5-year review)	Between 2013 and mid-2018 a maximum of 19 individuals were sighted during bait surveys in one day at Palikea; between 2013 and mid-2018 a	Not yet established	N/A

	maximum of 1 individual was observed during bait surveys in one day at ʻŌpaeʻula Lower; between 2011 and mid-2018 a maximum of 1 individual was observed during bait surveys in one day at Kaʻala; between 2013 and 2015 a maximum of 1 individual was observed during bait surveys in one day in East Makaleha; and between 2007 and mid-2018 a maximum of 10 individuals were observed during bait surveys in one day at Schofield Barracks		
2024 (5-year review)	Between 2018 and mid-2023 a maximum of 12 individuals were sighted during bait surveys in one day at Palikea; no individuals were sighted during bait surveys in one day at ʻŌpaeʻula Lower and Kaʻala	Not yet established	N/A

Table 2. Threats to *Drosophila substenoptera* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Yes. OANRP's 2009 INRMP included feral ungulate control in areas within and adjacent to the West Range of Schofield Barracks Military Reservation. Hawaiʻi Department of Land and Natural Resources, Division of Forestry and Wildlife is actively managing the Honouliuli Forest Reserve with fence maintenance, construction of ungulate exclosures, and ungulate control.
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Yes. OANRP's 2009 INRMP included nonnative plant species control in areas within and adjacent to the West Range of Schofield Barracks Military Reservation.

Climate change degradation or loss of habitat	A, E	Increasing	No.
Rodent predation or herbivory degradation of habitat	C	Ongoing	No. Host plants are vulnerable to rat predation and the plants are vulnerable to habitat degradation.
Alien predators - Invertebrates	C	Ongoing	No. *Drosophila substenoptera* face substantial predation pressure from nonnative insects such as yellowjacket wasps and ants.
Inadequacy of existing regulatory mechanisms	D	Ongoing	Yes. O‘ahu has a biosecurity program in place to prevent introduction of invasive species but the program is in its beginning stage.
Alien competitors	D, E	Ongoing	No. *Drosophila substenoptera* larval stage may possibly face resource competition from nonnative tipulid flies (crane flies, family Tipulidae). Existing regulations offer inadequate protection to these species from the introduction of nonnative insects and the loss of their host plants.
Human disturbance	E	Ongoing	No.
Environmental catastrophes	E	Ongoing	No.
Stochastic events—Reduced viability due to low numbers	E	Ongoing	No. Surveys are currently being conducted on lands managed by the Army. No *Drosophila substenoptera* are in captive rearing.

Recommendations for Future Actions:

- Survey and Inventory—Develop and implement a systematic *Drosophila substenoptera* survey and monitoring plan that includes historic habitats and other suitable habitats on O‘ahu.
- Develop and implement a Recovery Plan and Recovery Implementation Strategy.
- Habitat and natural process protection, management, and restoration.
    - Protect, manage, and restore *Drosophila substenoptera* habitat and host plant habitat.
    - Evaluate the need to re-establish or supplement host plants and wild picture-wing fly populations within their historical range.
- Evaluate host plant (*Cheirodendron* spp*., Polyscias* spp.) populations and enhance age class structure from seedling to senescent phase, if necessary.
- Survey and document predator threats.
- Ungulate monitoring and control.

    - Construct and maintain fenced exclosures to protect all *Drosophila substenoptera* life stages and host plants from the negative impacts of feral ungulates.
    - Monitor fenced areas to maintain absence of ungulates.
- Fire, predation, herbivore, and disease monitoring and control—Implement effective control methods for fire, rat, nonnative insect, predator, and ungulate threats, and habitat altering plant disease within the vicinity of *Drosophila substenoptera* and its host plants populations.
- Climate change adaptation strategy—Research the suitability of habitat for reintroducing this species and its host plants in the future due to the impacts of climate change.
- Stochastic events—build resilience and redundancy—Increase numbers of populations and individuals scattered through the historic range to reduce impacts from low numbers.
- Population biology research.
    - Conduct biological and ecological research on *Drosophila substenoptera*.
    - Conduct biological and ecological research on the host plants of *Drosophila substenoptera*.
- Captive rearing and reintroduction—Evaluate the need to develop and implement a captive rearing and reintroduction program for *Drosophila substenoptera* in its historic range.
- Alliance and partnership development—Coordination efforts with stake holders for host plants management and invasive plant, insect, and mammal control.
- Outreach and Education – Develop and implement a public information program.

References:

See previous 5-year reviews completed in 2012 and 2019 for a more complete list of references (USFWS 2012, 2019). Only references not included in these documents are provided below.

[ANRP] Army Natural Resources Program, Oʻahu. 2018. Status report for the Mākua and Oʻahu Implementation Plans. U.S. Army Garrison, Hawaiʻi. 261 pp.

[ANRP] Army Natural Resources Program, Oʻahu. 2019. Status report for the Mākua and Oʻahu Implementation Plans. U.S. Army Garrison, Hawaiʻi. 253 pp.

[ANRP] Army Natural Resources Program, Oʻahu. 2020. Status report for the Mākua and Oʻahu Implementation Plans. U.S. Army Garrison, Hawaiʻi. 238 pp.

[ANRP] Army Natural Resources Program, Oʻahu. 2021. Status report for the Mākua and Oʻahu Implementation Plans. U.S. Army Garrison, Hawaiʻi. 232 pp.

[ANRP] Army Natural Resources Program, Oʻahu. 2022. Status report for the Mākua and Oʻahu Implementation Plans. U.S. Army Garrison, Hawaiʻi. 255 pp.

[ANRP] Army Natural Resources Program, Oʻahu. 2023. Status report for the Mākua and

O‘ahu Implementation Plans. U.S. Army Garrison, Hawai‘i. 281 pp.

[USFWS] U.S. Fish and Wildlife Service. 2019. *Drosophila substenoptera* (Picture-wing Fly) 5-Year Review Summary and Evaluation. 7 pp.

[USFWS] U.S. Fish and Wildlife Service. 2022. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 167 species in Oregon, Washington, Idaho, Montana, California, Hawai‘i, Guam, and the Northern Mariana Islands. Federal Register 87(90): 28,031–28,034.

In Litteris

Peralta, R. 2022. in litt. Email communication between Ryan Peralta, Forest Management Supervisor, Division of Forestry and Wildlife and Charmian Dang, U.S. Fish and Wildlife Service, Honolulu, Hawai‘i on January 7, 2022.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of
Picture-wing Fly (*Drosophila substenoptera*)

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

Recommendation resulting from the 5-year review:

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

Review Conducted By:
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