

*Astragalus lentiginosus* var. *piscinensis*  
(Fish Slough milk-vetch)

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



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California State University Monterey Bay*

**U.S. Fish and Wildlife Service  
Ventura Fish and Wildlife Office  
Ventura, CA**

**January 2009**

**5-YEAR REVIEW**  
***Astragalus lentiginosus* var. *piscinensis* (Fish Slough milk-vetch)**

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## **5-YEAR REVIEW**

### ***Astragalus lentiginosus* var. *piscinensis* (Fish Slough milk-vetch)**

#### **I. GENERAL INFORMATION**

##### **Purpose of 5-Year Review**

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**

*Astragalus lentiginosus* var. *piscinensis*, a member of the Fabaceae (pea family), is a prostrate herbaceous perennial, with few-branching stems that are each up to 1 meter (3 feet) long. It produces relatively few seeds with narrow germination requirements and low probability of dispersal. Seed scarification is essential for seed germination, and without some form of localized disturbance event, seed germination may be a rare event. The establishment, survival, and growth of juvenile plants are strongly influenced by hydrologic conditions at specific sites. Fish Slough is a desert spring-fed wetland ecosystem, consisting of alkali habitat, located in Inyo and Mono counties, California. At the present, *Astragalus lentiginosus* var. *piscinensis* is restricted to the same range as it was at the time of listing, a 10 kilometer (km) (6 mile (mi)) stretch of alkaline flats paralleling Fish Slough. The slough supports the species on less than 540 acres (ac) (219 hectares (ha)).

##### **Methodology used to complete this review.**

We, the U.S. Fish and Wildlife Service (Service), published a Federal Register (FR) notice (72 FR 7064) announcing our initiation of a 5-year review of *Astragalus lentiginosus* var. *piscinensis* and asked the public for information. We reviewed the information in our files regarding *Astragalus lentiginosus* var. *piscinensis* including all scientific papers, survey reports, and letters to and from the Ventura Fish and Wildlife Office regarding this taxon. We spoke with experts on the genus *Astragalus* and knowledgeable individuals regarding new information that has been acquired since its listing and designation of critical habitat, as well as any other pertinent

information regarding the species. We incorporated all information from our files into our review as appropriate; no information was received from the public.

### **Contact Information.**

**Lead Region:** Region 8, California/Nevada Operations Office

**Contact:** Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, (916) 414-6453; and Jenness McBride, Recovery Coordinator, (916) 414-6464

**Lead Field Office:** Ventura Fish and Wildlife Office

**Contact:** Michael Glenn, Biologist, (805) 644-1766 ext. 328; and Connie Rutherford, Listing and Recovery Coordinator, (805) 644-1766 ext. 306

### **Federal Register citation announcing initiation of this review**

On February 14, 2007, the U.S. Fish and Wildlife Service announced initiation of the 5-year review for *Astragalus lentiginosus* var. *piscinensis* and asked for information from the public regarding the subspecies' status (U.S. Fish and Wildlife Service 2007). This notice initiated a 60-day request for information period which closed on April 16, 2007. No information was received as a result of this request.

### **Listing history:**

#### Original Listing

FR notice: 63 FR 53596

Date listed: October 6, 1998

Entity listed: variety (*Astragalus lentiginosus* var. *piscinensis*)

Classification: Threatened

### **Associated rulemakings:**

Critical habitat for *Astragalus lentiginosus* var. *piscinensis* was designated on June 9, 2005 (70 FR 33774).

### **Review History:**

No 5-year reviews of this plant have previously been initiated or completed. The status of *Astragalus lentiginosus* var. *piscinensis* was reviewed during the preparation of the critical habitat rule (Service 2005) and the Owens Basin Wetland and Aquatic Species Recovery Plan (Service 1998).

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

The recovery priority number for *Astragalus lentiginosus* var. *piscinensis* is currently 9; this indicates it is a subspecies with a moderate degree of threat and a high recovery potential.

**Recovery Plan or Outline:**

**Name of plan:** *Owens Basin Wetland and Aquatic Species Recovery Plan, Inyo and Mono Counties, California*

**Date issued:** September 30, 1998

**Dates of previous revisions:** There have been no revisions to this plan.

**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 of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Since the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

**Recovery Criteria**

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

**Yes** However, the criteria should be made as specific as possible using current information on the species (see Recommendations for Future Actions below).

**No**

**Adequacy of recovery criteria.**

**Do the recovery criteria reflect the best available (i.e., most up-to-date) information on the biology of the species and its habitat?**

**Yes**

**No**

**Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?**

Yes  
 No

**List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors\* are addressed by that criterion. If any of the 5 listing factors are not relevant to this species, please note that here.**

The recovery criteria and tasks are listed in the Service's recovery plan (Service 1998). Factors A, C, D, and E are addressed with no new threats known at this time. Listing Factor B was not a threat to the species at the time of its listing, and no new information has been presented indicating that Factor B is a threat at this time.

The recovery plan addresses the recovery needs for a suite of three species that occur in the Owens Basin area, and includes the following species-specific criteria for *Astragalus lentiginosus* var. *piscinensis*:

Delisting *Astragalus lentiginosus* var. *piscinensis* should be considered when all of the following have been achieved:

(1) The Fish Slough vegetation communities [specifically for *Astragalus lentiginosus* var. *piscinensis*] are restored and are being managed to maintain conditions such as those described in the Natural Resources Conservation Service (NRCS) Ecological Site Descriptions, the Bureau of Land Management's (BLM) Desired Plant Community Definitions for springs and wet meadows, and the guidelines for riparian zone proper functioning condition. This criterion specifically addresses threats described in the listing document under Factors A and D.

For the purpose of this review, we are assuming that the target vegetation communities are those that support *Astragalus lentiginosus* var. *piscinensis*. Habitat for *Astragalus lentiginosus* var. *piscinensis* consists of wet alkali meadows. This habitat is managed primarily by Los Angeles Department of Water and Power (LADWP), and to a lesser extent by the Bureau of Land Management and California Department of Fish and Game (CDFG). The Fish Slough Area of Critical Environmental Concern (ACEC) was established in 1984, before *Astragalus lentiginosus* var. *piscinensis* was listed, and is being managed to achieve and maintain the following conditions: watershed stability, riparian area protection, resource monitoring, and recovery plan implementation.

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\*A) Present or threatened destruction, modification or curtailment of its habitat or range  
B) Overutilization for commercial, recreational, scientific, or educational purposes  
C) Disease or predation  
D) Inadequacy of existing regulatory mechanisms  
E) Other natural or manmade factors affecting its continued existence

NRCS's Riparian Area Management guides describe proper functioning conditions for riparian-wetland vegetation to include: a diverse age-class distribution of riparian-wetland vegetation, a diverse composition of riparian-wetland vegetation, species present are indicators of riparian-wetland soil moisture characteristics, adequate riparian-wetland vegetative cover to protect soil surface and dissipate energy during high wind and wave events or overland flows, and existence of high vigor riparian-wetland plants (NRCS 1993).

Road relocation, road armoring, and impoundment alterations have provided some protection and additional habitat for *Astragalus lentiginosus* var. *piscinensis*. The current restoration rate for specific alkali habitat and the management to maintain proper conditions is not sufficient to satisfy this criterion for downlisting. Criterion 1 has been partially met. We believe this criterion is adequate and appropriate with respect to recovery of *Astragalus lentiginosus* var. *piscinensis*.

(2) Colonies in the north, middle and south regions of the slough are secured from the negative effects of invasive nonnative species, livestock grazing and other human-induced threats. This criterion specifically addresses threats described in the listing document under Factors C and E.

BLM and LADWP have programs in place to remove invasive nonnative species such as *Lepidium latifolium* (perennial pepperweed), *Salsola tragus* (Russian thistle), *Elaeagnus angustifolia* (Russian olive), and *Tamarix spp.* (saltcedar). Invasive nonnative plants remain a threat to *Astragalus lentiginosus* var. *piscinensis*. In particular, perennial pepperweed remains a threat in the northern region; cattle and vehicles may facilitate its spread within Fish Slough.

A limited amount of cattle grazing continues to occur on LADWP lands in all three regions of the Fish Slough ACEC, the exception being land in the northern region within an 80-acre (32-hectare (ha)) cattle enclosure (Hubbard in litt. 2007). Population monitoring is ongoing, but data are inconclusive with respect to long-term trends (see section on Abundance).

A sand and gravel mining business, operating since the 1950's, has unknown effects on *Astragalus lentiginosus* var. *piscinensis* and its habitat in the southern region of the species' range. The mine site is operated by Desert Aggregates under a long-term lease with the landowner, the LADWP. The effects of dewatering activities at the sand and gravel mine on *Astragalus lentiginosus* var. *piscinensis* still need to be studied.

Criterion 2 has not been met. We believe this criterion is adequate and appropriate with respect to recovery of the species.

(3) Recruitment of new individuals into the populations and other demographic factors appear sufficient to ensure viability over time as determined by monitoring over a 10 to 15-year period. This criterion specifically addresses threats described in the listing document under Factor E.

Monitoring on both LADWP and BLM lands indicate that low recruitment remains a threat to *Astragalus lentiginosus* var. *piscinensis*, possibly due to herbivory on seedlings (Murray and Sala 2003) and changes to soil chemistry or hydrology that make the area less hospitable for seedlings.

Criterion 3 has not been met. We believe this criterion is adequate and appropriate with respect to recovery of the species.

(4) Unless research and monitoring show otherwise, population targets for juvenile and adult plants should be a minimum of 2,100 plants in the northern region of Fish Slough, 1,200 in the middle region of Fish Slough and 105 plants in the southern region of Fish Slough; these targets assume that habitat restoration will increase carrying capacity beyond the 1992 levels. This criterion indirectly addresses threats described in the listing document under Factors A, C, and E.

Criterion 4 has not been met. As of 2008, minimum plant population targets have been met in the northern and southern regions but not been met in middle region. We believe this criterion is adequate and appropriate with respect to recovery of the species.

### **Information on the Species and its Status at Time of Listing or Previous 5-Year Review, Compared to that Based on Updated and Current Information.**

#### Species biology and life history.

*Astragalus lentiginosus* var. *piscinensis*, a member of the Fabaceae (pea family), is a prostrate herbaceous perennial, with few-branching stems that are each up to 1 meter (3 feet) long and are covered with stiff appressed hairs. The leaflets are reduced to only 1 to 2 pairs laterally, with a greatly elongated terminal leaflet. The lavender flowers are arranged in loose but short, 5- to 12-flowered racemes. The fruits are papery, strongly inflated with a complete septum, and are covered with appressed hairs (Spellenberg 1993).

*Astragalus lentiginosus* var. *piscinensis* cannot self-pollinate; therefore, seed production is dependent on cross-pollination (Mazer and Travers 1992). Although specific pollinators of *A. lentiginosus* var. *piscinensis* have not been studied, the most likely pollinators (based on records of pollinators on other *Astragalus*) include bumble bees, leafcutting and mason bees (Megachilidae: *Anthidium* spp., *Hoplitis* spp., *Osmia* spp., *Megachile* spp.), non-corbiculate (no pollen basket on hind tibia) Apidae (Anthophorinae, Eucerini: *Melissodes* spp., *Synhalonia* spp., and Anthophorini: (*Anthophora* spp., *Habropoda* spp.), and Andrenidae (Thorp in litt. 2004). Most of these taxa are either cavity-nesting or soil-nesting (in well-drained soils), and would use old rodent burrows, bird nests, beetle burrows, and cavities in dead or down trees and shrubs in upland habitats adjacent to the more saturated soils of the slough system (Service 2004).



*Astragalus lentiginosus* var. *piscinensis* individuals produce relatively few seeds. The seeds have narrow germination requirements and low probability of dispersal. Controlled studies on *Astragalus lentiginosus* var. *piscinensis* seed germination requirements were conducted at the University of Montana (Murray and Sala 2003). Studies showed that scarification with a razor blade yielded 100 percent seed germination, while scarification by simple agitation with coarse gravel resulted in only 2 percent seed germination. Murray and Sala's (2003) findings indicated that without some form of localized disturbance event, seed germination may be a rare event.

The establishment, survival and growth of juvenile plants are strongly influenced by hydrologic conditions at specific sites (see section on Physiology below). The potential life span is estimated at 15 to 35 years, but median life span appears to be about 10 years. A BLM botanist noted that select plants aged by the University of Montana showed individuals can range between 15-25 years, which indicates some plants can be relatively long-lived (Halford in litt. 2007).

#### The Effects of Hydrologic Conditions on Physiological Response of *Astragalus lentiginosus* var. *piscinensis*

Results of a four-year study ending in 2003 on the ecophysiology of *Astragalus lentiginosus* var. *piscinensis*, conducted by the University of Montana for LADWP (Murray 2003), concluded that soil inundation (standing water in a given location) at Fish Slough during fall and winter months, depending upon the timing, may have negative consequences in terms of *Astragalus lentiginosus* var. *piscinensis* root functions and photosynthesis during the growing season. Additionally, a generally higher water table will result in overall higher soil moisture at a given site. Water table level is clearly of ecological importance to *Astragalus lentiginosus* var. *piscinensis*. Under experimental conditions, this taxon's physiological performance, growth and fecundity (seed mass, seed production per plant) are limited by hydric soils in excess of approximately 40 percent water content per volume. The taxon's net photosynthetic rates, growth rates and seed mass were highest in areas of slough habitat where early season (May-June) water table depths exceeded approximately 30 cm (11.8 in) (Murray and Sala 2003). Studies have also indicated that the growth and survival of *Astragalus lentiginosus* var. *piscinensis* in relatively nitrogen-limited alkali flat habitats is related to the acquisition of biologically fixed nitrogen (root symbiotic bacteria).

In summary, *Astragalus lentiginosus* var. *piscinensis* is an herbaceous perennial that produces relatively few seeds with narrow germination requirements and low probability of dispersal. Seed scarification is essential for seed germination. Without some form of localized disturbance event, seed germination may be a rare event. The establishment, survival and growth of juvenile plants are strongly influenced by hydrologic conditions at specific sites. The potential life span is estimated at 15 to 35 years, but median life span appears to be about 10 years.

### Spatial distribution, trends in spatial distribution:

At the time of listing, the known range of *Astragalus lentiginosus* var. *piscinensis* was thought to be restricted to a 10 km (6 mi) stretch of alkaline flats paralleling Fish Slough. Fish Slough is a desert spring-fed wetland ecosystem, consisting of alkali habitat, located in Inyo and Mono counties, California. At the present, *Astragalus lentiginosus* var. *piscinensis* is restricted to the same range as it was at the time of listing. The slough supports the species on less than 540 ac (219 ha).

Biologists from LADWP and BLM conducted the first thorough survey of all potential habitat for *Astragalus lentiginosus* var. *piscinensis* in 1992. They identified a population comprised of 8 colonies of varying size totaling approximately 3,200 plants. These 8 colonies were grouped in three regions of Fish Slough. In 1992, the northern region of Fish Slough supported 63 percent of the total numbers of individuals, the middle region of Fish Slough supported about 34 percent of the numbers of individuals, and the southern region of the slough supported the remaining 3 percent. Similar surveys conducted in 2000 identified 7 colonies grouped in three regions. In 2000, the northern region supported 46 percent, the middle region supported 49 percent, and the southern region supported the remaining 5 percent of the total numbers of individuals (See Figure 1 and Table 1). Plants in the northern region of Fish Slough are entirely on LADWP lands while those in the middle and southern regions are on lands managed by both LADWP and BLM.

At the time of listing, *Astragalus lentiginosus* var. *piscinensis* was thought to be restricted to a 10 km (6 mile (mi)) stretch of alkaline flats paralleling Fish Slough. At the present, *Astragalus lentiginosus* var. *piscinensis* is restricted to the same range as it was at the time of listing and consists of seven colonies. The slough supports the taxon on less than 540 acres (ac) (219 hectares (ha)).

### Abundance, population trends, demographic features, or demographic trends

Abundance: At the time of listing in 1998, we reported that approximately 3,200 plants of *Astragalus lentiginosus* var. *piscinensis* were found widely scattered over approximately 530 ac (212 ha) (63 FR 53598). These numbers were based on a 1992 survey by LADWP, on whose lands the majority of the populations occur. The survey was the first comprehensive survey of adult age-class *Astragalus lentiginosus* var. *piscinensis* undertaken throughout the Fish Slough system. LADWP and BLM replicated the survey in 2000, and the overall number of adult *Astragalus lentiginosus* var. *piscinensis* showed a decline from 3,163 individuals in 1992 to 1,543 in 2000. Surveys conducted by LADWP and BLM in 2008 showed the overall number of adult *Astragalus lentiginosus* var. *piscinensis* increased from 1,543 individuals in 2000 to 4,493 in 2008. Over the 16-year span from 1992 to 2008, the percent increase in number of individuals has been greatest for the northern region (68 percent). Over this same time period, the number of individuals increased 39 percent in the southern region; the number of individuals decreased by 1 percent in the middle region (See Table 1 below).

Table 1: Number of milk-vetch individuals censused in 3 regions of Fish Slough between 1992 and 2008

| Year | Northern Region | Middle Region | Southern Region | Total Number of Plants |
|------|-----------------|---------------|-----------------|------------------------|
| 1992 | 1,993           | 1,076         | 94              | 3,163                  |
| 2000 | 717             | 747           | 79              | 1,543                  |
| 2008 | 3,299           | 1,063         | 131             | 4,493                  |

Grazing Effects: Data on plant numbers and recruitment numbers, collected from LADWP study plots in grazed and ungrazed areas of Fish Slough from 1991 to 2005 suggest that some recruitment of new individuals into the population is occurring in both grazed and ungrazed sample areas. The sampled plots are few (five grazed plots and two ungrazed plots) and the numbers of plants within those plots fluctuated substantially over the sampling period without clear trends (Hubbard in litt. 2007).

Correlation with Precipitation: Surveys were conducted in 2005 in both LADWP and BLM *Astragalus lentiginosus* var. *piscinensis* trend plots. LADWP plots are small (0.01 ac (0.004 ha)); BLM trend plots are larger (1 ac (0.4 ha)). The number of mature plants has declined in wet years on all LADWP plots, but this does not carry through in BLM trend plot data. BLM trend plot surveys in 2005 indicated the numbers of plants in these trend plots are static to increasing from 1991 plant counts.

Table 2: Number of milk-vetch adults and seedlings censused within exclosures

| Year | BLM Spring Plot |           | Cattle Exclosure Plot (LADWP) |           | North of Cattle Exclosure Plot (LADWP) |           |
|------|-----------------|-----------|-------------------------------|-----------|--|-----------|
|      | Mature          | Seedlings | Mature                        | Seedlings | Mature                                 | Seedlings |
| 1991 | 21              | 6         | N/A                           | N/A       | N/A                                    | N/A       |
| 1993 | N/A             | N/A       | 116                           | 61        | 13                                     | 27        |
| 2005 | 18              | 0         | 32                            | 10        | 17                                     | 11        |

Propagation efforts:

Initial propagation and out-planting efforts for *Astragalus lentiginosus* var. *piscinensis* undertaken by BLM has yielded promising results. Seed germination rates ranged between 80 and 90 percent, once the seeds are scarified. Out-planting timing influenced plant survival success. The highest survivorship from seedlings planted in spring and early summer was approximately 40 percent. Out-plantings in spring of 2005 had a 25 percent survivorship rate and 10 percent flowered within one year. Despite the relatively low survivorship of out-planted individuals, the success in seed germination and the relative ease of propagation is encouraging. In addition, the plants from 2005 are persisting and flowering (Halford in litt. 2007). Long-term success of outplantings is unknown at this time.

### Habitat characteristics and conditions:

Ferren and Davis (1991a, 1991c) and Odion et al. (1991) characterized Fish Slough plant communities specific to the habitat of *Astragalus lentiginosus* var. *piscinensis*. This taxon occurs in alkali flats in *Spartina-Sporobolus* (cord grass and dropseed) plant associations and in the transition zone between *Spartina-Sporobolus* and *Distichlis-Chrysothamnus* (salt grass and rabbit brush) plant associations described by Odion et al. (1991). Topography at Fish Slough is nearly flat. Consequently, minor changes to the water table (the upper limit of the portion of the ground wholly saturated with water) may be pronounced in portions of the Slough.

Fish Slough wetland habitats are estimated to be only several thousand years old and are a result of the bottom of a fault basin dropping below the water table; the area remains seismically active (Ferren and Davis 1991c). Seismic activity leading to changes in hydrology has and will likely continue to have significant effects on the distribution and extent of water availability in Fish Slough, and will influence the distribution and viability of *Astragalus lentiginosus* var. *piscinensis* as well as other rare species (Halford in litt. 2007). Seismic instability at the North East Spring area was demonstrated in 1986 when an earthquake occurred and changed spring seep patterns.

Habitat and ecosystem conditions for *Astragalus lentiginosus* var. *piscinensis* have improved since the time it was first listed. Habitat improvements have been made by removing impoundments, rerouting roads, and constructing cattle exclosures. Two projects were completed in 2004 through 2006 that reduced vehicular impacts to *Astragalus lentiginosus* var. *piscinensis* and its habitat. BLM rerouted approximately 0.75 mi (1.2 km) of an existing road section that bisected critical habitat and populations of *Astragalus lentiginosus* var. *piscinensis* to an area outside of the plant's known habitat. A road armoring project repaired 200 feet of an existing road to Fish Slough Lake, a popular fishing place. The project will help keep the road in working condition and avoid road proliferation into the adjacent *Astragalus lentiginosus* var. *piscinensis* population. Additional alkali habitat improvement may be achieved through the removal of Red Willow Dam at Fish Slough Lake, which would redistribute water into dewatered meadows downstream from the dam.

### Taxonomy classification or changes in nomenclature.

*Astragalus lentiginosus* var. *piscinensis* was described by Barneby (1977) based on a collection made by Mary DeDecker in 1974, from BLM Spring, Fish Slough, northwest of Bishop, California. Spellenberg (1993) retained this variety in his treatment of *Astragalus* for the Jepson Manual, and no other changes in taxonomic classification or nomenclature have been made since then.

### Genetics, genetic variation, or trends in genetic variation.

A genetics study was initiated in 2005 by Brian Knaus at Oregon State University on the *Astragalus lentiginosus* complex and included *Astragalus lentiginosus* var. *piscinensis*.

Knaus found that *Astragalus lentiginosus* var. *piscinensis* is well-nested within *Astragalus lentiginosus* but also appears genetically distinct from the rest of the *Astragalus lentiginosus* complex. It differs from other varieties by a very small number of mutational steps (Knaus in litt. 2008).

#### **Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

##### **Factor A. Present or threatened destruction, modification or curtailment of its habitat or range:**

At the time of listing in 1998, we stated that *Astragalus lentiginosus* var. *piscinensis* was threatened by loss of habitat due to modifications of its alkali wetland habitat; discussion of cattle impacts were found under Factor E of the rule, but are more appropriately included in Factor A.

The ownership and management of lands within the Fish Slough basin are key to the conservation and recovery of all the listed species that occur there. All of the entities that own or manage habitat for *Astragalus lentiginosus* var. *piscinensis* operate under directives that include the conservation of natural resources, as briefly summarized here: The BLM Manual 6840 directs the BLM to conserve Federally listed threatened and endangered species and ecosystems upon which they depend and to ensure that authorized actions do not adversely affect such species. LADWP manages land for watershed values, electrical power generation, and other multiple uses for the City of Los Angeles. CDFG manages California's diverse fish, plant, and wildlife resources for their ecological values and for use and enjoyment by the public. The University of California conducts management related research and advises on natural areas management. The Service implements the Endangered Species Act and other federal laws governing wildlife conservation.

In 1984, BLM established the Fish Slough ACEC to protect the federally endangered Owens pupfish (*Cyprinodon radiosus*), along with the entire wetland ecosystem and a suite of other sensitive species that occur there and nowhere else (BLM 1984). The ACEC encompasses the range of *Astragalus lentiginosus* var. *piscinensis*. BLM, LADWP, California Department of Fish and Game (CDFG), University of California Natural Reserve System (NRS), and the Service meet annually to discuss Fish Slough ACEC management issues. The Fish Slough ACEC management group has worked to increase and protect specific alkali habitat for *Astragalus lentiginosus* var. *piscinensis* by removing impoundments, implementing road re-routing and armoring an existing road.

Recovery actions for *Cyprinodon radiosus* (Owens pupfish) that increase ground water levels reduce habitat suitability for *Astragalus lentiginosus* var. *piscinensis*. Ferren and Davis (1991b) summarized impacts to botanical resources at Fish Slough, noting that those related to the enhancement of fisheries (construction of ponds, impoundments, roads, and ditches) have resulted in the greatest losses to this taxon's specific alkali habitats. Projects to lower ground water levels, through installing lower profile fish

barriers and removing excess emergent vegetation show some success of re-establishing alkali habitat.

The ACEC management group has worked to increase and protect specific alkali habitat for *Astragalus lentiginosus* var. *piscinensis* by removing impoundments, re-routing roads, and armoring an existing road (see Land Management section above). Additionally, lowering the water level at Fish Slough Lake would further increase habitat for *Astragalus lentiginosus* var. *piscinensis*.

#### Grazing:

In the listing rule we noted that grazing that began in the 1860s was ongoing on all LADWP lands except in the northern 80 ac (32 ha) enclosure (63 FR 53608). Over time, trampling by livestock alters the composition of the plant community by reducing or eliminating those that cannot tolerate trampling and increasing those species that tolerate disturbance. This may also introduce taxa that were not previously part of the native plant community. Currently a limited amount of cattle grazing occurs on LADWP lands in all three regions of the Fish Slough ACEC, the exception being land in the northern region within the cattle enclosure (Hubbard in litt. 2007).

In summary, although some restoration of alkali habitat has occurred since the time of listing, there continue to be potential threats to the species under Factor A. Threats attributed to impoundments created to protect and enhance habitat for the Owens pupfish have increased ground water levels, reducing the amount of suitable habitat for *Astragalus lentiginosus* var. *piscinensis*.

#### **Factor B. Overutilization for commercial, recreational, scientific, or educational purposes:**

In the listing rule, we stated that overutilization was not known to be a factor/threat to *Astragalus lentiginosus* var. *piscinensis* (63 FR 53606). We are not aware that this poses a threat to the taxon at this time.

#### **Factor C. Disease or predation:**

In the listing rule (63 FR 53606), we stated that disease was not known to be a factor for *Astragalus lentiginosus* var. *piscinensis*. We also noted that evidence exists that native herbivores may exert a substantial effect on reproduction of individual plants of *Astragalus lentiginosus* var. *piscinensis* (63 FR 53606). Seedling herbivory is specifically cited (under Factor E). Infestations of vegetative parts and root systems by phloem-sucking insects and red ants, respectively, and high rabbit herbivory were all reported for individuals of *Astragalus lentiginosus* var. *piscinensis* in the middle region of Fish Slough by Mazer and Travers (1992).

Herbivory remains a threat to *Astragalus lentiginosus* var. *piscinensis*. Seedling herbivory remains a threat to recruitment of new individuals. Field observations suggest that several factors (herbivory, seed germination requirements, seedling establishment,

and interspecific competition) interact, placing constraints on *Astragalus lentiginosus* var. *piscinensis* survival (Murray and Sala 2003).

**(D) Inadequacy of existing regulatory mechanisms:**

At the time of listing, we noted that the following may provide some protection for *Astragalus lentiginosus* var. *piscinensis*: (1) the Federal Endangered Species Act, in those areas where the species occur in habitat occupied by other listed species, (2) the Clean Water Act, (3) the Federal Land Policy and Management Act (FLPMA), and (4) regional planning efforts (such as the cooperative agency management of Fish Slough). Most of these potential regulatory processes have not come to bear, one way or another, on the conservation of *Astragalus lentiginosus* var. *piscinensis*.

In 1984, BLM established the Fish Slough ACEC to protect the federally endangered Owens pupfish (*Cyprinodon radiosus*), along with the entire wetland ecosystem and a suite of other sensitive species that occur there and nowhere else (BLM 1984). The ACEC encompasses the range of *Astragalus lentiginosus* var. *piscinensis*. BLM, LADWP, California Department of Fish and Game (CDFG), University of California Natural Reserve System (NRS), and the Service meet annually to discuss Fish Slough ACEC management issues. The BLM Manual 6840 requires the BLM to conserve Federally listed threatened and endangered species and ecosystems upon which they depend and to ensure that authorized actions do not adversely affect such species. LADWP manages land for watershed values, electrical power generation, and other multiple uses for the City of Los Angeles. CDFG manages California's diverse fish, plant, and wildlife resources for their ecological values and for use and enjoyment by the public. The University of California conducts management related research and advises on natural areas management. The Service implements the Endangered Species Act and other federal laws governing wildlife conservation. The Fish Slough ACEC management group has worked to increase and protect specific alkali habitat for *Astragalus lentiginosus* var. *piscinensis* by removing impoundments, implementing road re-routing and armoring an existing road.

Of the regulatory mechanisms listed, the Federal Endangered Species Act provides some protection for *Astragalus lentiginosus* var. *piscinensis*. The taxon occurs within the Fish Slough ecosystem, a wetland supporting the Owens pupfish, a federally listed endangered species. Management guidance for the Fish Slough ACEC provided direction to manage the area for the conservation of listed and sensitive species, including *Astragalus lentiginosus* var. *piscinensis*. Listing of the Owens pupfish under the Act provides protection for the Fish Slough ecosystem. Protection of spring discharges and adjacent wetland habitat to aid in Owens pupfish recovery indirectly benefits the *Astragalus lentiginosus* var. *piscinensis*.

Conversely, impoundments and other manipulations of the spring system of the slough, created in part to provide habitat for the Owens pupfish, have resulted in the loss of alkali meadow habitat for *Astragalus lentiginosus* var. *piscinensis*. Although the ACEC was established for multiple resource values, management has a special focus on the Owens

pupfish. Management emphasis on only one species or group of related species will not provide adequate protection to all sensitive species in the wetland system and, as in this case, may be detrimental to the survival or recovery of co-occurring species. The occurrence of federally listed fish species in Fish Slough does not provide adequate protection for *Astragalus lentiginosus* var. *piscinensis* and its adjacent wetland habitat. However, three recent projects should benefit *Astragalus lentiginosus* var. *piscinensis* by restoring alkali habitat. Two projects closed existing roads that bisected *Astragalus lentiginosus* var. *piscinensis* habitat and another project armored a road providing reliable access to a local swimming location reduced route proliferation in *Astragalus lentiginosus* var. *piscinensis* habitat.

FLPMA and the ESA encourage conservation-oriented management of the Fish Slough ACEC. However, due to differing requirements for the various listed and sensitive species, not all management actions undertaken to benefit other species have benefited *Astragalus lentiginosus* var. *piscinensis*.

**(E) Other natural or manmade factors affecting their continued existence:**

Lack of recruitment:

At the time of listing, we noted that lack of recruitment was a potential threat to *Astragalus lentiginosus* var. *piscinensis*. Potential causes cited in the rule were high rabbit/rodent herbivory of seedlings (discussed in Factor C) and changes in soil hydrology or chemistry that make the area less hospitable for seedlings (63 FR 53608). We also discussed the threat of livestock grazing under Factor E of the rule. However, Factor A (which would include alteration in habitat due to cattle grazing) and Factor C (which would include grazing of individual *Astragalus* plants) are more appropriate Factors for these discussions; please refer to Factors A and C in this review.

Data on numbers of individuals of *A. lentiginosus* var. *piscinensis*, collected from plots in cattle-grazed or trampled and ungrazed areas of Fish Slough from 1991 to 1996, suggest that some recruitment was occurring in both the grazed and ungrazed sample areas. The sample plots were few (three grazed plots and two ungrazed plots) and numbers of plants within the plots fluctuated substantially over the sampling period, without clear increasing or declining trends (Service 1998). Studies on *Cirsium fontinale* var. *obispoense* (Chorro Creek bog thistle), a plant species with some similarities in life history and habitat to *Astragalus lentiginosus* var. *piscinensis*, showed that cattle grazing may either harm or benefit the plants depending on how it is managed. For instance, cattle may negatively impact Chorro Creek bog thistle by trampling. However, cattle that move through Chorro Creek bog thistle may positively affect the species through hoof-planting seed, creating habitat around hoof prints, and dispersing seed (Chipping 1994). Because the alkali meadow habitat that *A. lentiginosus* var. *piscinensis* occupies is likewise moist, cattle may facilitate the establishment of new individuals in a similar fashion.



Seismic activity:

Although not mentioned in the listing rule, seismic activity leading to changes in hydrology have and will likely continue to have significant effects on the distribution and extent of water availability in Fish Slough and will influence the distribution and viability of *Astragalus lentiginosus* var. *piscinensis* habitat (Halford in litt. 2007).

Small population size:

Also not specifically called out in the listing rule, *Astragalus lentiginosus* var. *piscinensis* may be vulnerable to extirpation by stochastic factors including demographic stochasticity, environmental stochasticity, and genetic stochasticity (Shaffer 1981). Demographic stochasticity refers to random variability in survival or reproduction among individuals within a population (Shaffer 1981), and could play a role in the extirpation of small populations of *A. lentiginosus* var. *piscinensis*. Environmental stochasticity is the variation in birth and death rates from one season to the next in response to weather, disease, competition, predation, or other factors external to the population (Shaffer 1981), and this could also play a role in extirpations of small populations. Genetic stochasticity results from the changes in gene frequencies due to founder effect, random fixation, or inbreeding (Shaffer 1981). The naturally disjunct distribution of *A. lentiginosus* var. *piscinensis* decreases genetic variation within the population, which could impair the species' ability to adapt to changes in the environment or contribute to inbreeding depression (i.e., loss of reproductive fitness or vigor). Small population size makes it difficult for *A. lentiginosus* var. *piscinensis* to persist while sustaining the impacts of high seedling herbivory rates and changes in soil hydrology or chemistry that make the area less hospitable for seedlings; while impacts from cattle grazing have been reduced, they still remain a concern, exacerbating concerns about the risks associated with small population size.

Climate change:

Climate change was not discussed at the time of listing. Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007). Recently, the potential impacts of climate change on the flora of California were discussed by Loarie et al. (2008). Based on modeling, they predicted that species' distributions will shift in response to climate change and that the species will "move" or disperse to higher elevations and northward, depending on the ability of each species to do so. Increases in species diversity in these higher elevations and northern locations due to climate change have the potential to result "...in new species mixes, with consequent novel patterns of competition and other biotic interactions..." with unknown consequences to the species which currently exist there (Loarie et al. 2008). While we lack adequate information to make specific and accurate predictions regarding how climate change, in combination with other factors such as small population size, will affect *Astragalus lentiginosus* var. *piscinensis*; small ranged species, such as *Astragalus lentiginosus* var. *piscinensis*, are more vulnerable to extinction due to these changing conditions (Loarie et al. 2008).

#### IV. Synthesis

In summary, when *Astragalus lentiginosus* var. *piscinensis* was listed in 1998, the species was threatened by lack of recruitment, possibly due to high rabbit/rodent herbivory of seedling and changes in soil hydrology or chemistry that made the area less hospitable for seedlings. Plants were also reported to be threatened by livestock grazing. Currently, a limited amount of cattle grazing occurs in the Fish Slough ACEC with recruitment occurring in grazed and ungrazed areas. Also, seismic activity leading to changes in hydrology, extirpation by stochastic factors, and climate change may threaten the species.

The 2008 census of adult-class *Astragalus lentiginosus* var. *piscinensis* indicated an increase from 2000. However, this increase only meets part of criteria 4 and does not meet the other three recovery criteria. Alkali habitat losses due to modifications of wetland habitat since listing have adversely affected *A. lentiginosus* var. *piscinensis*. However, recent habitat improvement projects closed two roads that bisected *Astragalus lentiginosus* var. *piscinensis* habitat. These habitat improvement projects should restore some alkali habitat and allow for *Astragalus lentiginosus* var. *piscinensis* recruitment into these areas.

The main threat to *Astragalus lentiginosus* var. *piscinensis* is lack of recruitment, possibly caused by herbivory of seedlings and changes in soil hydrology or chemistry that make the area less hospitable to seedlings. At this time, the status of *A. lentiginosus* var. *piscinensis* should remain as threatened because the main threats identified at the time of listing still persist. Conservation measures that have been implemented have not substantially improved the status of this taxon. In addition, the new potential threat of climate change has been identified since the time of listing. The taxon is not likely in danger of extinction throughout all or a significant portion of its range, thus an endangered designation is not appropriate.

#### V. RESULTS

##### Recommended Classification:

Uplist to Endangered

Delist

No change is needed

New Recovery Priority Number: N/A

Listing and Reclassification Priority Number: No change

#### VI. RECOMMENDATIONS FOR FUTURE ACTIONS

- 1) CDFG, BLM and LADWP should work to lower water levels by regulating flow in Fish Slough Lake and monitor *Astragalus lentiginosus* var. *piscinensis* recruitment results.

- 2) BLM should study the benefits of soil disturbances on *Astragalus lentiginosus* var. *piscinensis* recruitment.
- 3) BLM should continue with propagation and out-planting projects to enhance recruitment.
- 4) BLM should study the extent and population impacts of herbivory and ant colony infestations on *Astragalus lentiginosus* var. *piscinensis* recruitment.
- 5) The Service should work with LADWP to develop and implement a grazing plan for LADWP cattle allotment lands within the Fish Slough ACEC.

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

*Astragalus lentiginosus* var. *piscinensis* (Fish Slough milk-vetch)

Current Classification: Threatened

Recommendation resulting from the 5-Year Review

- Downlist to Threatened  
 Uplist to Endangered  
 Delist  
 No change needed

Appropriate Listing/Reclassification Priority Number: N/A

Review Conducted by: Michael Glenn

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve Diane K. Nole Date 1/14/09

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Fish and Wildlife Service

Approve M. Quinn Date 2-4-09