Achyranthes splendens var. *rotundata*
(Round-leaved chaff-flower)

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: *Achyranthes splendens* var. *rotundata* (Round-leaved chaff-flower)

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Achyranthes splendens var. *rotundata/* Round-leaved chaff-flower

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:
Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia, (503) 231-2071

Lead Field Office:
Pacific Islands Fish and Wildlife Office, Gina Shultz, Deputy 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 (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) beginning on March 8, 2007. The Bernice P. Bishop Museum provided most of the updated information on the current status of *Achyranthes splendens* var. *rotundata* and also provided recommendations for conservation actions needed prior to the next 5-year review. The evaluation of the status of the species was prepared by the lead PIFWO biologist and reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species, and Deputy Field Supervisor, before submission to the Field Supervisor for approval.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

USFWS. 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 71 species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and Territory of Guam. Federal Register 72(45):10547-10550.

1.3.2 Listing history

Original Listing
FR notice: USFWS. 1986. Endangered and threatened wildlife and plants; determination of endangered status for *Achyranthes rotundata*; final rule. Federal Register 51(58):10518-10521.
Date listed: March 26, 1986
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:

Not applicable

1.3.4 Review History:

Species status review [FY 2008 Recovery Data Call (September 2008)]: Declining

Recovery achieved:
1 (0-25%) (FY 2008 Recovery Data Call)

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

3

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: USFWS. 1994 Draft recovery plan for *Chamaesyce skottsbergii* var. *kalaeloana* and *Achyranthes splendens* var. *rotundata* - Draft. USFWS. Portland, OR. 79 pages.
Date issued: N/A; not completed due to taxonomic issues with *Chamaesyce*.
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 criteria?

____ ***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 synthesis of the threats (Factors A, B, C, D, and E) affecting *Achyranthes splendens* var. *rotundata* is presented in section 2.4.

Downlisting, and delisting objectives were provided in a draft recovery plan for *Chamaesyce skottsbergii* var. *kalaeloana* and *Achyranthes splendens* var. *rotundata* (USFWS 1993). While the draft recovery plan was not signed (see section 1.3.6), we provide the draft downlisting and delisting objectives below.

To consider downlisting *Achranthes splendena* var. *rotundata*, there must be at least three self-reproducing populations with a minimum of 500 reproductive plants per population in each of the two geographically distinct regions in which they occur (Ewa Plain and Kaena Point regions). The population trend should be growing or stable at 500 reproductive individuals and threats should be removed or controlled for at least 10 years prior to downlisting. Land area for each of these populations should be sufficient to provide a buffer of 30 to 50 meters (100 to 165 feet) around the expanded population.

To consider delisting *Achranthes splendens* var. *rotundata*, all criteria for downlisting should be met as well as the following criteria: at least three populations of *A. splendens* var. *rotundata* with a minimum of 1,000 reproductive plants each should be re-established within the taxon's historical range on the island(s) of Lanai and/or Molokai to ensure against losses due to a catastrophic event affecting the island of Oahu. In addition, all populations should be stable and self-sustaining, with no human manipulation, for a minimum of 10 years prior to delisting and expected to remain so into the foreseeable future.

2.3 Updated Information and Current Species Status

In addition to the status summary table below, information on the species' status and threats is summarized in section 2.4 ("Synthesis") below, which also includes any new information about the status and threats of the species.

Table 1. Status of *Achyranthes splendens* var. *rotundata* (Round-leaved chaff-flower) from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Delisting criteria identified in draft Recovery Plan	Delisting Criteria Completed?
1986 (listing)	~ 400	0	3 naturally reproducing populations with a minimum of 1,000 reproductive plants per population in both the Ewa Plain and Kaena Point regions	No
			Each population secure from threats	No
			Each population stable and increasing in number for a minimum of 10 consecutive years	No
			Land area for each of populations should be sufficient to provide a buffer of 30-50 meters around the expanded population	No
1994 (draft recovery plan)	~ 1,500	1,553	3 naturally reproducing populations with a minimum of 1,000 reproductive plants per population in both the Ewa Plain and Kaena Point regions	Partially
			Each population secure from threats	No
			Each population stable and increasing in number for a minimum of 10 consecutive years	Partially
			Land area for each of populations should be sufficient to provide a buffer of 30-50 meters around the expanded population	No
2008(5-yr review)	~ 1,600-1,700	100s	3 naturally reproducing populations with a minimum of 1,000 reproductive plants per population in both the Ewa Plain and Kaena Point regions	Partially
			Each population secure from threats	Partially
			Each population stable and increasing in number for a minimum of 10 consecutive years	Partially
			Land area for each of populations should be sufficient to provide a buffer of 30-50 meters around the expanded population	No

2.3.1 Biology and Habitat [see note in section 2.3]

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

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:

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

2.3.1.4 Taxonomic classification or changes in nomenclature:

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.):

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

2.3.1.7 Other:

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms) [see note in section 2.3]

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

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

2.3.2.3 Disease or predation:

2.3.2.4 Inadequacy of existing regulatory mechanisms:

2.3.2.5 Other natural or manmade factors affecting its continued existence:

2.4 Synthesis

Historically, *Achyranthes splendens* var. *rotundata* was found on arid and semi-arid coastal lowlands of Oahu, Molokai, and Lanai. *Achyranthes splendens* var. *rotundata*

was federally listed under the name *Achyranthes rotundata* (USFWS 1986). Wagner *et al*. (1999b) did not consider the division of *A. splendens* into five species by St. John (1979) to be valid and recognized two varieties, var. *rotundata* and var. *splendens*. The range of *A. splendens* var. *rotundata* is the same as the listed entity of *A. rotundata*.

At the time of Federal listing in 1986, only two populations consisting of two individuals at Kaena Point State Park, and approximately 400 individuals at Barbers Point, within the Ewa Plain, were known on Oahu. The populations on Molokai and Lanai were already extirpated at the time of listing (USFWS 1986). From 1987 to 1991, three subpopulations were discovered at Kaena Point consisting of 71 individuals at all live stages. There were four subpopulations on the Ewa Plains reported from 1985 to 1991 containing approximately 1,387 individuals. The Ewa Plain on Oahu has been heavily impacted by development and numbers of individual have been fluctuating, with some populations significantly reduced, largely from bulldozing, while others have been augmented. The biggest subpopulation was fenced and in 1990 and three plant sanctuaries were created to protect plants *in situ* (on site). One of the plants sanctuaries was a newly reintroduced population from nursery stock. The habitat surrounding the population on the Ewa Plain has largely been developed (USFWS 1993).

In 1996, two populations were known to occur at the Barbers Point area of the Ewa Plains (4,270 individuals), and Kaena Point, Oahu (48 individuals) (USFWS 1996). In 2004, a second subpopulation at Barbers Point (Brewer Plant Sanctuary) consisted of 150 mature and 150 immature plants, and two other fenced exclosures (Alternative Tech Park) consisting of 62 mature and 200 immature individuals (Kane 2004). However, in 2004, a decline in the number of extant individuals was reported, with a loss of 224 individuals in a subpopulation at Barber's Point (Lighthouse Plant Sanctuary). Molokai and Lanai populations are presumed extinct (Wagner *et al*. 1999a).

Propagation of the species by cuttings and seed is easy (Lilleeng-Rosenberger 2005). Each dry fruit contains a single seed, and while a high percentage of non-viable seed are found in some batches, viable seed has a 90 percent germination rate (Center of Tropical Agriculture and Human Resources 2008). *Achyranthes splendens* var. *rotundata* at Barbers Point grow in proximity to sinkholes or carnes within the limestone substrate (Kane 2004). The air above open sinkholes containing water is humid as compared to sinkholes filled with debris, modern trash, coral stones and green water. Those individuals growing in close proximity to filled sinkholes have been observed to not be as healthy as plants growing next to open sinkholes with water in the base. The species was also observed to be more successful under full sunlight conditions. The Makaha-Waianae Kai population is found in very different habitat from the other populations, being restricted to nearly vertical basaltic cliffs in narrow gulches (J. Lau, Botanical Consultant, pers. comm., 2008).

The genetic resources noted to be in storage consists of 83 seed stored at the Center for Conservation, Research, and Training Seed Storage Laboratory (2008). The Honolulu Botanical Gardens (2008) has 155 plants in genetic storage, representing 109 wild individuals; the Waimea Arboretum (2008) has 87 individuals in genetic storage, from seed and cuttings, representing six wild individuals; the Hawaii Division of Forestry and Wildlife, Oahu Office (2008) has 15 seeds in storage representing three individuals from Kaena Point. They also reintroduced 14 plants in Kaena Point in from 2007 to 2008.

The species is increasing in number of extant individuals on Oahu, largely due to the active augmentation of populations. In 2007, estimates of the number of wild and reintroduced individuals ranges from four subpopulations found in Kaena, Makaha, Campbell Industrial Park, and USFWS Kalaeloa Unit part of the Oahu National Wildlife Refuge Complex (B. Koebele, Kaala Farms, pers. comm. 2008) to six subpopulations on other sites on Oahu consisting of about 1,000 individuals (USFWS 2008). A population of 600 to 700 mature individuals was discovered in 2004 on the ridge between Makaha and Waianae Kai (J. Lau, pers. comm. 2008; USFWS 2008). In 2006, the Barbers Point (Kaomi Loop/Campbell Industrial Park) subpopulation was reported to consist of four mature individuals, four immature individuals and one seedling (USFWS 2008). At the Kalaeloa Unit, 100s of individuals have been reintroduced and natural recruitment is occurring, but actual counts are not available (B. Koebele, pers. comm. 2008).

However, *Achyranthes splendens* var. *rotundata* has had 88 percent of its historic range reduced by habitat conversion largely for industrial and agricultural developments (Factor A), and the remaining 12 percent of habitat has been degraded by invading exotic shrubs and trees (Factor E) (USFWS 1986). Habitat destruction continues to be the main threat to the survival of the taxon. At Kaena point, *Leucaena leucocephala* (haole koa) is the major invasive introduced plant threat to the species, and at Barbers Point *Pluchea indica* (sourbush) and *Prosopis pallida* (kiawe) alter the habitat of the species and compete for light (Factor E) (USFWS 1986, 1994, 1996, 2008; Kane 2004). Weed control is ongoing at the Kalaeloa population (Koebele 2007). Increased mortality of wild individuals has been observed due to scale farming by long-legged ants (*Anoplolepis longipes*) in the Kalaeloa Unit (Factor C) (USFWS 2008).

In addition, human activities, such as the deposition of trash and construction material into exclosures, are a threat to the survival of the taxon in its native habitat (Factor E) (Kane 2004). Survival has been noted to be dependent on drought (Factor E), but a high seed bank remains in the soil (USFWS 2008). The inflorescences and leaves of *A. splendens* var. *rotundata* have been used for making leis (flower garlands), and its foliage has been valued for traditional lei making (Factor B and D) (USFWS 1986); however, this use appears to have ended (USFWS 1996).

It is not possible to determine if the delisting goals for this species have been met, as the number of mature individuals is not currently known and the recovery plan has

not been finalized, due to taxonomic issues with the other species in the plan. In addition, not all of the threats are being managed (see Table 1). Therefore, *Achyranthes splendens var. rotundata* meets the definition of endangered as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.3 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: N/A

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

- Continue collection of fruit and plant material for future reintroductions, especially from the recently discovered population at Waianae Kai/Makaha
- Eradicate invasive introduced plant species within the species' habitat.
- Establish more populations within suitable habitat in protected sites.
- Survey geographical and historical range for a thorough current assessment of the species.
- Determine and implement control methods for scales and ants in the populations.
- Assess genetic variability within extant populations.
- Assess the suitability of habitat for reintroducing this species on Lanai and Molokai.

- Initiate planning and contribute to implementation of ecosystem level restoration and management to benefit this taxon.

- Study *Achyranthes splendens* var. *rotundata* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, seed banks, specific environmental requirements, limiting factors, and threats.

- Revise draft recovery plan with current information.

5.0 REFERENCES

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Personal communications:

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Achyranthes splendens* var. *rotundata*

Current Classification: E

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:
Christian Torres-Santana, Student Trainee Biologist
Marie Bruegmann, Plant Recovery Coordinator
Marilet A. Zablan, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species
Gina Shultz, Deputy Field Supervisor

Approved _____ Date 22 July 2009
Acting Field Supervisor, Pacific Islands Fish and Wildlife Office