

Alopecurus aequalis var. *sonomensis*
(Sonoma alopecurus)

**5-Year Review:
Summary and Evaluation**



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**U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California**

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5-YEAR REVIEW

Alopecurus aequalis var. *sonomensis* (Sonoma alopecurus)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Alopecurus aequalis var. *sonomensis* is a tufted perennial in the Poaceae (grass family). The plant occurs in freshwater marshes and swamps and riparian scrub within Marin and Sonoma Counties, California (California Natural Diversity Database (CNDDB) 2011). Five of six known populations are clustered within a 12-square kilometer (4.6-square mile) area on the Point Reyes Peninsula in Marin County. The only known extant population in Sonoma County is located at Annadel State Park. *Alopecurus aequalis* var. *sonomensis* grows from 30 to 75 centimeters (12 to 30 inches) tall. The stems are mostly erect and either straight or weakly bent near the base. The leaf blades are up to 7.5 millimeters (0.3 inch) wide. The panicle is 2.5 to 9.0 centimeters (1.0 to 3.5 inches) long and 4 to 8 millimeters (0.1 to 0.3 inch) wide. The spikelets are usually tinged violet-gray near the tip. The awn is straight, and exceeds the lemma body by 1.0 to 2.5 millimeters (0.04 to 0.1 inch). This variety is distinguished from *A. aequalis* var. *aequalis* by a more robust, upright appearance, generally wider panicle, violet-gray tinged spikelets, and longer awn (Rubtzoff 1961; W. Crins, Ontario Ministry of Natural Resources, *in litt.* 1993).

Methodology Used to Complete This Review:

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from surveys conducted by experts who have been monitoring various localities of this species. Monitoring reports, a thesis by Sasha Gennet entitled *Experimental Introductions of the Endangered Grass Sonoma alopecurus (Alopecurus aequalis* var. *sonomensis)* at Point Reyes National Seashore (Gennet 2004), and communications with experts were our primary sources of information used to update

the species' status and threats. We received no information from the public in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

Lead Regional Office: Larry Rabin, Deputy Division Chief for Listing, Recovery, and Environmental Contaminants, Region 8, Pacific Southwest; (916) 414-6464.

Lead Field Office: Josh Hull, Recovery Division Chief; Sacramento Fish and Wildlife Office, (916) 414-6600.

Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 25, 2009 [74 FR 12878-12883]. No responses regarding *Alopecurus aequalis* var. *sonomensis* were received from the public.

Listing History:

Original Listing

FR Notice: 62 FR 55791

Date of Final Listing Rule: October 27, 1997

Entity Listed: *Alopecurus aequalis* var. *sonomensis*, a plant variety

Classification: endangered

State Listing

None

Associated Rulemakings: None

Review History: No formal status review has been conducted since the species was listed in 1997.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Alopecurus aequalis* var. *sonomensis* is 9 according to the Service's 2010 Recovery Data Call for the SFWO, based on a 1 to 18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a variety that faces a moderate degree of threat and has a high potential for recovery.

Recovery Plan or Outline: No recovery plan or outline for this species has been completed.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species Act defines “species” as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species’ listing is not addressed further in this review.

Information on the Species and its Status

Species Biology and Life History

While the reproductive mechanisms of this species have not been studied, *Alopecurus aequalis* var. *sonomensis* appears to reproduce both sexually (assumed via wind pollination) and vegetatively (via rhizomes) (Gennet 2004). Flowering begins in mid - May and lasts through August (Gennet 2004). Gennet (2004) observed germination rates in the greenhouse at 62.2 percent. All seed germination occurred within 16 days of planting. There appeared to be a linear relationship between seed weight and germination rate (Gennet 2004).

Spatial Distribution

Historically, *Alopecurus aequalis* var. *sonomensis* was known from 16 populations in Marin and Sonoma Counties. When the final listing rule was written, *A. aequalis* var. *sonomensis* was known from eight natural populations. Three of the populations, in Sonoma County, were privately owned, four populations were on Federal land within Point Reyes National Seashore (PRNS) in Marin County, California, and one population was on a private inholding within the PRNS (CNDDDB 1993; Service 1997). One of the populations in Marin County was initially thought to be the result of seeds washed down from a reintroduced population, but it is now considered a natural population (Service 1997). Currently, the CNDDDB (CNDDDB 2011) lists 22 occurrences for *Alopecurus aequalis* var. *sonomensis*. Fourteen of these occurrences are historical, meaning they have not been observed in at least 20 years. Due to difficulty in verifying older records, it is uncertain if some of the occurrences are duplicates of others (Gennet 2004). All populations occur in moist soils in permanent freshwater marshes and swamps or riparian scrub between 10 and 1,180 feet in elevation.

The historical range of *Alopecurus aequalis* var. *sonomensis* was approximately 48 kilometers (30 miles), reaching north from Point Reyes Peninsula to Guerneville and east to Cunningham Marsh. At the time of listing, we noted that although fewer sites were present, the range of the species had changed little from the historical range. Currently, Point Reyes National Seashore has five out of six known extant populations of *A. aequalis* var. *sonomensis*. These five populations are clustered in a small (12-square kilometer) area on the Point Reyes Peninsula (PRNS 2010). A small population at Ledson Marsh is the only known extant population in Sonoma County, and the population distribution of this grass species has shifted to Marin, rather

than Sonoma, County (Gennet 2004). In addition, as of summer 2010, the population at Ledson Marsh was present, but reduced in size, and appropriate habitat appeared to be shrinking (A. Howald, Garcia and Associates, *in litt.* 2009 in A. Ryan, PRNS, *in litt.* 2011; J. Herrick, California Native Plant Society (CNPS) *in litt.* 2010).

Abundance

Observations made during the censusing and monitoring visits at both the Marin and Sonoma populations from 1983 to 2000 indicate that the number of individuals in each *Alopecurus aequalis* var. *sonomensis* population can fluctuate dramatically among and within years. This fluctuation may be attributable to annual habitat characteristics, weather patterns, and water level, changing land use patterns, or to inconsistent monitoring and inventory methods (Gennet 2004). To control for monitoring irregularities and more accurately observe *A. aequalis* var. *sonomensis* population dynamics at PRNS, a standard monitoring protocol was established in 2000. Because identifying individual plants is not possible due to the plants growth habit and morphology, the number of inflorescences is counted during the census. In addition to census data, photopoints have been established at each site (PRNS 2006).

In 2000, a park-wide survey of potential *Alopecurus aequalis* var. *sonomensis* habitat resulted in the discovery of PRNS population 7 and in 2001 a similar park-wide survey resulted in the discovery of PRNS population 8 (Gennet 2004). The PRNS population 8 is located on U.S. Coast Guard land within the PRNS (A. Ryan, PRNS pers. comm. 2011). The population at Annadel State Park that we thought was extirpated at the time of listing was rediscovered in 2001.

Currently there are six extant populations (Table 1), five at Point Reyes National Seashore (PRNS) in Marin County (3, 4, 5, 7, and 8), and one at Annadel State Park in Sonoma County (ANSP 1). Point Reyes National Seashore ecologists believe that PRNS 6 is either extirpated or was incorrectly numbered originally and is part of PRNS population 3. At the time of listing, three populations were known from Sonoma County; currently the population at Annadel State Park is the only known remaining population in Sonoma County.

The PRNS staff and CNPS began to monitor this species in the early 1980s. Since then, monitoring has been refined to better define population boundaries and improve census methods. Based on this information, populations 1 and 2 appear to have been extirpated from the Seashore. The PRNS population 1 never recorded high numbers of individuals, and after fencing out cattle in 1986, the remaining few plants disappeared. Despite reopening the fence in 1991 with the intent of reintroducing disturbance to the site, no plants have been found since 1991. Similarly, PRNS population 2 had a few individuals from 1990 through 1995, with no individuals found on site between 1996-2000 (PRNS 2006).

The number of individuals in populations of *Alopecurus aequalis* var. *sonomensis* may fluctuate markedly within and between years. The exact number of individuals is difficult to determine due to the species' growth habitat (PRNS 2006) and different methods of assessing population size that have been used. Staff at Point Reyes National Seashore implemented a new monitoring protocol in 2000 in which they census each population within the park by counting inflorescences.

Table. 1: *Alopecurus aequalis* var. *sonomensis* inflorescence counts in Sonoma and Marin Counties 2000- 2010 (PRNS 2006, 2008, 2009a, 2010, and 2011). Dashes indicate no data.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PRNS 1	0	-	-	0	-	-	0	-	-	-	-
PRNS 2	0	-	-	0	-	-	0	-	-	-	-
PRNS 3	2,166	1,588	3,544	3,617	800	709	3,309	1,844	1807	406	311
PRNS 4	1,572	3,405	7,530	8,386	668	1,049	-	-	474	321	1,273
PRNS 5	60	648	129	661	49	105	-	-	615	203	310
PRNS 6	-	-	-	-	-	-	-	-	-	-	-
PRNS 7	53	336	340	1,042	119	102	-	-	17	4	18
PRNS 8	-	200	1,752	1,488	78	41	-	-	3,097	-	2,426
ANSP 1	-	979	-	-	-	-	-	-		150	7

Population 6 is either presumed extirpated or possibly is now part of population 3.

The greatest number of inflorescences recorded within a population in recent years was 8,386 in 2003 at PRNS 4. All but one of the extant populations at Point Reyes National Seashore had greater than 1,000 inflorescences in 2003. However, except for PRNS 4, the number of inflorescences at each monitored site within Point Reyes National Seashore has declined since 2003. The number of inflorescences at PRNS 5 decreased in 2004 and then increased slightly in 2005. Surveys in 2008 to 2010 showed an increase in the number of inflorescences compared to the number of inflorescences in 2005 (PRNS 2009a, 2010, 2011).

Reintroduction of Alopecurus aequalis var. sonomensis

There have been two attempts to establish new populations at Point Reyes National Seashore in 1987 and 2002.

In 1986, only one population was known at PRNS. Seeds were collected from that population, grown in the PRNS nursery, and introduced at several new locations at PRNS in 1987. The goal of this introduction effort was to extend the range of *Alopecurus aequalis* var. *sonomensis* and ensure its long-term survival at PRNS by creating new, self-perpetuating populations (W. Shook, PRNS, pers. comm. 2001 in Gennet 2004). The *A. aequalis* var. *sonomensis* introduced at these sites failed to establish populations. By the time of listing, the attempts to reintroduce the species from seed to suitable habitat within its range had failed, as has an attempt to start a population in the East Bay Botanic Garden in Tilden Park

A reintroduction project was undertaken in 2002 to try and define species specific habitat requirements for *Alopecurus aequalis* var. *sonomensis*. In March 2002, 576 plants were introduced to four new sites in PRNS. This experimental reintroduction of *A. aequalis* var. *sonomensis* had two objectives, (1) to better define the taxon's ecological niche and determine some of the habitat characteristics required for establishment at new sites and (2) to help recover the taxon by establishing new, self-perpetuating populations of *A. aequalis* var. *sonomensis* (Gennet 2004).

The sites, which were visually similar to the natural population sites were seasonally to perennially inundated coastal prairie with sandy soils and grazed intermittently by beef cattle (Gennet et al. 2004). With the four introduction populations established in 2002, an effort was made to monitor key habitat characteristics so that success or failure can more definitively be linked to environmental conditions (Gennet 2004).

Early surveys of the 2002 reintroductions indicated that the populations appeared to have become established (Table 2) and were reproducing; however, after several years of monitoring, both the 1987 and 2002 efforts appeared to have failed (CNDDB 1996; Service 1997; PRNS 2006, 2008, 2009a, 2010, and 2011). Currently, none of the reintroduced populations at PRNS have any *Alopecurus aequalis* var. *sonomensis* plants (PRNS 2011).

Table 2: *Alopecurus aequalis* var. *sonomensis* inflorescence counts at four reintroduction sites in the Point Reyes National Seashore in Marin County 2003- 2010 (PRNS 2006, 2008, 2009a, 2010 and 2011). Dashes indicate no data.

	2003	2004	2005	2007	2008	2009	2010
PRNS 9	108	3	0	-	-	-	-
PRNS 10	28	20	0	-	-	-	-
PRNS 11	504	167	48	20	0	-	-
PRNS 12	28	3	0	-	0	0	-

Habitat or Ecosystem

Alopecurus aequalis var. *sonomensis* is found in riparian stream communities both in the stream channel and along the wet banks between 3 and 360 meters (10 and 1,180feet) in elevation. Most of the wetlands where *A. aequalis* var. *sonomensis* now grow are located within Coastal Grasslands. In the PRNS, *A. aequalis* var. *sonomensis* occur in the pastoral zone, where cattle grazing has occurred since the 1830s (PRNS 2010). On PRNS the plants are found in running water flowing from freshwater marsh through dunes and in a marshy area along the edge of a lagoon. Soil types in these locations are Sirdak sand, Sirdak variant sand, and dunes (U.S. Soil Conservation Service 1985). Common associates on PRNS are *Potentilla anserina* spp. *pacifica* (Pacific potentilla), *Mimulus guttatus* (seep monkeyflower), *Hydrocotyle ranunculoides* (floating marshpennywort), *Holcus lanatus* (common velvetgrass), *Oenanthe sarmentosa* (water parsley), *Cyperus* sp. (umbrella sedge), *Juncus* sp. (rushes), *Glyceria occidentalis* (manna grass), *Gnaphalium* sp. (cudweed), and *Veronica* sp. (speedwell) (PRNS 2010).

Changes in Taxonomic Classification or Nomenclature

No change in either taxonomic classification or nomenclature has occurred since the listing.

Genetics

No genetic studies have been conducted since the listing.

Species-specific Research and/or Grant-supported Activities

Research conducted as part of the reintroduction attempt documented that soil moisture and hydrologic conditions were extremely important to at least initial success of reintroduced occurrences, but that site factors – unidentified environmental or biological variables – seemed to have as strong, if not stronger, effects on preliminary success of outplantings (Gennet 2004). The intensity and timing of grazing also appears important, although initial attempts to document this experimentally through biomass clipping were not necessarily successful, potentially because grazing may have some of its strongest effects during the seed germination stage (Gennet 2004).

Population 5 is being monitored to help determine what caused the decline in *Alopecurus aequalis* var. *sonomensis* numbers. Was the decline due to the removal of grazing or was it due to a difference in the hydrologic regime? Currently, groundwater wells are being monitored every 2 or 3 weeks to determine the groundwater depth. Member of the Point Reyes National Seashore staff also collect precipitation data (PRNS 2010).

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range.

At the time of listing, the primary threats to *Alopecurus aequalis* var. *sonomensis* were habitat destruction and modification due to urbanization, land use changes, or alterations in hydrology. We noted that a portion of the historical range of *A. aequalis* var. *sonomensis* was within the project boundaries of a wastewater treatment facility (Service 1997).

The majority of the historical populations of *Alopecurus aequalis* var. *sonomensis* experienced dramatic human-influenced land use changes prior to their decline or extirpation. Some wetland areas had been drained or altered in preparation for the construction of structures or buildings; others were fenced and intensively grazed (CNDDB 2002; Gennet 2004).

Conservation Actions

In 2002, the PRNS acquired a 522-acre parcel of inholding land that previously was owned by American Telegraph & Telephone (AT&T) (PRNS population 3). The parcel has Western snowy plover and *Alopecurus aequalis* var. *sonomensis* (National Park Service 2002).

In October 2007, PRNS received private funding to realign a section of the Abbotts Lagoon trail that borders PRNS population 5. In 1987, the trail was formalized by installing a cattle-exclusion fence across the upper section of the drainage. Since the installation, the lower portion filled in with *Scirpus microcarpus* (small-fruited bulrush). In 2008, the former trail was closed and the existing trail infrastructure was removed. In an effort to expand PRNS population 5 and to reestablish *Alopecurus aequalis* var. *sonomensis* plants in the lower portion of the drainage, the cattle pasture fencing was moved downstream (PRNS 2009b).

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial, recreational, scientific, or educational purposes was not known to be a factor in the 1997 final listing rule (Service 1997). Overutilization for any purpose does not appear to be a threat at this time.

FACTOR C: Disease or Predation

At the time of listing, we reported that 7 of the 8 known sites of *Alopecurus aequalis* var. *sonomensis* were currently grazed or had been grazed in recent years by cattle (CNDDB 1996; V. Norris, *in litt.* 1995; R. Soost, *in litt.* 1996). We stated that some grazing may be necessary to maintain populations of *A. aequalis* var. *sonomensis* in the face of competition from other plants, but that excessive grazing by cattle can adversely impact the species (Service 1997).

Too much or too little grazing may be detrimental to a population. For example, PRNS Population 1 was extirpated within three years after grazing cessation at the site (Shook pers. comm. 2001 in Gennet 2004). Conversely, the number of reproducing tillers at PRNS Population 5 was reduced by 90 percent in June 2001 after cattle were released onto the site (Gennet 2004). Tillers are shoots that are capable of producing a new plant. Both heavy grazing and exclusion from grazing can adversely affect the species. Overgrazing of foliage could limit the plant's ability to photosynthesize, which could result in death or diminished reproductive output. Consumption of inflorescence or seed could reduce the genetic variability of plants within a given population and could decrease the overall reproductive output of the individual plant. However, grazing may reduce competition from more abundant or invasive species. All natural populations of *Alopecurus aequalis* var. *sonomensis* within the PRNS are currently managed by grazing (Service 2002). The population at Annadel State Park is the only known natural population not maintained by grazing. Grazing activities may additionally result in trampling of individual plants, soil compaction, and impacts which may influence presence of invasive species (see Factor E).

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to provide inadequate protection for *Alopecurus aequalis* var. *sonomensis* included: (1) the California Environmental Quality Act (CEQA); and (2) the Clean Water Act. The listing rule (Service 1997) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain currently valid for the CEQA, but not for the Clean Water Act.

There are several State and Federal laws and regulations that are pertinent to federally listed species, each of which may contribute in varying degrees to the conservation of federally listed and non-listed species. These laws, most of which have been enacted in the past 30 to 40 years, have greatly reduced the threat of wholesale habitat destruction. The Endangered Species Act is the primary Federal law that provides protection for this species since its listing as endangered in 1992. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Endangered Species Act.

State Laws and Regulations

California Environmental Quality Act (CEQA): The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

California Coastal Act (CCA): The California Coastal Commission considers the presence of listed species in determining environmentally sensitive habitat lands subject to section 30240 of the California Coastal Act of 1976, which requires their protection. Certain local jurisdictions

have developed their own Local Coastal Programs or Land Use Plans that have been approved by the Coastal Commission. Some of the major accomplishments of this act include reduction in overall development, the acquisition of prime habitat along the coast, restoration of coastal streams and rivers, and a reduction in the rate of wetland loss. The CCA provides additional minimal protections in association with the previous State regulatory mechanisms.

Federal Laws and Regulations

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that result from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related Natural Community Conservation Planning program.

With regard to federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the "take" of federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or

destruction of endangered plants on any other area in knowing violation of a state law or regulation or in the course of any violation of a state criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

National Environmental Policy Act (NEPA): NEPA (42 U.S.C. 4371 *et seq.*) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

The National Park Service - National Park Service (NPS) Organic Act: The NPS Organic Act of 1916 (39 Stat. 535, 16 U.S.C. 1, as amended), states that the National Park Service “shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations ... to conserve the scenery and the national and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” The National Park Service Management Policies indicate that the Park Service will “meet its obligations under the National Park Service Organic Act and the Endangered Species Act to both pro-actively conserve listed species and prevent detrimental effects on these species.” This includes working with the Service and undertaking active management programs to inventory, monitor, restore, and maintain listed species habitats, among other actions. Four of the six extant populations of *Alopecurus aequalis* var. *sonomensis* exist on lands managed by PRNS which is part of the National Park Service.

Clean Water Act: Under section 404, the U.S. Army Corps of Engineers (Corps or USACE) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term “wetland” refers to areas meeting the Corps’s criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, National Environmental Policy Act, and Endangered Species Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

The Corps interprets “the waters of the United States” expansively to include not only traditional navigable waters and wetlands, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. However, recent Supreme Court rulings have called into question this definition. On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving “isolated” wetlands. Currently, Corps regulatory oversight of such wetlands (e.g., vernal pools) is in doubt because of their “isolated” nature. In response to the Supreme Court decision, the Corps and the U.S. Environmental Protection Agency (USEPA) have recently released a memorandum

providing guidelines for determining jurisdiction under the Clean Water Act. The guidelines provide for a case-by-case determination of a “significant nexus” standard that may protect some, but not all, isolated wetland habitat (USEPA and USACE 2007). The overall effect of the new permit guidelines on loss of isolated wetlands, such as vernal pool habitat, is not known at this time.

Nationwide permit No. 26, under section 404 of the Clean Water Act, was established by the U.S. Army Corps of Engineers (Corps) to facilitate issuance of permits for discharge of fill into wetlands. Under the regulations at the time of listing, these nationwide permits could be issued for fill of up to 1.2 hectare (3 acres) of wetlands. For wetland fill of less than 0.13 hectare (0.33 acre) only an after-the-fact report was required to be submitted to the Corps. Thus for *Alopecurus aequalis* var. *sonomensis*, which sometimes occupies wetlands less than 0.13 hectare (0.33 acre) in size, the *post facto* reporting was considered inadequate to prevent extirpation of the species. In 2000; however, Nationwide Permit No. 26 expired and new replacement Nationwide Permits were issued. Nationwide permit No. 29 covers residential developments and Nationwide permit No. 39 covers commercial and institutional developments (USACE 2008).

In summary, the Endangered Species Act is the primary Federal law that provides protection for this species since its listing as endangered in 1997. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Endangered Species Act.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

At the time of listing, threats to *Alopecurus aequalis* var. *sonomensis* under Factor E were: competition from invasive emergent wetland species, including *Juncus* spp. (rushes) and *Cyperus* spp. (nutsedges) at one location; susceptibility to random events including flash floods; and small population size. Additionally we noted that *A. aequalis* var. *sonomensis* was not readily propagated.

Competition from native invasive emergent wetland species currently impacts *Alopecurus aequalis* var. *sonomensis* at two populations. In addition, *Holcus lanatus* potentially threatens *A. aequalis* var. *sonomensis* at one location (PRNS 2006).

The threat to the species from natural events because of few populations and small population size remains unchanged. *Alopecurus aequalis* var. *sonomensis* has six currently known extant populations. The combination of few populations, small range, and restricted habitat makes this species highly susceptible to extinction or extirpation from a significant portion of its range due to random events, such as flood, drought, disease, or other occurrences (Shaffer 1981; Primack 2006). Such events are not usually a concern until the number of populations or geographic distribution become severely limited. Small population size increases the susceptibility of a population to extirpation from random demographic, environmental, and genetic events (Shaffer 1981, 1987; Primack 2006; Groom et al. 2006). In this 5-year review, populations of 200 growing plants (not counting ungerminated seeds) or less are considered to be small, in keeping

with Menges' (1992) calculation that populations of this size are especially vulnerable to even moderate levels of environmental uncertainty. The combination of few populations, small range, and restricted habitat still renders *A. aequalis* var. *sonomensis* susceptible to extinction or extirpation from a significant portion of its range due to random events, such as flood, drought, disease, or other factors (Shaffer 1981, 1987; Groom et al. 2006). *Alopecurus aequalis* var. *sonomensis* is considered by NPS resource management staff and CNPS botanists as one of the taxa at greatest risk of extinction on PRNS due the low number of populations and the high degree of interannual census fluctuations (Gennet 2004).

Small populations may also be subject to increased genetic drift and inbreeding (Menges 1991; Ellstrand and Elam 1993). Populations that are continually small in size are particularly susceptible to genetic changes due to drift. However, drift may also cause genetic changes with populations that occasionally fluctuate to small sizes (e.g., undergo population bottlenecks). Increased homozygosity resulting from genetic drift and inbreeding may lead to a loss of fitness (ability of individuals to survive and reproduce) in small populations. In addition, reduced genetic variation in small populations may make any species less able to successfully adapt to future environmental changes (Ellstrand and Elam 1993). The extant occurrences of *Alopecurus aequalis* var. *sonomensis* includes populations, which have been observed to dip below 200 individuals.

Grazing activities may result in trampling of individual plants, soil compaction, consumption (discussed under Factor C), and impacts which may influence presence of invasive species. Trampling may reduce the plant's reproductive output by breaking immature inflorescence before fruit ripening. Alternatively, trampling may scarify seed present in the soil which would be beneficial to recruitment into the population. Soil compaction may affect the plant's rhizosphere, minimizing the uptake of nutrients. The rhizosphere is the soil region subject to the influence of plant roots that is characterized by a zone of increased microbiological activity. Additionally, soil compaction may reduce the ability for seeds to germinate (Service 2002).

The attempts to reintroduce *Alopecurus aequalis* var. *sonomensis* have been discussed under the Information on the Species and its Status section. We still are unable to establish viable persisting populations of *A. aequalis* var. *sonomensis*.

An additional threat to the species noted since the listing is climate change. Climate is predicted to change in California during the 21st century (Field et al. 1999; Cayan et al. 2005). Even modest changes in warming could result in a reduction of the spring snowpack, earlier snowmelt, and more runoff in winter with less runoff in spring and summer, more winter flooding, and drier summer soils (Field et al. 1999; Cayan et al. 2005). The predicted impacts on California's ecosystems projected with a high certainty include higher sea level; decreased suitable habitat for many terrestrial species as climate change intensifies human impacts; and increased competition among urban, agricultural, and natural ecosystem uses (Field et al. 1999). Although the specific effects of climate change on *Alopecurus aequalis* var. *sonomensis* are unknown, the effects of increased winter flooding and drought conditions in the spring have the potential to adversely affect this species.

According to scientific predictions, Point Reyes will receive increased rainfall, more intense and frequent El Niño events, and a rise in sea surface temperature. Sea level is projected to rise 0.5 to 1 meter (18.9 to 36 inches) by 2100, which will result in shoreline erosion, saltwater intrusion into groundwater aquifers, inundation of wetlands and estuaries change (National Parks Conservation Association 2009). Research shows one half of the park's coastline is highly vulnerable to these effects based on six variables: geomorphology, historical shoreline change rate, regional coastal slope, relative sea level change, mean significant wave height, and tidal range. Animals, plants, and other organisms that currently inhabit the park could be forced to find new places to live in response to rising temperatures due to global climate change (National Parks Conservation Association 2009).

Summary of Factor E

Currently, competition from invasive plants, extirpation from random events and small population size; occasional trampling by cattle; and lack of reproductive success in the field still threaten *Alopecurus aequalis* var. *sonomensis*. Additionally, *A. aequalis* var. *sonomensis* is likely threatened by global climate change throughout its range.

III. RECOVERY CRITERIA

No approved final or draft recovery plan for *Alopecurus aequalis* var. *sonomensis* has been completed or is in preparation.

IV. SYNTHESIS

At the time of final listing in 1997, 8 populations of *Alopecurus aequalis* var. *sonomensis* were known to exist in Marin and Sonoma Counties. Three of the populations, in Sonoma County, were privately owned, four populations were on Federal land within Point Reyes National Seashore in Marin County, California, and one population was on a private inholding within the Point Reyes National Seashore (CNDDDB 1993; Service 1997). At the time of listing the species was threatened by competition from invasive plant species, trampling and grazing by cattle, and low reproductive success. Currently there are 6 known extant populations that are threatened by competition from invasive plant species, trampling and grazing by cattle, low reproductive success, random events and global climate change. Therefore, we believe *Alopecurus aequalis* var. *sonomensis* still meets the definition of endangered, and recommend no status change at this time.

V. RESULTS

Recommended Listing Action:

- ☐ Downlist to Threatened
- ☐ Uplist to Endangered
- ☐ Delist (indicate reason for delisting according to 50 CFR 424.11):
 - ☐ *Extinction*
 - ☐ *Recovery*
 - ☐ *Original data for classification in error*
- ☒ No Change

New Recovery Priority Number and Brief Rationale: No change in recovery priority number.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Conduct grazing studies to investigate the effects of trampling, soil churning and compaction, direct removal of shoot and reproductive tissue of *Alopecurus aequalis* var. *sonomensis* plants by cattle, and timing and duration of grazing. An improved understanding of the mechanisms and magnitudes of impacts to *Alopecurus aequalis* var. *sonomensis* plants and populations by cattle grazing would help ranchers and resource managers determine optimal timing, duration, and intensity of grazing.
2. Conduct surveys to try to locate additional natural occurrences of *Alopecurus aequalis* var. *sonomensis*.
3. Continue attempt to isolate factors controlling the size and viability of *Alopecurus aequalis* var. *sonomensis* populations including: (a) timing and duration of grazing, (b) timing and quantity of precipitation, (c) temperature patterns, and (d) groundwater regimes.
4. Conduct a site assessment study to improve potential success of future *Alopecurus aequalis* var. *sonomensis* populations.

VII. REFERENCES CITED

- [CNDDDB] California Natural Diversity Database. 1993. California Department of Fish and Game, Natural Heritage Division. Sacramento, California.
- [CNDDDB] California Natural Diversity Database. 1996. California Department of Fish and Game, Natural Heritage Division. Sacramento, California.
- CNDDDB] California Natural Diversity Database. 2002. California Department of Fish and Game, Natural Heritage Division. Sacramento, California
- .

- [CNDDB] California Natural Diversity Database. 2011. Biogeographic Data Branch, California Department of Fish and Game. January 2011.
- Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western North America? U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, California.
- Ellstrand, N.C., and D.R. Elam. 1993. Population genetic consequences of small population size: implications for plant conservation. *Annual Review of Ecology and Systematics* 24: 217-242.
- Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC.
- Gennet, A. S. 2004. Experimental introductions of the endangered grass Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*) at Point Reyes National Seashore, Marin County, CA. Master's Thesis, University of California, Berkeley.
- Gennet, S, J. Battles, B. Allen-Diaz, and J.W. Bartolome. 2004. Initial findings from experimental introductions reveal clues for restoring an endangered wetland grass (California). *Ecological Restoration* 22: 152-153.
- Groom, M.J., Meffe, G.K., and C.R. Carroll. 2006. Principles of conservation biology, third edition. Sinauer Associates, Inc., Sunderland, Massachusetts.
- Menges, E.S. 1991. The application of minimum viable population theory to plants. Pages 45-61 in D.A Falk and K.E. Holsinger (editors). *Genetics and conservation of rare plants*. Oxford University Press, New York, New York.
- Menges, E.S. 1992. Stochastic modeling of extinction in plant populations. Pages 253-275 in P.L. Fiedler and S.K. Jain (editors), *Conservation biology: the theory and practice of nature conservation, preservation and management*. Chapman and Hall, New York.
- National Parks Conservation Association. 2009. State of the parks. Point Reyes National Seashore. A resource reassessment. Washington, DC.
- National Park Service. 2002. Point Reyes National Seashore. Critical AT&T parcel acquired at Point Reyes National Seashore. Available on the internet at <http://home.nps.gov/pore/parknews/newsreleases_20020206_att_acquisition.htm>. Accessed December 20, 2010.

- [PRNS] Point Reyes National Seashore. 2006. Sonoma alopecurus *Alopecurus aequalis* var *sonomensis* USFWS Permit TE018180-2 annual report 2000-2005. National Park Service, Point Reyes Station, California. 16 pp.
- [PRNS] Point Reyes National Seashore. 2008. Sonoma alopecurus *Alopecurus aequalis* var *sonomensis* USFWS Permit TE018180-3 annual report 2007. National Park Service, Point Reyes Station, California. 12 pp.
- [PRNS] Point Reyes National Seashore. 2009a. Sonoma alopecurus *Alopecurus aequalis* var *sonomensis* USFWS Permit TE018180-4 annual report 2008. National Park Service, Point Reyes Station, California. 12 pp.
- [PRNS] Point Reyes National Seashore. 2009b. National Park Service recovery update USFWS threatened and endangered species August 2009. National Park Service, Point Reyes Station, California. 6 pp.
- [PRNS] Point Reyes National Seashore. 2010. Sonoma alopecurus *Alopecurus aequalis* var *sonomensis* USFWS Permit TE018180-4 annual report 2009. National Park Service, Point Reyes Station, California. 33 pp.
- [PRNS] Point Reyes National Seashore. 2011. Sonoma alopecurus *Alopecurus aequalis* var *sonomensis* USFWS Permit TE018180-4 annual report 2010 draft. National Park Service, Point Reyes Station, California. 22 pp.
- Primack, R. B. 2006. Essentials of conservation biology, fourth edition. Sinauer Associates, Sunderland, Massachusetts.
- Rubtzoff, P. 1961. Notes on freshwater marsh and aquatic plants in California-II. Leaflets of Western Botany 9: 165-180.
- Shaffer, M.L. 1981. Minimum population sizes for species conservation. Bioscience 31: 131-134.
- Shaffer, M.L. 1987. Minimum viable populations: coping with uncertainty. Pages 69-86 in M.E. Soule (editor), Viable Populations for Conservation. Cambridge University Press, Cambridge, England.
- <http://www.pewclimate.org/docUploads/Key-Scientific-Developments-Since-IPCC-4th-Assessment.pdf>
- [USACE] U.S. Army Corps of Engineers. 2008.
<http://www/spk.usace.army.mil//organizations/cespk-co/regulatory/nwp.html>. Accessed December 9, 2008.
- [USEPA and USACE] U.S. Environmental Protection Agency and U.S. Army Corps of Engineers. 2007. Memorandum: Clean Water Act jurisdiction following the U.S.

Supreme Court's decision in *Rapanos v. United States* and *Carabell v. United States*. June 5, 2007.

[Service] U.S. Fish and Wildlife Service. 1997. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Nine Plants from the Grasslands or Mesic Areas of the Central Coast of California. Federal Register 62: 55791-55808.

[Service] U.S. Fish and Wildlife Service. 2002. Formal consultation on the grazing permit renewal project, Point Reyes National Seashore, Marin County, California. Service file number 1-1-01-F-310. Sacramento, California.

U.S. Soil Conservation Service. 1985. Soil Survey of Marin County, California. United States Department of Agriculture, Soil Conservation Service. U.S. Government Printing Office, Washington, DC.

In Litteris

Crins, William J. 1993. Ontario Ministry of Natural Resources. Fascimile to Betty Warne, Botanist, Botany Branch, Sacramento Field Office dated December 10, 1993.

Herrick, John. 2010. California Native Plant Society, Milo Baker Chapter. Electronic mail to Amelia Ryan, PRNS dated June 6, 2010.

Howald, A. 2009. Garcia and Associates. Electronic mail to Amelia Ryan, PRNS dated June 8, 2009.

Norris, Virginia. 1995. California Native Plant Society, Marin Chapter. Letter to Joel Medlin, Field Supervisor, U.S. Fish and Wildlife Service dated September 25, 1995.

Ryan, Amelia. 2011. Wetland Ecologist, PRNS, Electronic mail to Kirsten Tarp, Fish and Wildlife Biologist dated March 1, 2011.

Soost, Robert. 1996. California Native Plant Society, Marin Chapter. Letter to Field Supervisor, Fish and Wildlife Service dated October 1, 1996.

Personal Communications

Ryan, Amelia. 2011. Point Reyes National Seashore. Wetland Ecologist, PRNS. Conversation with Kirsten Tarp, Fish and Wildlife Biologist, SFWO.

Shook, W. 2001. PRNS. Sasha Gennet, Point Reyes Station, National Park Service. Conversation with PRNS, Chief of Natural Resources Bill Shook during site visit to Sonoma alopecurus introduction sites from 1987.

**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW**

Alopecurus aequalis var. *sonomensis* (Sonoma Alopecurus)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Kirsten Tarp, Sacramento Fish and Wildlife Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve  Date 9-8-11