

Picture-wing fly
(Drosophila neoclavisetae)

5-Year Review
Summary and Evaluation

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

5-YEAR REVIEW

Species reviewed: Picture-wing fly (*Drosophila neoclavisetae*)

TABLE OF CONTENTS

1.0	GENERAL INFORMATION	3
1.1	Reviewers	3
1.2	Methodology used to complete the review:	3
1.3	Background:	3
2.0	REVIEW ANALYSIS	4
2.1	Application of the 1996 Distinct Population Segment (DPS) policy	4
2.2	Recovery Criteria	5
2.3	Updated Information and Current Species Status	6
2.4	Synthesis.....	10
3.0	RESULTS	10
3.1	Recommended Classification:	10
3.2	New Recovery Priority Number:	11
3.3	Listing and Reclassification Priority Number:	11
4.0	RECOMMENDATIONS FOR FUTURE ACTIONS	11
5.0	REFERENCES	11
	Signature Page.....	13

5-YEAR REVIEW
Picture-wing fly/*Drosophila neoclavisetae*

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

Region 1, Endangered Species Program, Division of Recovery Jesse D'Elia,
(503) 231-2349

Lead Field Office:

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

Cooperating Field Office(s):

N/A

Cooperating Regional Office(s):

N/A

1.2 Methodology used to complete the review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on April 8, 2010. The review was based on the final rule to list 12 Hawaiian picture-wing flies, designation of Critical Habitat for 12 species of picture-wing flies from the Hawaiian Islands Final Rule, the Recovery Outline for 12 Hawaiian picture-wing flies, current published and unpublished materials and expert opinions and knowledge on the *Drosophila neoclavisetae* species. The draft five-year review was then reviewed by the Endangered Species Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before signature by the Pacific Islands Fish and Wildlife Office Field Supervisor and transmittal to the Regional Office.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

1.3.2 Listing history

Original Listing

FR notice: [USFWS] U.S. Fish and Wildlife Service. 2006. Endangered and threatened wildlife and plants; Determination of status for 12 species of picture-wing flies from the Hawaiian Islands. Federal Register 71(89):26835-26852.

Date listed: May 9, 2006

Entity listed: Species

Classification: Endangered

Revised Listing, if applicable

FR notice: N/A

Date listed: N/A

Entity listed: N/A

Classification: N/A

1.3.3 Associated rulemakings:

[USFWS] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; Designation of critical habitat for 12 species of picture-wing flies from the Hawaiian Islands. Final Rule. 73(234):73794-73888.

One critical habitat management unit totaling 237 hectares (584 acres) has been designated for *Drosophila neoclavisetae* on the island of Hawaii.

1.3.4 Review History: N/A

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

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: Recovery Outline for 12 Hawaiian Picture-wing Flies

Date issued: August 2006

Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

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

2.1.1 Is the species under review a vertebrate?

 Yes

 X No

2.1.2 Is the species under review listed as a DPS?

 Yes

 X No

2.1.3 Was the DPS listed prior to 1996?

Yes
 No

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

Yes
 No

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

Yes
 No

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

Yes
 No

2.2 Recovery Criteria

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

Yes
 No

2.2.2 Adequacy of recovery criteria.

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

Yes
 No

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

Yes
 No

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

A draft recovery plan for *Drosophila neoclavisetae* is being developed but was not published at the time of completing this 5-year review.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

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

The general life cycle of Hawaiian *Drosophila* is typical of most flies: after mating, females lay eggs from which larvae (immature stage) hatch; as larvae grow they molt (shed their skin) through three successive stages (instars); when fully grown, the larvae change into pupae (a transitional form) in which they metamorphose and emerge as adults.

The larval stage host plant of *Drosophila neoclavisetae* has not yet been confirmed, although it is likely one or both of the two *Cyanea* sp. (*Cyanea kunthiana* and *Cyanea macrostegia* subspecies *macrostegia*) (family Campanulaceae) present within its range. Because both collections of this fly occurred within a small patch of *Cyanea* spp. and many other species in the *Drosophila adiantola* species group use species in this genus and other plants in the family Campanulaceae, researchers believe that one or both of the two *Cyanea* spp. found at Puu Kukui are the correct larval stage host plants for *D. neoclavisetae* (Science Panel 2005).

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

Drosophila neoclavisetae is known historically from only two populations located in wet native forest on Maui. Populations were found historically along the Puu Kukui Trail within montane wet *Metrosideros polymorpha* forests on State land in West Maui. One habitat site was found in 1969 at 1,400 meters (4,600 feet) and the other in 1975 at 1,040 meters (3,400 feet) above sea level (K. Kaneshiro, *in litt.* 2005). Fewer than ten individuals have been observed despite attempts to relocate the species (K. Kaneshiro, *in litt.* 2005; K. Kaneshiro *in litt.* 2006). Researchers estimate that between 90 and 95 percent of *D. neoclavisetae*'s total potential range has been surveyed (K. Kaneshiro, *in litt.* 2006).

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

No new information is available.

2.3.1.4 Taxonomic classification or changes in nomenclature:

No changes in taxonomic classification have occurred. *Drosophila neoclavisetae* was described by Perreira and Kaneshiro (1990) from specimens collected at Puu Kukui, West Maui, in 1969. It was named for its obvious affinities with *Drosophila clavisetae* from East Maui. Both species are similar in wing and thorax markings, and they share a

specialized part of the courtship behavior. The male bends its abdomen up over its head, produces a bubble of liquid (believed to be a sex pheromone) from its anal gland and then vibrates the abdomen, fanning the scent toward the female. Both *D. neoclavisetae* and *D. clavisetae* are members of the *Drosophila adiantola* species group (Perreira and Kaneshiro 1990), and while other species in this group perform similarly unusual mating dances, the behavior is highly exaggerated in *D. clavisetae* and *D. neoclavisetae*.

Drosophila neoclavisetae is between 6.0 and 6.4 millimeters (0.2 and 0.25 inches) in length, with wings 6.5 to 7.0 millimeters (0.26 to 0.3 inches) long. It is distinguished by its amber brown head and yellow face, with the middle portion raised to form a prominent ridge. The thorax is predominantly reddish brown with a distinct brown median stripe, bordered on each side by two brown stripes. The legs are yellow, with brown on the femora and a distinct brown band on the tips of the tibiae. The wings are broad and rounded, more than twice as long as wide, and with the front portion covered with brown markings and large clear spots tinged light yellow. It shares with *Drosophila clavisetae* an extra cross-vein in the wing, which distinguishes both these species from the other species of the *Drosophila adiantola* group. The abdomen is dark brown and black with numerous long hairs on the hind segments of the male.

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

Seasonal and day-to-day variability of *Drosophila* presence and detection with baits significantly complicates assessing the range of this species. *Drosophila neoclavisetae* has only been recorded twice, once in 1969 and once in 1975, in Puu Kukui on Maui. *Drosophila neoclavisetae* is limited to the highlands of West Maui, where degradation and modification of its habitat, particularly from the effects of feral pigs, have occurred (Science Panel 2005). The lack of positive survey results for *D. neoclavisetae* despite extensive, focused efforts to relocate this species suggest *D. neoclavisetae* may be in danger of extinction.

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

In accordance with section 3(5)(A)(i) of the Endangered Species Act and the regulations at 50 CFR 424.12, in determining which areas occupied at the time of listing to propose as critical habitat, we consider the Primary Constituent Elements (PCE) to be those physical and biological features that are essential to the conservation of the species and that may require special management or protection. The PCE for *Drosophila neoclavisetae* are: (1) Wet, montane, ohia forest between the elevations of 1,036–1,399

meters (3,405–4,590 feet), and (2) the larval stage host plants *Cyanea kunthiana* and *Cyanea macrostegia* ssp. *macrostegia*, which exhibit one or more life stages (from seedlings to senescent individuals) (USFWS, 2008).

A Final Rule establishing critical habitat for *Drosophila neoclavisetae*, went into effect January 5, 2009 (USFWS, 2008). *Drosophila neoclavisetae*-Unit 1-Puu Kukui consists of 237 hectares (584 acres) of montane, wet, *Metrosideros polymorpha* (ohia) forest within the west Maui mountains on the island of Maui. Ranging in elevation between 1,040–1,400 meters (3,405–4,590 feet), this unit is both privately and State-owned. This unit occurs within the boundary of the Puu Kukui Watershed Preserve, lands jointly managed by The Nature Conservancy of Hawaii, the State of Hawaii, and Maui Land and Pineapple Company. According to the most recent survey data (K. Kaneshiro, *in litt.* 2005), this unit was occupied by *D. neoclavisetae* at the time of listing. This unit includes the known elevation range, moisture regime, and native forest components used by foraging adults that have been identified as the PCEs for this species. This unit also includes populations of *Cyanea kunthiana* and *Cyanea macrostegia* subspecies *macrostegia*, the larval stage host plant associated with this species.

2.3.1.7 Other:

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

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

Drosophila neoclavisetae has only been observed twice in one area of West Maui. The larval stage host of *D. neoclavisetae* has not been confirmed, although it is likely one or both of the two *Cyanea* spp. (*Cyanea kunthiana* and *Cyanea macrostegia* subspecies *macrostegia*) (family Campanulaceae) are present within its range. Because both collections of this fly occurred within a small patch of *Cyanea* sp. and many other species in the *Drosophila adiantola* species group use species in this genus and other plants in the family Campanulaceae, researchers believe that one or both of the two *Cyanea* spp. found at Puu Kukui are the correct larval stage host plants for *D. neoclavisetae* (Science Panel 2005). The habitat of this picture-wing fly and *Cyanea* spp., the unconfirmed larval stage host plant, is threatened by nonnative plants, possible tipulid competition, and predation by yellowjacket wasps. *Drosophila neoclavisetae* is limited to the highlands of West Maui, where degradation and modification of its habitat, particularly from the effects of feral pigs, have occurred (Science Panel 2005). Rats are also a factor threatening *D. neoclavisetae* habitat and are abundant in the areas where *D. neoclavisetae* has been observed (Kishinami 2001; Science Panel 2005). Yellowjacket

wasps are believed to be a significant threat to this species, and in combination with habitat loss, threaten its continued existence (Science Panel 2005). These threats, considered in the context of the small number of individuals of the species (as inferred from the lack of positive survey results, despite extensive, focused efforts to relocate this species), are magnified and place *D. neoclavisetae* in danger of extinction.

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

Overutilization is not known to be a threat to this species.

2.3.2.3 Disease or predation:

Disease is not known to be a threat to any of the Hawaiian picture-wing flies. However, predation by nonnative insects and other arthropods poses a grave threat to Hawaii's native *Drosophila* (Howarth and Medeiros 1989; Howarth and Ramsay 1991). Western yellowjackets and ants are nonnative arthropods that pose a serious threat to *D. neoclavisetae* through predation (Howarth and Medeiros 1989; Howarth and Ramsay 1991; Howarth et al. 2001).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Regulatory mechanisms remain inadequate for thorough protection of the species, particularly quarantine regulations pertaining to the prevention of accidentally introduced arthropods, and augmentation and introduction of biological control agents in Hawaii.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Several species of nonnative rats, including the Polynesian rat (*Rattus exulans*), the roof rat (*Rattus rattus*), and the Norway rat (*Rattus norvegicus*) are present on the Hawaiian Islands and cause considerable environmental degradation (Kishinami 2001). The seeds, bark, and flowers of many endemic plants are susceptible to herbivory by all the rat species (Science Panel 2005; K. Magnacca, *in litt.* 2005). The herbivory by rats causes plant mortality, diminished vigor, and seed predation, resulting in reduced plant fecundity and viability (Science Panel 2005; K. Magnacca, *in litt.* 2005). The direct impact of rat predation on the plant hosts of *Drosophila neoclavisetae* are unknown because the larval stage host plants of *D. neoclavisetae* have not been confirmed. Rats are abundant in the habitat last known to be occupied by *D. neoclavisetae*.

The effects of climate change on picture-wing flies and host-plant range will likely be significant. Life cycle characteristics such as length of larval period and adult longevity are highly dependent on temperature and other environmental factors affected by climate change. In general, stage length and longevity decrease with temperature increase. Fecundity and

sex ratio may also be influenced by temperature in some species. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

2.4 Synthesis

Hawaii picture-wing fly, *Drosophila neoclavisetae*, is an endangered endemic species found only on the island of Maui. *Drosophila neoclavisetae* has only been observed twice in one area of West Maui and has not been recorded since 1975. The larval stage host of *D. neoclavisetae* has not been confirmed, although it is likely one or both of the two *Cyanea* sp. (*Cyanea kunthiana* and *Cyanea macrostegia* subspecies *macrostegia*) (family Campanulaceae) are present within its range. The habitat of this picture-wing fly and *Cyanea* spp., which are the unconfirmed larval stage host plants, are threatened by nonnative plants, possible tipulid competition, and predation by yellowjacket wasps. *Drosophila neoclavisetae* is limited to the highlands of West Maui, where degradation and modification of its habitat, particularly from the effects of feral pigs, have occurred. Rats are also a factor threatening *D. neoclavisetae* habitat and are abundant in the areas where *D. neoclavisetae* has been observed. Yellowjacket wasps are believed to be a significant threat to this species, and in combination with habitat loss, threaten its continued existence. These threats combined with the lack of positive survey results for *D. neoclavisetae* despite extensive, focused efforts to relocate this species suggest *D. neoclavisetae* may be in danger of extinction. Climate change will significantly impact the life cycle characteristics of *D. neoclavisetae* and the range of its host plants. A draft recovery plan for this species is being developed.

3.0 RESULTS

3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist

Extinction

Recovery

Original data for classification in error

No change is needed

3.2 New Recovery Priority Number:

Brief Rationale:

3.3 Listing and Reclassification Priority Number:

N/A

Reclassification (from Threatened to Endangered) Priority Number: _____

Reclassification (from Endangered to Threatened) Priority Number: _____

Delisting (regardless of current classification) Priority Number: _____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

1. Develop and implement a Recovery Plan.
2. Develop and implement a systematic *Drosophila neoclavisetae* survey and monitoring plan that includes historic habitats and other suitable habitats.
3. Protect *Drosophila neoclavisetae* habitat and control fire, rat, nonnative insect, and ungulate threats.
4. Determine the larval stage host plant for *Drosophila neoclavisetae*.
5. Eliminate or manage nonnative plants that compete with the larvae host plants and increase wildfire risk.
6. Survey and document predatory threats.
7. Evaluate the need to re-establish or supplement larvae host plants and wild picture-wing fly populations within their historical range.

5.0 REFERENCES

- Howarth, F.G., and A. Medeiros. 1989. Non-native invertebrates. Pages 82-87 in C.P. Stone and D.B. Stone (Editors), Conservation Biology in Hawaii. Cooperative National Park Resources Studies Unit. University of Hawaii. Honolulu, Hawaii.
- Howarth, F.G., and G.W. Ramsay. 1991. The conservation of island insects and their habitats. Pages 71-107 in N.M. Collins and J.A. Thomas (Editors), The Conservation of Insects and Their Habitats. Academic Press. London. UK.
- Howarth, F.G., G.M. Nishida, and N.L. Evenhuis. 2001. Insects and other terrestrial arthropods. Pages 41-62 in Hawaii's invasive species. A Hawaii Biological

Survey Handbook. Mutual Publishing and Bishop Museum Press. Honolulu, Hawaii.

Kishinami, C.H. 2001. Mammals. Pages 17-20 in G.W. Staples and R.H. Cowie (Editors), Hawaii's Invasive Species. Mutual Publishing and Bishop Museum Press. Honolulu, Hawaii.

Perreira, W.D., and K.Y. Kaneshiro. 1990. Three new species of picture-winged *Drosophila* from the Hawaiian Islands. Proceedings of the Hawaiian Entomological Society 30:79-84.

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[USFWS] U.S. Fish and Wildlife Service. 2006. Endangered and threatened wildlife and plants; Determination of status for 12 species of picture-wing flies from the Hawaiian Islands. Federal Register 71:26835-26852.

[USFWS] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; Designation of critical habitat for 12 species of picture-wing flies from the Hawaiian Islands. Final Rule. 73:73794-73888.

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75:17947-17950.

***IN LITT.* REFERENCES**

Foote, D. 2005. Information regarding yellow-jacket studies in and around Hawaii Volcanoes National Park. Email message from David Foote, U.S. Geological Survey, Biological Resources Discipline, to Mike Richardson, U.S. Fish and Wildlife Service.

Kaneshiro, K. *in litt.* 2005. Complete collection data for the 12 species of Hawaiian picture-wing flies. Compiled from the Hawaiian *Drosophila* Database Project. Excel program file format. 16 pp.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Picture-wing fly
(*Drosophila neoclavisetae*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By:

Diane Sether, Invertebrate Biologist
Jess Newton, Endangered Species Recovery Program Leader
Assistant Field Supervisor for Endangered Species

Approved Jess Newton Date 8/28/2012
for Field Supervisor, Pacific Islands Fish and Wildlife Office