Picture-wing fly
(Drosophila aglaia)

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 aglaia*)

TABLE OF CONTENTS

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

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from the Hawaiian Islands Final Rule, the Recovery Outline for 12 Hawaiian picture-wing flies, current published and unpublished materials and expert opinions and knowledge on the *Drosophila aglaia* species.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.

Two Critical Habitat units totaling 119 hectares (295 acres) have been designated for *Drosophila aglaia* on the island of Oahu.

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***

__X__ ***No***

2.2 Recovery Criteria

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

____ ***Yes***

_X__ ***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 aglaia* 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. *Drosophila aglaia* is restricted to the natural distribution of its host plant, *Urera glabra* (family Urticaceae), which is a small shrub-like endemic tree. The larvae of *D. aglaia* develop in the decomposing bark and stem of *U. glabra*. This plant does not form large stands, but is infrequently scattered throughout slopes and valley bottoms in dry and mesic forest habitat in the Waianae Mountains of Oahu, Hawaii.

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:
Bait can be used to survey for Hawaiian *Drosophila* but only to indicate the presence or absence of taxa. There is no technique currently available to uniquely mark individual flies and thereby quantify the number of *Drosophila aglaia* visiting the bait (K. Magnacca, *in litt*. 2010). In addition, Hawaiian *Drosophila* life cycles, are influenced by rainfall patterns and other environmental variables, making survey results difficult to compare over time and across sites. Even the very common species of picture-wing flies fluctuate widely seasonally as well as daily, confounding negative survey records for a taxa (K. Magnacca, *in litt*. 2012b).

A total of 20 individuals have been observed during bait-based surveys conducted since April 1969 in the historical range of *Drosophila aglaia* (K. Kaneshiro, *in litt*. 2005; K. Magnacca *in litt*. 2012a, OANRP 2007). The historical sites include: three lowland mesic forest sites in Makaleha Valley, Palikea, and Peacock Flat (Kapuahikahi); one site in the diverse mesic forest at Puu Kaua; one lowland, dry to mesic forest site at Puu Pane (K. Kaneshiro, *in litt*. 2005a); and Kaala, where *D. aglaia* was first collected by Hardy in 1946. The number of surveys conducted, the number of surveys that had *D. aglaia* observations, and the total number of individuals observed for each survey location and time period are summarized (Table).

The last observation of this species occurred in May1997 during a survey of Palikea. The species has not been observed at the other historical sites

since 1970 or 1971. However, Makaleha Valley and Peacock Flats (Kapuahikahi Gulch) have not been surveyed since the 1970s and the Puu Pane has been surveyed only once in 1991 (K. Kaneshiro, *in litt*. 2005a). *Drosophila aglaia* flies have not been observed in subsequent surveys conducted at Palikea, Puu Kalena, Kaluaa Gulch, and Puu Hapapa, or along Kaala trail, between 2006 and 2011 (K. Magnacca *in litt*. 2012a). Other listed *Drosophila* species have been observed during these surveys. The rarity in detection of *D. aglaia* and the wide variability in detection of *Drosophila* species in general, complicate estimation of population abundance, structure, and demographics.

TABLE. Total number of surveys (first number), number of surveys with *Drosophila aglaia* fly observations (second number), and total number of *D. aglaia* observed (third number) between 1965-2011 at Kaala, Makaleha Valley, Palikea, Peacock Flat, Puu Kaua, and Puu Pane in the Waianae Mountain range, Oahu.

	Total No. surveys/No. of surveys with *Drosophila aglaia*/Total number of flies observed					
Years	**Kaala**	**Makaleha Valley**	**Palikea**	**Peacock Flat**	**Puu Kaua**	**Puu Pane**
1965-1969	5/0/0	10/2/3	6/0/0	3/0/0		
1970-1974	4/0/0	7/1/1		3/1/1	7/3/12	7/1/1
1975-1979	1/0/0		3/0/0	1/0/0		
1980-1984	1/0/0		2/1/1			
1985-1989	3/0/0					
1990-1994	6/0/0					1/0/0
1995-1999	2/0/0		5/1/1		5/0/0	
2006-2007	1/0/0					
2009-2010			3/0/0			
2011	1/0/0					

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. Hardy (1965) formally described *Drosophila aglaia* from specimens collected on Mount Kaala, Oahu, in 1946. The picture wing group is divided into four major subgroups based on maps of chromosomal inversions. *D. aglaia* is in the glabripex subgroup (Edwards et al. 2007).

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 a species. *Drosophila aglaia* was first recorded in 1946, on Mount Kaala on the island of Oahu, and described by Hardy (1965). Found only on Oahu, *D. aglaia* was historically known from five mesic forest localities within the Waianae Mountains of Oahu between 1,400–2,900 feet (425–885 meters) above sea level. The sites include one lowland mesic *Diospyros* sp. and *Metrosideros polymorpha* forest site in Makaleha Valley, two lowland mesic *Acacia koa* and *M. polymorpha* forest sites at Palikea and Peacock Flat (Kapuahikahi Gulch), one site in diverse mesic forest at Puu Kaua, and a lowland, dry to mesic forest site at Puu Pane (K. Kaneshiro, *in litt*. 2005).

This species is restricted to the natural distribution of its larval stage host plant, *Urera glabra* (family Urticaceae), which is a small shrub-like endemic tree found within dry to mesic, lowland, *Diospyros* sp., ohia and koa forest. The larvae of *Drosophila aglaia* feed within the decomposing bark and stem of *U. glabra*. This plant does not form large stands, and is infrequently scattered throughout slopes and gulches within mesic forest habitat in the Waianae Mountains on Oahu. Grazing damage and displacement of *U. glabra* by invasive plants contributes to fragmentation of the habitat.

During 83 surveys conducted between 1966 and 2011, 20 individuals were observed (K. Kaneshiro, *in litt*. 2005; K. Magnacca *in litt*. 2012; OANRP, 2007). The last observation of this species occurred in 1997 during a survey of the Palikea region of the Waianae Mountain Range. The species has not been observed at the other four historical sites since 1970 or 1971. However, two of the sites, Makaleha Valley and Peacock Flat, have not been surveyed since the 1970s, and Puu Pane, has been surveyed only once in 1991 (K. Kaneshiro, *in litt*. 2005). The greatest number of *Drosophila aglaia* observed during recorded bait surveys has been at Puu Kaua in 1970 and 1971 when 12 individuals were observed in three surveys. *Drosophila aglaia* has not been observed in five subsequent surveys conducted at Puu Kaua between 1997-1999. *Drosophila aglaia* has not been observed in subsequent surveys conducted from 2006 to 2009 in Palikea and has not been observed during surveys in suitable habitat regions of the Waianae Mountain range (K. Magnacca, *in litt*. 2012a).

The U.S. Army Oahu Integrated Natural Resources Management Plan (INRMP) updated in 2009, includes measures to benefit *Drosophila aglaia* where they occur within or adjacent to the West Range of Schofield Barracks Military Reservation. The measures include (1) outplanting of native plants, which provides for the natural forest conditions necessary

for adult fly foraging; (2) feral ungulate control, which prevents direct loss of the larval stage host plants and adult foraging substrate and prevents habitat alteration by feral ungulates; (3) wildland wildfire control, which prevents loss and alteration of habitat; and (4) nonnative plant control, which prevents habitat alteration.

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 conservation of the species and that may require special management or protection. The PCE for *Drosophila aglaia* are: (1) dry to mesic, lowland, ohia, koa, and *Diospyros* sp. forest between the elevations of 568–910 meters (1,865–2,985 feet); and (2) the larval stage host plant *Urera glabra*, which exhibits one or more life stages (from seedlings to senescent individuals (USFWS, 2008).

A Final Rule establishing Critical Habitat for *Drosophila aglaia*, went into effect January 5, 2009 (USFWS, 2008). *Drosophila aglaia*-Unit 1-Palikea consists of 84 hectares (208 acres) of lowland, mesic, koa and ohia forest within the southern Waianae Mountains of Oahu. The unit ranges in elevation from 585–910 meters (1,920–2,985 feet). This unit is privately and State-owned, and is part of a larger area called the Honouliuli Preserve, administered and managed by The Nature Conservancy of Hawaii (TNCH).

Drosophila aglaia-Unit 2-Puu Kaua consists of 35 hectares (87 acres) of lowland, diverse mesic, koa and ohia forest within the southern Waianae Mountains of Oahu. Ranging in elevation from 570–870 meters (1,865–2,855 feet), this unit is privately owned and is part of a larger area called the Honouliuli Preserve, which is administered and managed by TNCH.

According to survey data (K. Kaneshiro, in litt. 2005), these two units were occupied by *Drosophila aglaia* at the time of listing. The two units include the known elevation range, moisture regime, and native forest components used by foraging adults that have been identified as the PCEs for this species. These units also include populations of *Urera glabra,* the larval stage host plant associated with this species.

The U.S. Army completed an update of its 2000 Oahu Integrated Natural Resources Management Plan (INRMP) in 2009. Conservation measures included in the INRMP that benefit *Drosophila aglaia* include (1) outplanting of native plants, which provides for the natural forest conditions necessary for adult fly foraging; (2) feral ungulate control,

which prevents direct loss of the larval stage host plants and adult foraging substrate and prevents habitat alteration by feral ungulates; (3) wildland wildfire control, which prevents loss and alteration of habitat; and (4) nonnative plant control, which prevents habitat alteration. Based on the above considerations, and in accordance with section 4(a)(3)(B)(i) of the Endangered Species Act, USFWS determined that conservation efforts identified in the U.S. Army Garrison Hawaii Oahu Training Areas Natural Resource Management Final Report (U.S. Army, 2000 b) and the 2002–2006 Oahu Integrated Natural Resources Management Plan (U.S. Army, 2000a) provide benefits to *D. aglaia* where they occur within or adjacent to the West Range of Schofield Barracks Military Reservation. Therefore, this installation was exempt from critical habitat designation under section 4 (a)(3) of the Endangered Species Act (USFWS, 2008).

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:

Urera glabra, the host plant for *Drosophila aglaia*, are rare or sparsely distributed and threatened by ongoing habitat degradation. Lands with suitable habitats and those designated as Critical Habitat units need management and control for feral ungulates, such as pigs and goats; yellowjackets, tipulids, and other nonnative insects; rats; nonnative plants, particularly *Psidium cattleianum* and *Clidemia hirta*; and wildfire (Cuddihy and Stone 1990; Howarth et al 2001; Kishinami 2001; Science Panel 2005). *Melinis minutiflora* is a grass that burns readily, often grows at the border of forests, and tends to carry fire into areas with woody native plants (Smith 1985; Cuddihy and Stone 1990). This invasive grass is able to spread prolifically after a fire and effectively out-compete less fire-adapted native plant species, ultimately creating a stand of nonnative grass where forest once stood. Invasive nonnative weeds have not been eliminated or effectively managed through hand removal, selective herbicide application, or other control methods to alleviate competition and reduce fire risk. Invasion by nonnative plants and the resultant increase in fire risk remains a significant threat to the mesic forests that *D. aglaia* inhabits on Oahu.

Additionally, suitable lands need management and supplementation of *Urera glabra* plants so that all age classes, from seedling to senescent phase, are present.

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*, through direct predation or possibly parasitism as well as competition for food or space (Howarth and Medeiros 1989; Howarth and Ramsay 1991; Howarth et al. 2001). *Drosophila aglaia* flies face substantial predation pressure from nonnative insects such as ants and yellowjacket wasps at all life stages. Larval stages face resource competition from nonnative tipulid flies (Science Panel 2005; Howarth et al. 2001). Lizards are not endemic to Hawaii, and pose threats to *Drosophila*. Currently, existing regulations offer inadequate protection to these species from the introduction of nonnative insects and the loss of their host plants.

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:
Urera glabra, the host plant for *Drosophila aglaia*, does not form large stands, and is infrequently scattered throughout slopes and valley bottoms in mesic and wet forest habitat in the Waianae Mountains of Oahu. Loss of age classes of this plant host through habitat destruction and environmental change reduces the availability of suitable food and developmental resources and threatens *D. aglaia* population stability.

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 aglaia*, is an endangered endemic species found only on the island of Oahu. *D. aglaia* is restricted to the natural distribution of its host plant, *Urera glabra* (family Urticaceae), which is a small shrub-like endemic tree. The larvae of *D. aglaia* develop in the decomposing bark and stem of *U. glabra*. This plant does not form large stands, but is infrequently scattered throughout slopes and valley bottoms in mesic and wet forest habitat in the Waianae Mountains of Oahu. The Primary Constitutive Elements (PCE) for *D. aglaia* are: (1) dry to mesic, lowland, ohia, koa, and *Diospyros* sp., forest between the elevations of 568–910 meters (1,865–2,985 feet); and (2) the larval stage host plant *U. glabra*, which exhibits one or more life stages (from seedlings to senescent individuals).

Surveys for picture-wing flies rely on baiting which provides only presence or absence taxa data and does not provide quantitative data on abundance. The last observation of *Drosophila aglaia* occurred in 1997 during a survey at Palikea. *D. aglaia* has not been observed in subsequent surveys conducted from 2006-2011 in suitable habitat areas, including Palikea. *Drosophila aglaia* species has not been observed at the other four historical sites in the Waianae Mountains since 1970 or 1971 but three of the sites (Makaleha Valley, Peacock Flat, and Puu Kaua) have not been surveyed since the 1970s and the fourth site, Puu Pane, was surveyed only once in 1991 (K. Kaneshiro, *in litt*. 2005). Negative survey records do not provide definitive estimates of abundance and population trends because of seasonal and daily variability of observing Drosophila species in general.

Current threats to *Drosophila aglaia* include feral ungulates which feed on *Urera* sp., reducing regeneration and impacting host plant age distribution. Lands with suitable habitats and those designated as Critical Habitat units need management and control for feral ungulates, such as pigs and goats. Invasive plants, particularly *Psidium cattleianum* and *Clidemia hirta*, further degrade the suitable habitat through competition, displacement, and increased wildfire risk. Picture-wing flies face predation threats by non-native ants, yellowjackets, tipulids, other insects, and lizards. Currently, existing regulations offer inadequate protection to these species from the introduction of nonnative insects and the loss of their host plants. Climate change will significantly impact the life cycle characteristics of *D. alagaia* and the range of its host plants. A draft recovery plan for this species is being developed.

New observations of *Drosophila aglaia* have not been reported since the species was listed as endangered under the Endangered Species Act. Most threats are not being managed. Therefore, *D. aglaia* meets the definition of endangered, as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X__ 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. Protect *Drosophila aglaia* and *Urera glabra* habitat and control fire, invasive weeds, and ungulate threats.

3. Evaluate *Urera glabra* population and enhance age class structure from seedling to senescent phase, if necessary.

4. Continue coordination efforts with the military on the development and implementation of Integrated Natural Resource Management Plans.

5. Survey and document predatory threats.

6. Develop and implement a systematic *Drosophila aglaia* survey and monitoring plan that includes historic habitats and other suitable habitats.

7. Evaluate the need to re-establish or supplement *Urera glabra* and wild picture-wing fly populations within their historical range.

5.0 REFERENCES

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of the Native Hawaiian Vegetation; Effects of Humans, Their Activities and Introductions. Cooperative National Park Resources Studies Unit. University of Hawaii. Honolulu, Hawaii.

Edwards K.A., L.T. Doescher, K.Y. Kaneshiro, D. Yamamoto. 2007. A Database of Wing Diversity in the Hawaiian Drosophila. PLoS ONE 2(5): e487.

Hardy, D.E. 1965. Insects of Hawaii. Vol. 12 Diptera: Cyclorrhapha II, Series Schizophora, Section Acalypterae I. Family Drosophilidae. University of Hawaii Press, Honolulu, 814 pp.

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., Nishida, G.M., 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.

[OANRP] Oahu Army Natural Resources Program. 2007. Makua and Oahu Implementation Plan Status Report. Unpublished.

Science Panel for 12 Species of Hawaiian Picture-wing Flies. 2005. Notes for science panel hosted by the Pacific Islands Fish and Wildlife Office, November 15 to 16, 2005. 23 pp.

Smith, C.W. 1985. Impact of alien plants on Hawaii's native biota. Pages 180-250 in C.P. Stone and J.M. Scott (Editors), Hawaii's Terrestrial Ecosystems: Preservation and Management. Cooperative National Park Resources Studies Unit. University of Hawaii. Honolulu, Hawaii.

[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

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.

Magnacca, K. *in litt.* 2010. Army environmental sites collecting report. Puu Hapapa, February 23-25, 2010. Submitted by Karl Magnacca, Department of Biology, University of Hawaii, Hilo. 1 pp.

Magnacca, K. *in litt.* 2012a. Collection and survey data set for listed Hawaiian Drosophila from 2009 to 2011 compiled by Karl Magnacca, Research Entomologist, Division of Forestry and Wildlife and sent to Diane Sether, U.S. Fish and Wildlife Service, Honolulu, HI.

Magnacca, K. *in litt.* 2012b. Email communication between Karl Magnacca, Research Entomologist, Division of Forestry and Wildlife and Diane Sether, U.S. Fish and Wildlife Service, Honolulu, HI on May 1, 2012.

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

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ 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 for **Field Supervisor, Pacific Islands Fish and Wildlife Office** Date 8/28/2012