

Schiedea verticillata
(No common name)

**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: *Schiedea verticillata* (No common name)

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5-YEAR REVIEW
***Schiedea verticillata*/ (No common name)**

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

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Lead Field Office:

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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 *Schiedea verticillata*. 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. 1996. Endangered and threatened wildlife and plants; endangered status for three plants from the island of Nihoa, Hawaii; final rule. Federal Register 61(163): 43178-43184.

Date listed: August 21, 1996

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. 2003. Endangered and threatened wildlife and plants; designation of critical habitat for five plant species from the Northwestern Hawaiian Islands; final rule.

Critical habitat was designated for *Schiedea verticillata* in one unit totaling 405 hectares (1,219 acres) or the entire island of Nihoa. This designation includes habitat on Federal land (USFWS 2003).

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:

2

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: USFWS. 1998. Final recovery plan for three plant species on Nihoa Island. U.S. Fish and Wildlife Service, Portland, OR. 83 pages.

Date issued: March 31, 1998

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
 No

2.1.2 Is the species under review listed as a DPS?

Yes
 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 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 C and E) affecting this species is presented in section 2.4. Factors A (present or threatened destruction, modification or curtailment of its habitat or range), B (overutilization for commercial, recreational, scientific, or educational purposes), and D (inadequacy of existing regulatory mechanisms) are not known to be a threat to *Schiedea verticillata*.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the three plant species from Nihoa (USFWS 1998). Interim objectives include that population numbers remain stable, a monitoring program is established to monitor their status and threats twice annually, the major threats to taxon must be determined and controlled, and the taxon must be fully represented in *ex situ* (off-site) collections. *Ex situ* collections should maintain the maximum number of genetically distinct individuals practical.

This recovery objective has not been met.

For downlisting, interim objectives must be attained. In addition, a total of at least five colonies should exist on Nihoa and successful propagation and outplanting *ex situ* must be underway. Each of these must be stable, secure, and naturally reproducing. Colony sizes on Nihoa should be increased with caution, and only if there is good evidence that Nihoa can support additional colony growth without negative ecological impacts. This is a concern because of Nihoa's small size and its relatively intact, native ecosystem. Colony sizes will ultimately be determined by the carrying capacity of the site where they are grown. However, a preliminary target level for *Schiedea verticillata* is a minimum of 300 mature individuals per colony. Each colony should be stable or increasing minimum of five consecutive years before downlisting is considered. The need for continued species-specific management actions should not preclude downlisting. As a component of threat control, a remote monitoring system should be installed on Nihoa to detect and record illegal landings and shipwrecks on the island and relay the information to National Wildlife Refuge (NWR) staff in Honolulu.

This recovery objective has not been met.

To achieve delisting objectives, downlisting objectives must be attained. In addition, delisting may be considered with the establishment of one to three additional colonies on an island other than Nihoa. Necker Island, Kilauea Point, and Midway Atoll NWRs should be assessed for suitability since they are protected areas, have plant

nursery facilities, and have full-time staffs. Midway has a similar climate to Nihoa and Kilauea Point, with north-facing cliffs similar to those on Nihoa. Should establishment of one to three colonies of this taxon on an island other than Nihoa occur, delisting may be considered when they have reached the same targets as those described for downlisting, including a minimum of 300 mature individuals per colony. Each colony should be stable or increasing for a minimum of five consecutive years. If the establishment of this taxon on a second island proves unfeasible, delisting may be considered if the downlisting objectives have been met and the colonies persist at target levels for a minimum of ten years. In order to initiate delisting in any of the above situations, there should no longer be a need for continued species-specific management actions, but delisting may proceed if there is a continuing need for ecosystem-wide management actions.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

In addition to the status summary table below, information on the species' status and threats was included in the final critical habitat rule referenced above in section 1.3.3 (“Associated Rulemakings”) and in section 2.4 (“Synthesis”) below, which also includes any new information about the status and threats of the species.

Table 1. Status of *Schiedea verticillata* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1996 (listing)	170-190	0	5 colonies with minimum of 300 mature individuals per population for a minimum of 5 consecutive years	No
			Successful propagation and outplanting <i>ex situ</i>	No
			Remote monitoring system	No
1998 (recovery plan)	359	0	5 colonies with minimum of 300 mature individuals per population for a minimum of 5 consecutive years	No
			Successful propagation and outplanting <i>ex situ</i>	Partially
			Remote monitoring system	No
2003 (critical habitat)	No new information	0	5 colonies with minimum of 300 mature individuals per population for a minimum of 5 consecutive years	No
			Successful propagation and outplanting <i>ex situ</i>	Partially
			Remote monitoring system	No
2008 (5-year review)	1,042	0	5 colonies with minimum of 300 mature individuals per population for a minimum of 5 consecutive years	Partially
			Successful propagation and outplanting <i>ex situ</i>	Partially
			Remote monitoring system	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:

2.3.2.4 Other natural or manmade factors affecting its continued existence:

2.4 Synthesis

Schiedea verticillata was discovered on Nihoa in 1923 and described in 1931 by Forrest Brown, and has never been found elsewhere. All but one of the historically known colonies were still known to be extant at the time of the critical habitat

designation (USFWS 2003), and colony locations and plant numbers were observed to shift with each visit. However, total numbers island-wide remained relatively stable until the large increase during the last census in 2006. Populations are apparently able to recover from recent periodic vagrant grasshopper (*Schistocerca nitens*) infestations.

Between 1980 and 1983, seven colonies totaling 497 individuals were counted; in 1992 USFWS staff counted between 170 and 190 plants in six colonies; and in 1996 a total of 359 plants in 10 colonies were counted (USFWS 1998, 2003). Over 1,000 plants, most of them flowering and with immature seeds, were observed on a 2006 survey (Tangalin 2006), exceeding totals from all previous counts going back to 1980, due largely to the thoroughness of the survey. Tangalin recorded approximately 300 plants from Dog's Head to the cliffs above Derby's Beach; approximately 300 plants at Devil's Slide; approximately 100 plants in the Needle Rock area; approximately 75 plants at Miller's Peak; 39 plants at Albatross Plateau cliffs; 114 adults, 13 juveniles, and 1 seedling at the cliff edge of Middle Valley; approximately 100 plants at Tanager Peak; and possibly hundreds at Tunnel Cave above the cliffs, where the steep topography and late afternoon lighting made it difficult to make an accurate count. A grand total of approximately 1,000 plants were recorded, not including the "possibly hundreds" of plants at Tunnel Cave. Most of the plants were flowering and with immature seeds. All life stages were represented. Historically, counts have been lower and quite variable, probably in part due to the ability of the plant to die back to its fleshy roots during dry periods, at which time it becomes unrecognizable.

The species produces among the largest flowers in the genus and has specialized recurved nectary shafts that arch above the sepals with only the tips touching them, where a relatively large quantity of nectar is deposited (Wagner *et al.* 2005). While it suggests the possibility of biotic pollination, no pollination vectors or seed dispersal agents have yet been observed in the field. Conant (1985) noted that the reproductive cycle may not be seasonal, since a variety of life stages were seen simultaneously throughout the year, and individual plants flower, set seed, and disperse seed in a relatively short period of time. While the species is hermaphroditic (with both male and female parts), it apparently outcrosses, since Weller *et al.* (1996) reported a very high level of isozyme variability in the species, and *Schiedea verticillata* is said to have the highest degree of genetic diversity among individuals of any species in the genus (USFWS 2003). High diversity bodes well for the species, aiding it in offsetting the problem of inbreeding typical in small, restricted populations.

A recent major threat to *Schiedea verticillata* is the introduced vagrant grasshopper, first reported on Nihoa in 1990. It was of minimal concern until 2002, and again in 2004, when a virtual plague of grasshoppers ravaged and denuded the vegetation on the island (Gilmartin 2005). During the latter infestation, an estimated six million grasshoppers were chewing vegetation at the rate of 1,200 pounds a day, removing practically all green foliage (Miller 2006). On April 2006, Tangalin (2006) found an average of one to two grasshoppers per day while in the area of Miller and Middle

Valley, where of *S. verticillata* populations were located. A scientific team visiting in October 2006 found the island fairly wet, the vegetation healthy, and the grasshopper population moderate (TenBruggencate 2006). The grasshopper's population explosions are apparently triggered by warm, dry conditions. Although the vegetation appears to have recovered following each episode, a continuation of this pattern does not bode well for the long-term survival of *S. verticillata* or the three other endangered plant species on Nihoa (Factor C). Mice (*Mus musculus*) and rats (*Rattus* spp.) (Factor C) might find the fleshy roots of *S. verticillata* palatable, but are not currently known on Nihoa (USFWS 1998). Great care must be taken not to allow rodent stowaways from shipboard to gain access to the island.

Portulaca oleracea (pigweed), which grows in habitats similar to *Schiedea verticillata*, remains the main herbaceous introduced invasive plant species problem on the island (Factor E). The introduced invasive plant species *Tetragonia tetragonioides* (New Zealand spinach) forms an herbaceous ground cover near Needle Rock (Factor E), where it is associated with a colony of about 100 *S. verticillata* (Tangalin 2006). No *Cenchrus echinatus* (common sandbur) was noted during Tangalin's visit; it was last documented on Nihoa from a single plant in 1981 (USFWS 1996).

Catastrophic random environmental events (*e.g.*, erosion, landslides, rockslides, flooding) will continue to be threats of major concern to the survival of *Schiedea verticillata* (Factor E), especially in the steep, rocky, unstable habitats supporting the species. In the limited available habitat of the species supporting limited numbers of individuals, such events would cause severe habitat loss and death of individual plants or entire populations. Fire is also a continuing potential threat (Factor E).

The reefs and islets of the Northwestern Hawaiian chain from Nihoa through Kure Atoll are protected within Papahānaumokuākea Marine National Monument, co-managed by the USFWS, State of Hawaii, and National Oceanic and Atmospheric Administration. In addition, Nihoa is protected within the Hawaiian Islands National Wildlife Refuge (HINWR), which is managed in accordance with the National Wildlife Refuge System Administration Act of 1966. Access is strictly regulated through the Monument permitting system because of the sensitivity of the organisms on these islands to human disturbance. Strict protocols for packing for field camps and moving between islands and atolls are upheld due to the high risk of importation of non-native plant and invertebrate species or pathogens. Papahānaumokuākea Marine National Monument managers have plans to control introduced invasive species, increase colonies numbers of *Schiedea verticillata*, and expand the locations via outplantings by year 2018 (Papahānaumokuākea Marine National Monument 2008).

The National Tropical Botanical Garden (2008) reported 2,650 seeds in storage. The University of California at Irvine (2008) reported eight plants in storage for research at Drs. Steve Weller and Ann Sakai's laboratory facilities, but the material has been infected with an unknown virus, and so is unsuitable for use in reintroduction efforts

(S. Weller, University of California at Irvine, pers. comm. 2008).

No efforts have been made to outplant this species on other nearby islands, but Lehua Island State Seabird Sanctuary, located 1.1 kilometers (0.7 miles) north of Niihau and approximately 220 kilometers (136.7 miles) southwest from Nihoa could be a feasible location once rats are eradicated from the island (B. Flint, Supervisory for Wildlife Biologists, USFWS, HINWR, pers. com. 2007).

The downlisting goals for *Schiedea verticillata* have not been met, as only two colonies on Nihoa have 300 individuals (see Table 1). In addition, a single catastrophic environmental event could threaten the species with extinction, and other colonies have not been established on other islands. Therefore, *S. verticillata* 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

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 seed and cuttings collection for *ex situ* genetic storage and reintroduction from underrepresented individuals.
- Continue to restrict human access.
- Control invasive introduced plant species in all existing populations and periodically monitor to ensure invasive species are not establishing nearby.

- Continue to prevent invasion of any introduced species on Nihoa.
- Determine if control of the vagrant grasshopper is needed, and if so, develop an efficient and effective control method.
- Assess feasibility of outplanting *Schiedea verticillata* on Lehua Island State Bird Sanctuary, Necker Island National Wildlife Refuge (NWR), Kilauea Point NWR, and Midway Atoll NWR, which are the closest islands to Nihoa and are managed for conservation.
- Work with Hawaii Division of Forestry and Wildlife and NWRs to provide ecosystem-level restoration and management of reintroduction sites to benefit this species.
- Study *Schiedea verticillata* 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.

5.0 REFERENCES:

- Conant, S. 1985. Recent observations on the plants of Nihoa Island, Northwestern Hawaiian Islands. *Pacific Science* 39:135–149.
- Gilmartin, W. G. (editor). 2005. Workshop to identify research and mitigation measures to address the *Schistocerca nitens* crisis on Nihoa Island, Northwestern Hawaiian Islands. April 25-26, 2005, Honolulu, Hawaii. 14 pages.
- Miller, S.L. 2006. USDA seeks UW grasshopper expertise to stop Hawaiian island onslaught. *Agriculture News (University of Wyoming, College of Agriculture)* 15(2):2–3.
- National Tropical Botanical Garden. 2008. 2008 report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished.
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[USFWS] U.S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; endangered status for three plants from the Island of Nihoa, Hawaii. Federal Register 61(163):43178–43184.

[USFWS] U.S. Fish and Wildlife Service. 1998. Final recovery plan for three plant species on Nihoa Island. Region 1, U.S. Fish and Wildlife Service, Portland, OR, 81 pages.

[USFWS] U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; designation of critical habitat for five plant species from the Northwestern Hawaiian Islands, Hawaii; final rule. Federal Register 68(99):28054–28075.

Weller, S.G., A.K. Sakai and C. Straub. 1996. Allozyme diversity and genetic identity in *Schiedea* and *Alsinidendron* (Caryophyllaceae: Alsinoideae) in the Hawaiian Islands. *Evolution* 50:23–34.

Personal Communications

Flint, Beth. Fish and Wildlife Biologist, USFWS, HINWR. Personal communication to Bernice P. Bishop Museum on January 11, 2008.

Weller, Stephen, G. Professor of Ecology and Evolutionary Biology, University of California-Irvine. Personal communication to Christian Torres-Santana (USFWS) on April 18, 2008.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Schiedea verticillata* (No common name)

Current Classification: _____ E _____

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:

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Approved  Date 21 July 2009
Acting Field Supervisor, Pacific Islands Fish and Wildlife Office