5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Sanicula mariversa* (no common name)

Current Classification: Endangered

Federal Register Notice 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 58 species in Washington, Oregon, California, and Hawaii. Federal Register 75(226):71726-71729.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawaii

Name of Reviewer(s):

Jiny Kim, Fish and Wildlife Biologist, PIFWO
Daniel Clark, Oahu, Kauai, Northwest Hawaiian and American Samoa Islands Team Manager, PIFWO
Marie Bruegmann, Plant Recovery Coordinator, PIFWO
Recovery Program Lead, PIFWO
Kristi Young, Programmatic Deputy Field Supervisor, PIFWO

Methodology used to complete this 5-year 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 January 31, 2012. The review was based on a review of current, available information since the last five-year review for *Sanicula mariversa* (USFWS 2008). The National Tropical Botanical Garden provided an initial draft of portions of the five-year review and recommendations for conservation actions needed prior to the next five-year review. The document was reviewed by the Fish and Wildlife Biologist, Island Team Manager, and Plant Recovery Coordinator, followed by the Recovery Program Lead. It was subsequently reviewed and approved by the Programmatic Deputy Field Supervisor.

Background:

For information regarding the species' listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (http://ecos.fws.gov/tess_public).

Review Analysis:

Please refer to the previous 5-year review for *Sanicula mariversa* published on January 18, 2008 (available at http://ecos.fws.gov/docs/five_year_review/doc1799.pdf) for a complete review of the species' status, threats, and management efforts. No significant new information regarding the species biological status has come to light since listing to warrant a change in the Federal listing status of *S. mariversa.*

This short-lived, monocarpic perennial is endangered and occurs on Oahu. The current status and trends for *Sanicula mariversa* are provided in the tables below.

New status information:

- Ohikilolo contains 35 immature individuals (inside the military action area) (Oahu Army Natural Resources Program [OANRP] 2012).
- Keaau contains 11 mature, 300 immature, and 40 seedling individuals (inside the military action area) (OANRP 2012).
- Kamaileunu contains 18 mature and 307 immature individuals and one seedling (outside the military action area) (OANRP 2012).
- The population at Puu Kawiwi, outside the military action area, is steep and difficult to access. It has only one mature individual (OANRP 2012).

Total numbers of wild individuals for all populations at the end of 2012 were 30 mature and 642 immature individuals and 41 seedlings (OANRP 2012). This represents anincrease from the 20 individuals reported in the last five-year review, but could be due to the time the species was monitored, given that this species remains dormant when rains are inadequate.

New threats:

- Climate change - Climate change may also pose a threat to this 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 (PICCC) funded climate modeling that will help resolve these spatial limitations. High spatial resolution climate outputs are expected in 2013.

New management actions:

- Ungulate exclosures
    - Fencing of the Puu Kawiwi population was completed in 2007 (U. S. Army Garrison 2007).
    - A small fence protecting the Kamaileunu population of *Sanicula mariversa* was completed in 2008 (U. S. Army Garrison 2008).
    - A Makua fence enclosing *Sanicula mariversa* was completed in 2010 (U. S. Army Garrison 2010).
    - All populations managed by the Army were ungulate free in 2010 (U.S. Army Garrison 2011).
- Captive propagation for genetic storage and reintroduction
    - OANRP continues to collect seeds for genetic storage from all populations. In 2011, the genetic storage goals were 64 percent complete for the Kamaileunu population (U. S. Army Garrison 2011).
    - Temperature data loggers were placed at all wild sites to record temperature fluctuations to help determine how they might affect germination (U. S. Army Garrison 2009).
- Reintroduction / translocation - None of the individuals which were reintroduced in previous years survived for more than two seasons (M. Keir, OANRP, pers. comm. 2012).
- Population viability monitoring

    - Intensive monitoring of *Sanicula mariversa* began in 2007 to collect demography data and develop population viability analysis models for the species to better guide management (Ching and Kawelo 2008; U. S. Army Garrison 2007).
    - At Kamaileunu, an *in situ* germination study was conducted to determine what percentage of seeds produced in a given year would become seedlings the following year. This study coincided with two years of population structure monitoring to assess the stability of the population (Ching and Kawelo 2008; U.S. Army Garrison 2009).
- Ecosystem-altering invasive plant species control - Fence line clearing and some other invasive plant removal have been conducted (U. S. Army Garrison 2009).
- Life history research
    - Field research conducted in 2008 indicated that this species is deciduous, dying back to a fleshy tap root in the dry summer months. It takes several years to reach maturity (flowering) and is monocarpic (dies after flowering). These factors make it difficult to determine population dynamics from year to year, as it seems to develop slowly from one year to the next (Ching and Kawelo 2008).
    - Research from 2007 indicated that the seeds of *Sanicula mariversa* are slow to germinate. Seeds started germinating eight months after sowing, and finished germinating ten months after sowing (U.S. Army Garrison 2007).
    - *Sanicula mariversa* may also have extended dormancy (U.S. Army Garrison 2007).
- Alliance and partnership development – OANPR has worked cooperatively with the Hawaii Division of Forestry and Wildlife, Honolulu Board of Water Supply and other land managers to plan and implement ecosystem-level restoration and management to benefit this species (U.S. Army Garrison 2009).

Synthesis:
Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Oahu (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Sanicula mariversa* is a monocarpic perennial, and to be considered stable, the taxon must be managed to control threats (*e.g*., fenced) and be represented in an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection. In addition, a minimum of three populations should be documented on the island of Oahu. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

The stabilization goals for this species have not been met, since no populations contain 50 or more mature individuals (Table 1) and all threats are not being sufficiently managed throughout the populations (Table 2). Therefore, *Sanicula mariversa* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Captive propagation for genetic storage and reintroduction - Continue to collect seeds from all existing populations.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impact of erosion and military activities.
- Fire protection – Develop and implement fire management plans for all wild and reintroduced populations.
- Genetic research – Assess genetic variability within extant populations.
- Population biology research – Study *Sanicula mariversa* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Threats research – Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

Table 1. Status of *Sanicula mariversa* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	<100	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	~75	Unknown	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	170	19	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2008 (5-yr review)	20	0	All threats managed in all 3 populations	2 populations partially fenced
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2013 (5-yr review)	30 mature, 642 immature and 41 seedlings – total 723	0	All threats managed in all 3 populations	All populations fenced, but other threats remain.
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

Table 2. Threats to *Sanicula mariversa* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – goats degrade habitat	A, D	Ongoing	All population units are ungulate free
Established ecosystem-altering invasive plant species	A	Ongoing	Partially controlled
Fire degradation of habitat and destruction of individuals	A, E	Ongoing	Prevention and response efforts are in place, but risk remains high in dry conditions
Military training activities	E	Ongoing	Partially. Military activity has precluded genetic collection in some years (United States Army Garrison 2009).
Erosion	A, E	Ongoing	Elimination of goats may help prevent further erosion.
Trampling by humans on or near trails	E	Ongoing	Fencing should help with this.
Low numbers vulnerable to stochastic events such as hurricane	E	Ongoing	Remains a risk, despite conservation measures that are increasing population numbers.
Climate change	A, E	Increasing	None

References:

See previous 5-year review for a full list of references (USFWS 2008). Only references for new information are provided below.

Ching, S. and K. Kawelo. 2008. Demographic analysis of the endangered plant *Sanicula mariversa*. Oahu Army Natural Resources Program, poster for the Hawaii Conservation Conference. Available online at http://manoa.hawaii.edu/hpicesu/DPW/HCC-2008/SC_KK_poster_2.pdf.

[OANRP] Oahu Army Natural Resources Program. 2012. Makua implementation plan - population unit status; *Sanicula mariversa*. 1 page. Unpublished.

U.S. Army Garrison. 2007. 2007 Status Reports for the Makua implementation plan and the draft Oahu implementation plan. U.S. Army Garrison, Hawaii and Pacific Cooperative Park Studies Unit. Schofield Barracks, Hawaii. 719 pages. Available online at < http://manoa.hawaii.edu/hpicesu/DPW/2007_YER/YER_2007_edited.pdf>.

U.S. Army Garrison. 2008. Final implementation plan for Oahu training areas: Schofield Barracks Military Reservation, Schofield Barracks East Range, Kawailoa Training Area, Kahuku Training Area, and Dillingham Military Reservation. U.S. Army Garrison, Hawaii and Pacific Cooperative Park Studies Unit. Schofield Barracks, Hawaii. 624 pages. Available online at <http://manoa.hawaii.edu/hpicesu/DPW/2008_OIP/2008_OIP_edited.pdf>.

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U.S. Army Garrison. 2011. 2011 status report for the Makua and Oahu implementation plans. U.S. Army Garrison, Hawaii and Pacific Cooperative Park Studies Unit. Schofield Barracks, Hawaii. 269 pages. Available online at <http://manoa.hawaii.edu/hpicesu/DPW/2011_YER/2011_YER_Edited.pdf>.

[USFWS] U.S. Fish and Wildlife Service. 1998. Recovery plan for the Oahu plants. Portland, Oregon. 207 pages + appendices.

[USFWS] U.S. Fish and Wildlife Service. 2008. *Sanicula mariversa* (no common name) 5-year review summary and evaluation. U.S. Fish and Wildlife Service, Honolulu, Hawaii. 12 pages. Available online at <http://ecos.fws.gov/docs/five_year_review/doc1799.pdf>.

Personal communications

Keir, Matt. 2012. Rare Plant Program Manager, Pacific Cooperative Studies Unit, Oahu Army Natural Resources Program. E-mail to Margaret Clark, National Tropical Botanical Garden, dated November 20, 2012. Subject: quick question San_mar.

U.S. FISH AND WILDLIFE SERVICE

SIGNATURE PAGE for 5-YEAR REVIEW of *Sanicula mariversa* (no common name)

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

acting deputy
Field Supervisor, Pacific Islands Fish and Wildlife Office

Marie M Bruegman Date 2013-08-22