U.S. Fish & Wildlife Service

Owens Basin Wetland and Aquatic Species Recovery Plan Inyo and Mono Counties, California

OWENS BASIN WETLAND AND AQUATIC SPECIES RECOVERY PLAN

INYO AND MONO COUNTIES, CALIFORNIA

Owens pupfish,
Owens tui chub,
and Fish Slough milk-vetch

and Selected Species of Concern

Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

Approved: _____
Manager
California/Nevada Operations Office
U.S. Fish and Wildlife Service

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LITERATURE CITATIONS

The literature citation for this recovery plan should read as follows:

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EXECUTIVE SUMMARY

Current Species Status: Owens pupfish and Owens tui chub are listed as endangered throughout their range. Fish Slough milk-vetch is listed as threatened throughout its range. Owens pupfish is declining, Owens tui chub and Fish Slough milk-vetch are stable or slowly declining. Owens Valley checkerbloom (*Sidalcea covillei)* (stable), Inyo County mariposa lily (*Calochortus excavatus*) (stable or declining), Owens speckled dace (stable), Long Valley speckled dace (declining), Owens Valley vole (status unknown), and the Owens, Fish Slough, and Aardhal's springsnails (presumed stable) are species of concern.

Habitat Requirements and Limiting Factors: The fish species reside in springs, streams, or river. The plants and the vole require mesic alkali meadows adjacent to aquatic habitats. Springsnails require springs, but do not inhabit streams or rivers. All species are affected by non-native species, habitat modification for diversion and ground water pumping. Excessive livestock grazing may affect voles, plants, and springsnails.

Recovery Objectives: Delist Owens pupfish, Owens tui chub, and Fish slough milk-vetch. Protect species of concern so that listing is unnecessary.

Recovery Criteria: Owens pupfish delisting may occur when reproducing populations are established as part of self-sustaining native fish assemblages in aquatic habitats in four Conservation Areas for a period of 7 consecutive years. Owens tui chub delisting may occur when reproducing populations are established as part of self-sustaining native fish assemblages in seven Conservation Areas for a period of 5 consecutive years. Delisting of Fish Slough milk-vetch may be considered when the vegetation communities in which it occurs are restored, populations are on protected lands and adequately secured from human-induced threats, and populations have maintained demographic characteristics, as measured by monitoring over a 10 to 15 year period, indicating they are likely to be viable over the long-term.

Actions Needed:

1. Protect and expand Owens tui chub and Owens pupfish refuges until Conservation Area populations are secure.
2. Delineate Conservation Area boundaries.
3. Manage Conservation Areas to control deleterious non-native plants and animals, rehabilitate habitats, reestablish populations, and protect habitats.

4. Conduct research to determine management strategies that will maintain characteristics of natural community persistence and resilience.
5. Implement population and habitat monitoring in Conservation Areas.
6. Initiate a public information and education program about the rare species in the Owens Basin.

Date of Recovery: Delisting could occur as early as 2015.

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I. INTRODUCTION

The Endangered Species Act of 1973 (Act), as amended, states that its purpose ". . . is to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." This recovery plan, and its companion document of management guidelines, adopt a two-tiered approach to rare species conservation in Owens Basin. The first tier includes Federal and State listed, proposed, and species of concern that are endemic to the wetland and aquatic ecosystems of the Owens Basin (Table 1). The second tier consists of Federal and State listed, species of concern, or rare species associated with wetland and aquatic ecosystems that also occur outside the Owens Basin, but warrant specific management guidelines to stabilize and enhance populations within the basin (Table 2). The goal of this recovery plan is to restore the target species to viable and interacting populations within their ecosystems. The goals of the management guidelines are to alert land managers to the presence of sensitive species in the basin, identify management actions to conserve these species, and thereby avert further declines of these species in the Owens Basin and ensure their long term conservation. The management guidelines are presented in Appendix C.

The Owens Basin provides habitat for numerous endemic plants and animals (Sada *et al.* 1995), and many that are rare throughout their range (Hershler 1989, California Department of Fish and Game Natural Diversity Database 1994, Skinner and Pavlik 1994). The ecological uniqueness of this area and recent discoveries of new species (e.g., Hershler 1989) suggest that future surveys may document the presence of additional unique plants and animals in the basin. Human activities during the past 130 years have caused the decline or disappearance of many populations of rare species in the Owens Basin, particularly those found in wetland and aquatic ecosystems (Miller 1961, 1969; Hershler 1989, Skinner and Pavlik 1994, Moyle *et al.* 1995). Declines have been most pronounced for Owens pupfish *(Cyprinodon radiosus)*, Owens tui chub (*Gila bicolor snyderi*), and Fish Slough

milk-vetch *(Astragalus lentiginosus* var. *piscinensis*), although many wetland-associated species are rare. Owens pupfish and Owens tui chub are listed as endangered, and Fish Slough milk-vetch is listed as threatened. This recovery plan describes actions necessary to restore populations and enhance habitat for these species so that they no longer require protection of the Act. This recovery plan also includes recommendations for protection of several State-listed, species of concern, and rare species that occur in the target ecosystems.

A recovery plan for the Owens pupfish was approved in 1984 (U.S. Fish and Wildlife Service 1984), and a draft recovery plan for the Owens tui chub was prepared in the 1980s, but never made final. Goals, recovery tasks, and objectives of this ecosystem-based recovery plan incorporate many concepts presented in these earlier plans. This broader plan takes precedence over all previous plans for these species.

This recovery plan identifies conservation tasks and programs that are intended to serve as a foundation for future completion of a single large or numerous small Habitat Conservation Plans (HCP) for the valley floor wetland. Habitat conservation plans are required to obtain permits, pursuant to section 10(a)(1)(B) of the Act, for the incidental take of federally listed animals. The implementation of an habitat conservation plan must not jeopardize the continued existence of any listed plant species. Therefore, listed plant species are also included in the planning process when present; other non-listed species may also be included provided that their needs are addressed as if they were listed. Section 10(a)(1)(B) permits can be issued for a single species or action or can encompass numerous actions and species over a large area. The larger plans will often include substantial public involvement. These plans will identify conservation programs that will be implemented by permittees to minimize and mitigate the adverse impacts of their activities on federally listed species (and ecosystems of which they are a part).

Successful implementation of this recovery plan will require substantial public education and involvement. An effective program that involves the public should

clarify that site specific conservation plans will provide for recovery for these species while maintaining public access and traditional land uses, and not adversely affect the regional economy. These assurances can only be communicated and demonstrated when recovery activities are designed and conducted with cooperation of local land owners and governments.

Table 1. Federal and State listed species, and species of concern endemic to the Owens Basin, Inyo and Mono counties, California, found in valley floor wetland and aquatic habitats (Tier 1 species).

Common Name	Scientific Name	Federal Status	State Status
Owens pupfish	*Cyprinodon radiosus*	E	E
Owens tui chub	*Gila bicolor snyderi*	E, CH	E
Fish Slough milk-vetch	*Astragalus lentiginosus var. piscinensis*	T	
Owens speckled dace	*Rhinichthys osculus ssp.*		CSC
Long Valley speckled dace	*Rhinichthys osculus ssp.*		CSC
Inyo County mariposa lily	*Calochortus excavatus*		SPL; CNPS 1B
Owens Valley checkerbloom	*Sidalcea covillei*		E
Fish Slough springsnail	*Pyrgulopsis perturbata*		CSC
Owens Valley springsnail	*Pyrgulopsis owensensis*		CSC
Aardhal's springsnail	*Pyrgulopsis aardhali*		CSC
Owens Valley vole	*Microtus californicus vallicola*		CSC

Abbreviations: E = listed as endangered; T = listed as threatened; CH = species with designated Critical Habitat; CSC = State of California Species of Special Concern; SPL = on the State of California's Special Plants List; CNPS 1B = the California Native Plant Society's list of Plants Rare, Threatened, or Endangered in California and elsewhere.

Table 2. Federal and State listed species and species of concern associated with Owens Basin aquatic and wetland ecosystems in the Owens Basin, Inyo and Mono counties, California (Tier 2 species). Management recommendations for these species are addressed in management guidelines (Appendix C).

Common Name	Scientific Name	Federal Status	State Status
Owens sucker	*Catostomus fumeiventris*		CSC
Least Bell's vireo	*Vireo bellii pusillus*	E	E
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	E
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*		E
Least bittern	*Ixobrychus exilis*		CSC
Western snowy plover	*Charadrius alexandrinus nivosus*		CSC
Yellow warbler	*Dendroica petechia brewsteri*		CSC
Yellow-breasted chat	*Icteria virens*		CSC
Silverleaf milk-vetch	*Astragalus argophyllus var. argophyllus*		SPL; CNPS 2
Alkali ivesia	*Ivesia kingii var. kingii*		SPL; CNPS 1B
Hot springs fimbristylis	*Fimbristylis thermalis*		SPL; CNPS 2
Inyo phacelia	*Phacelia inyoensis*		SPL; CNPS 4

Abbreviations: E = listed as endangered; CSC = State of California Species of Special Concern; SPL = on the State of California's Special Plants List; CNPS 1B = the California Native Plant Society's list of Plants Rare, Threatened or Endangered in California and Elsewhere; CNPS 2 = the California Native Plant Society's list of Plants Rare, Threatened or Endangered in California, But More Common Elsewhere. CNPS 4 = the California Native Plant Society's list of Plants of Limited Distribution.

A. Location, History, and Ecology

Physical Setting

The Owens Basin lies in east central California in the rain shadow of the Sierra Nevada (Figure 1). It is a north-south oriented basin encompassing approximately 7,900 square kilometers (km^2) (3,050 square miles (mi^2)) of a diverse ecological province. Natural community types range from high elevation sub-alpine forests at elevations of 4,400 meters (m) (14,500 feet (ft)) in the Sierra Nevada, White and Inyo Mountains, to low elevation Mojave Desert scrub at 850 m (2,900 ft) elevation in the southern part of the basin. Annual precipitation in high elevations is as much as 76 centimeters (cm) (30 inches (in.)) and as little as 13 cm (5 in.) at low elevations (U.S. Weather Bureau, Bishop, California). Precipitation falls mostly during the winter as snowfall in the mountains and rain in the valleys. During spring, summer, and early autumn, precipitation falls during infrequent thundershowers.

The ecological diversity of the Owens Basin is attributed to its geographic setting and physiography. It lies along the southwestern boundary of the Great Basin and the northwestern boundary of the Mojave Desert, and includes both desert and montane climates. It occupies a transitional zone and has a diverse array of resident plant and animal species whose distributions are centered north and east in the Great Basin or south in the Mojave Desert (Barbour and Major 1977, Hershler and Pratt 1990, Echelle and Echelle 1993).

In addition to harboring many species of distinct northern and southern affinities, a number of species are endemic to the area. These species are related to taxa occupying surrounding deserts; their progenitors are believed to have reached the Owens Basin during cooler climates of the Pleistocene Epoch, when Owens Basin waters were connected with Lahontan Basin lakes and streams to the north and the Death Valley system to the south (Miller 1948, Barbour and Major 1977, Minckley *et al.* 1986, Hershler and Pratt 1990). This cooler climate also permitted an invasion of

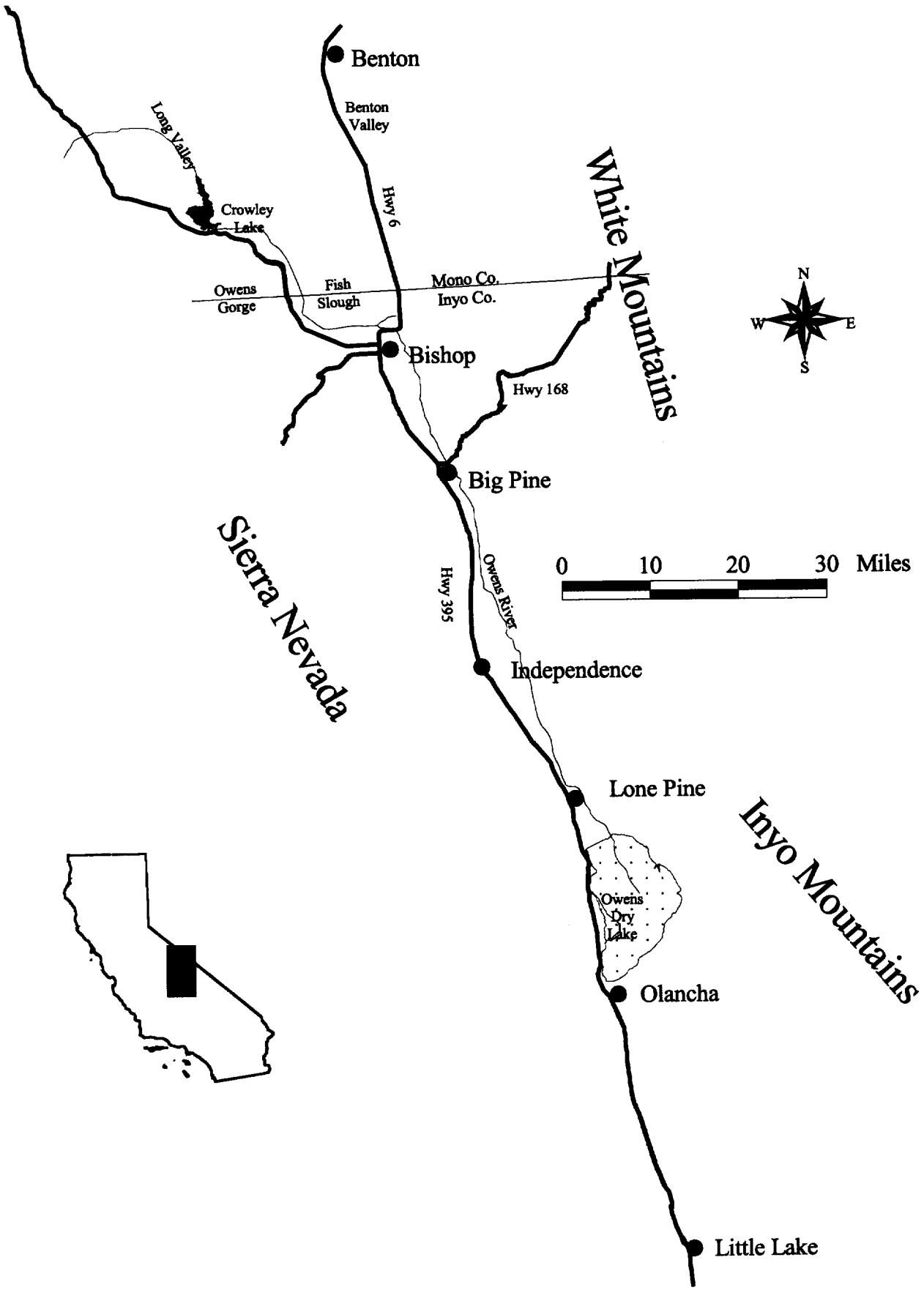

Figure 1. Owens Basin location and many surrounding geographic features.

plant species generally associated with northerly latitudes (Reveal 1979). Onset of warmer temperatures and drier conditions following the Pleistocene reduced the extent of wetlands, desiccated streams connecting the Owens Basin with surrounding regions, and isolated wetland species both within the Owens Basin and from other species in adjacent basins. This isolation allowed Owens Basin populations to diverge from their ancestors and to differentiate into taxonomically distinct entities.

Valley-floor wetlands in the Owens Basin are maintained by a variety of factors including the Owens River, springs, and high groundwater levels maintained by irrigation. These wetland communities are diverse and include mesic alkali meadows, marshes, riparian zones, and aquatic habitats. Owens Basin endemic animals historically occupied an array of habitats in these wetlands, including streams and the Owens River (fishes), springs (fishes and mollusks), and lush grassy meadows (vole). Rare plant species in the basin are found in mesic alkali meadows that are often distantly removed (up to 1 km (0.5 mi)) from aquatic habitats. Soil moisture in these habitats is generally maintained by a high water table.

The majority of the valley floor is owned by the City of Los Angeles and administered by the Department of Water and Power (LADWP) to provide municipal water for the City of Los Angeles. Most of the rest of the basin is publicly owned and managed by the California Department of Fish and Game (CDFG), the U.S. Bureau of Land Management (BLM), and the U.S. Forest Service, Inyo National Forest (USFS).

Valley-floor soil types and plant communities have been cataloged by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) (formerly known as the Soil Conservation Service) from Owens Basin soils mapping data recently collected by NRCS, and from vegetation data collected by LADWP and BLM. This information provides a foundation for Ecological Site Descriptions that categorize the landscape by soil types and potential vegetation communities that occur on these soils under natural conditions (U.S. Natural Resources Conservation Service 1995). Although these descriptions of landscape characteristics are dynamic and updated as new information becomes available, they are one of several ways that

functional condition of local vegetation communities can be assessed and management targets identified. Additional sources for management targets are found in the BLM's Desired Plant Community Definitions for Owens basin springs and wet meadows (U.S. Bureau of Land Management 1991, pages A2-4-A2-6) and BLM's processes for assessing proper functioning condition of riparian vegetation in the western U.S. (U.S. Bureau of Land Management 1995).

Ecological Site Descriptions are part of a comprehensive system that describes soils and potential vegetation communities of the United States (U.S. Department of Agriculture 1981). In this system, soils and vegetation communities are hierarchically described in large units referred to as Major Land Resource Areas (MLRA). These geographically associated regions are characterized by climate, elevation, soil types, water availability, and natural vegetation communities. Each MLRA is made up of Ecological Sites (e.g., wetlands, streambank, moist floodplain, etc.), which are mapped on a small scale to clearly describe soils and vegetation that would comprise the landscape mosaic barring human-caused alterations.

Ecological Sites on the Owens Basin valley floor all occur within three MLRAs: MLRA 26 (Carson Basin and Mountain), MLRA 29 (Southern Nevada Basin), and MLRA 30 (Sonoran Basin and Range) (U.S. Department of Agriculture 1981). Most valley floor sites in the Owens Basin occur in MLRA 29; MLRA 30 is limited to sites near Owens Dry Lake; and MLRA 26 occurs only in Long Valley. Ecological Site Descriptions have been prepared for all natural habitats in the Owens Basin. Ecological Site Descriptions for habitats occupied by species addressed in this recovery plan are summarized in Table 3. Complete Ecological Site Descriptions can be obtained at NRCS, BLM, and LADWP offices in Bishop, California.

Table 3. Potential Dominant species, vegetation composition, and ground cover characterizing Owens Basin valley-floor habitats.[1]

Ecological Site	MLRA[2]	Dominant Species[3]	Potential Vegetation Composition %			Ground[4] Cover %
			Grasses	Shrubs & Trees	Forbs	
Sodic Meadow	26	*Distichlis spicata, Carex douglassi, Poa secunda ssp. juncifolia*	80	5	15	25-45
Streambank	26	*Salix lutea, Salix exigua, Rosa woodsii, Carex nebrascensis, Juncus spp.*	30	60	10	70-85
Wet Meadow	26	*Carex nebrascensis, Carex rossii, Poa secunda ssp. juncifolia, Deschampsia cespitosa*	85	0	15	80-90
Wet Sodic Meadow	26	*Eleocharis palustris, Juncus balticus, Carex spp.*	90	0	10	60-80
Moist Floodplain	26	*Carex spp., Juncus spp., Poa secunda ssp. juncifolia*	75	15	10	80-90
Wet Meadow	29	*Carex nebrascensis, Juncus balticus, Poa secunda ssp. juncifolia*	80	5	15	70-90

Ecological Site	MLRA[2]	Dominant Species[3]	Potential Vegetation Composition %			Ground [4] Cover %
			Grasses	Shrubs & Trees	Forbs	
Saline Meadow	29	*Sporobolus airoides, Distichlis spicata, Juncus balticus, Leymus triticoides*	80	15	5	40-80
Saline Bottom	29	*Sporobolus airoides, Distichlis spicata, Sarcobatus vermiculatus*	65	25	10	20-40
Wetland	29	*Scirpus nevadensis, Typha domingensis, Eleocharis palustris*	80	15	5	70-90
Moist Floodplain	29	*Distichlis spicata, Sporobolus airoides, Leymus triticoides*	80	10	10	60-85
Streambank	29	*Betula occidentalis, Salix laevigata, Carex spp., Leymus triticoides*	35	55	10	70-85
Sodic Fan	29	*Atriplex torreyi, Sporobolus airoides, Sarcobatus vermiculatus*	25	70	5	20-40
Sodic Flat	29	*Distichlis spicata, Atriplex parryi*	65	30	5	5-20

Ecological Site	MLRA[2]	Dominant Species[3]	Potential Vegetation Composition %			Ground [4] Cover %
			Grasses	Shrubs & Trees	Forbs	
Sodic Terrace	29	*Atriplex confertifolia, Sarcobatus vermiculatus, Artemisia spinescens, Oryzopsis hymenoides*	20	70	10	5-15
Dry Sodic Terrace	30	*Atriplex parryi, Sueda moquinii, Sarcobatus vermiculatus, Distichlis spicata*	15	80	5	5-15
Wet Sodic Bottom	30	*Distichlis spicata*	80	15	5	25-60

1. Data are summarized from Ecological Site Descriptions prepared from U.S. Natural Resources Conservation Service (NRCS), Los Angeles Department of Water and Power, and U.S. Bureau of Land Management surveys. Complete survey information is available from NRCS, Los Angeles Department of Water and Power and U.S. Bureau of Land Management offices in Bishop, California.
2. Dominant species and percentages are that proportion (calculated by air-dry weight) of the total plant community that each contributes in an average production year.
3. MLRA = Major Land Resource Area.
4. Ground cover is approximate basal and crown cover.

History

Early accounts of the Owens Basin were recorded by trappers and others accompanying J.R. Walker during visits from 1834 to 1846 (Wilke and Lawton 1976), Davidson (1859), and the Death Valley Expedition in 1891 (Gilbert 1893, Merriam 1893). Some accounts from these expeditions refer to the luxuriance of the area and abundant water (e.g., Davidson 1859), while others mention little about natural history. Brewer spent several days in the Owens Valley during 1864 and reported 'great meadows' adjacent to the Owens River and streams flowing from the Sierra Nevada. He estimated these meadows comprised less than 10 percent of the valley and 'the rest is desert' (Farquar 1974).

Indigenous peoples irrigated meadows to grow edible native plants near large tributary streams (Steward 1933), which probably constituted the first human-caused alteration of Owens Basin wetlands. European settlement began in the late 1850s with arrival of ranchers who sold beef and crops to gold camps located north and east of the Owens Basin (Chalfant 1933). Cattle drives and sheep herding during this period probably had a large impact on valley floor vegetation (Burcham 1957, Sauder 1994). Early settlement was most active in northern Owens Valley and west of the Owens River where indigenous peoples had previously diverted streams and modified upland habitats. Babb (1992) reported that approximately 350 km (250 mi) of canals diverted Owens River water during the late 1880s, causing noticeable stream flow reduction and a decrease in the size of Owens Lake. By 1900, 1,660 hectares (ha) (41,026 acres (ac)) in the valley were irrigated by an extensive canal system. At this time, Owens Valley agriculture included a total of 424 farms covering 57,411 ha (141,059 ac) (Sauder 1994). For the next 25 years, approximately 56,000 ha (140,000 ac) of the Owens Valley was used for agriculture (Sauder 1994). Although meadows and riparian zones were included in this acreage, much of this area was upland habitat that was watered by diverting Owens River water through an extensive canal system.

Ecological Relationships

Four omnivorous species comprise the Owens Basin native fish assemblage, the Owens pupfish, Owens tui chub, Owens speckled dace (*Rhinichthys osculus* ssp.), and Owens sucker (*Catostomus fumeiventris*) (Moyle 1976a, Sada 1998). None of the native fishes prey on other fishes. Although no ecological studies have examined habitat utilization, resource partitioning, or demography of fishes in this assemblage, studies of similar assemblages in other western Great Basin streams suggest little interaction among native members of the Owens Basin assemblage. Moyle and Vondracek (1985) found habitat and diet overlap were low among members of species in an assemblage [including Tahoe suckers (*Catostomus tahoensis*), speckled dace, trout (*Salmo* spp.), Lahontan redside (*Richardsonius egregius*), and Paiute sculpin (*Cottus beldingi*)] occupying Martis Creek in the Truckee River system. They also concluded that populations in this assemblage are regulated more by environmental factors than by predation and competition. Similar conclusions were reached by Sada (1990) in studies of a Great Basin stream fish assemblage dominated by Tahoe suckers, speckled dace, and Lahontan redside. Microhabitat observations documented moderate niche overlap among species, with available habitats partitioned among species. Experimental studies examining effects of density and species composition on habitat use indicated that competitive interactions are minimal and that changes in habitat use are density dependent (Sada 1990). Each Owens basin native fish is also vagile (highly mobile and rapidly invades vacant habitats), has a high reproductive capacity, and each species is a habitat generalist. These life history characteristics differ from most non-native predatory fish, which require more specific habitats and have lower reproductive capacities. Such differences are important factors distinguishing native and non-native deleterious fishes which will permit implementation of management activities that may recover native fishes by creating habitats that are more conducive to them than to non-native predators.

Recent fisheries surveys indicate that Owens basin native fishes occasionally occur in habitats occupied by non-native aquatic species. Dienstadt *et al.* (1985, 1986) found that Owens suckers and Owens tui chub X Lahontan tui chub (*G.b. obesus*) hybrids are commonly found in fish assemblages dominated by brown trout (*Salmo trutta*) in Long Valley and northern Owens Valley. Surveys by Sada (1989) also found Owens sucker and Owens speckled dace in northern Owens Valley habitats inhabited by brown trout, and Kratz *et al.* (1991) found Owens pupfish and mosquitofish (*Gambusia affinis*) occupying habitats in Fish Slough. Although it appears that some non-native fish species may coexist with Owens Basin native fishes, the current distribution of native and non-native Owens Basin fishes indicates that native fishes cannot survive in many habitats occupied by introduced fish. Habitats no longer occupied by native Owens basin fishes are now typically inhabited by predatory fish [e.g., largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and catfish (*Ictalurus* sp.)]. Hereafter in this recovery plan, taxa that extirpate populations will be referred to as 'deleterious' species, which include all predatory fishes (e.g., bass, brown trout, etc.) and introduced and hybridized tui chubs (hybrid tui chubs reproduce with native tui chubs and produce genetically impure Owens tui chubs). Other non-native species may adversely affect native fishes but they are not known to extirpate populations (e.g., rainbow trout, *Oncorhynchus mykiss*, sticklebacks, *Gasterosteus aculeatus*, etc.). These fishes are not considered 'deleterious' to Owens basin native fishes.

Museum records indicate that the period from 1930 to 1970 was characterized by a rapid decline in abundance and distribution of Owens Basin native fishes (Miller 1969, Sada 1989). This rapid decline in native fish abundance is attributed to introduction of non-native predatory fishes which changed functional characteristics of the Owens basin fish assemblage from an assemblage dominated by omnivores to one that is now dominated by predators. By 1942, the Owens pupfish was believed to be extinct (Miller and Pister 1971,

Moyle 1976b). In the past two decades, native fish abundance and distribution in the Owens Basin have remained relatively stable owing to intensive management of refuge populations, static water use patterns, and a decline in the frequency of introductions of additional non-native aquatic species. The list of exotic species continues to grow, however. Tiger salamanders (*Ambystoma tigrinum*) and red-ear sunfish (*Lepomis microlophus*) have become established in the past several years (Sada 1998, Tomback 1998), both of these species are predators (Moyle 1976).

Owens basin valley floor wetland vegetation is dominated by sedges and grasses; riparian vegetation is additionally dominated by willows. These vegetation communities include fewer species than communities in more mesic regions but undisturbed native vegetation is usually sufficiently dense to cover soils and minimize erosion. Wetland plant communities are in comparatively good condition in many parts of the Owens basin. There are areas where disturbance has modified native vegetative communities, causing a decrease in native plant cover and frequently and an increase in noxious weed occurrence (e.g., *Lepidium latifolium*).

Changes in the vegetation of those natural communities not already altered by cultivation probably accelerated in the southern Owens Basin after 1913, when water was first diverted to southern California via the Los Angeles Aqueduct. Possible impacts of diversion on vegetation are indicated from studies by Brothers (1984) that compared Owens River riparian vegetation upstream and downstream of the Los Angeles Aqueduct intake. Vegetation growing along river reaches unaffected by diversion consisted mostly of native riparian species, while riparian vegetation adjacent to reaches dried by diversion was dominated by non-native saltcedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*). These impacts are consistent with changes in riparian vegetation attributed to stream diversion in several eastern Sierra Nevada streams and other southwestern United States riparian communities (Kondolf *et al.* 1987, Stromberg and Patten

1990, Smith *et al.* 1991, Stromberg *et al.* 1993).

Records from later biological surveys indicate that Owens Valley alkali meadows and springs were more densely populated by endemic plants and animals than they are today (Hitchcock 1957). Recent declines in endemic species may be attributed to effects of excessive ground water use, livestock grazing, natural drought, and impoundment of water (DeDecker 1982, Hershler 1989, California Department of Fish and Game Natural Diversity Database 1994, Manning 1994). Although it is difficult to quantify effects of drought, grazing, and groundwater depletion on wetlands and aquatic habitats, studies in other parts of the southwest and other arid regions document adverse impacts of these factors on fish populations and vegetation (Dudley and Larson 1976, Deacon 1979, Brown and Archer 1989, Platts 1990, Rinne and Minckley 1991, Stromberg *et al.* 1992, Milton *et al.* 1994). Additional work is needed to accurately determine the magnitude of these disturbances on Owens Basin wetland ecosystems.

B. Species Accounts

Human settlement of the Owens Basin and disturbance of its wetlands prior to comprehensive biological surveys make it impossible to quantitatively describe the historical distribution and abundance of species now rare in the basin. However, important aspects of plant and animal distribution and habitats may be inferred from post-settlement reports and museum records compiled by scientists in the late 1800s and early 1900s. These reports provide the best description of Owens Basin plant and animal communities prior to perturbations that caused the decline of many rare species. Few studies have been conducted to quantify habitat requirements of Owens Basin endemic species. Although this information is often necessary to design successful habitat restoration programs, pertinent knowledge from studies examining life history and habitat requirements of closely related species occupying nearby regions can be useful.

1. Listed and Proposed Species

Owens Pupfish **Recovery Priority 3**

The Owens pupfish (*Cyprinodon radiosus*) was listed as endangered on March 11, 1967 (32 FR 4001), because of population declines attributed to competition and predation by non-native species and adverse habitat modification caused by water diversion from the Owens River and its tributaries for agricultural and municipal purposes. Critical Habitat has not been designated. The current status of the species is declining.

The Owens pupfish was described in 1948 from a collection made at the west spring in Fish Slough on July 26, 1937 (Miller 1948). It is a small, deep-bodied fish with a total length that rarely exceeds 6 cm (2.5 in.). The species is sexually dimorphic, and males and females can be easily distinguished from each other by coloration. Females are dusky, olive green with several dark vertical bars aligned in a row along the sides. Males are bright blue, particularly during the spring and summer spawning season. It is distinguished from other pupfishes by anterior placement of its dorsal fin, its long caudal peduncle, absence of spine-like projections on scale circuli, and by absence of a terminal black band on the caudal fin. The number of rays in its dorsal, pelvic, pectoral, and anal fins is also greater than other species.

Morphological, genetic, and geological studies conclude that the desert pupfish (*Cyprinodon macularius*) of the lower Colorado River system is the closest relative of the Owens pupfish (Miller 1948, Minckley *et al.* 1986, Echelle and Dowling 1992, Echelle and Echelle 1993). Ancestral pupfish probably entered the Owens Basin through the Death Valley region when waters of the Colorado River and Death Valley system were connected during the Pleistocene (Miller 1948, Minckley *et al.* 1986, Echelle and Echelle 1993).

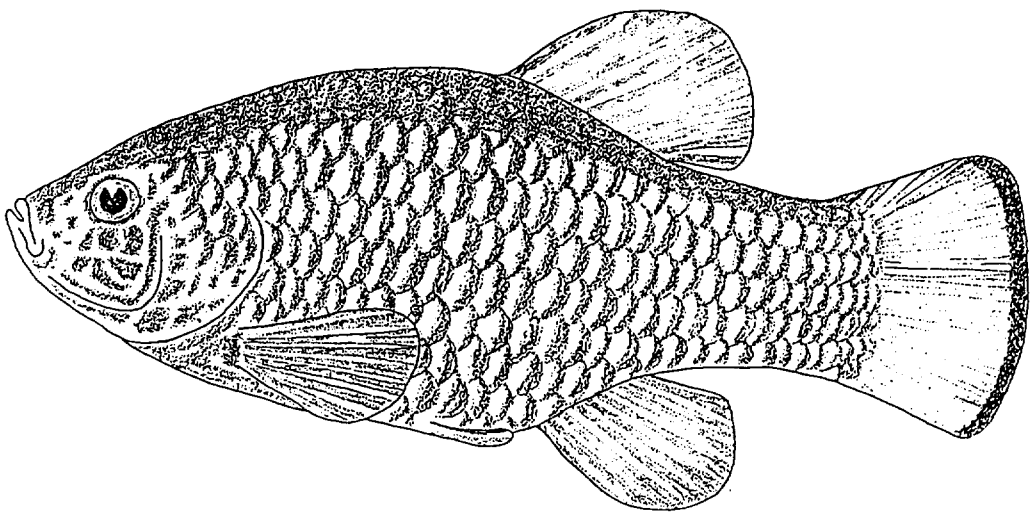

Figure 2. Illustration of Owens pupfish. Artist unknown.

Historical distribution and relative abundance of Owens pupfish were noted by early explorers and scientists. Steward (1933) reported that the native Paiute tribe captured large numbers of pupfish with basket-like nets and dried them for use as winter food. During a summertime visit to the Owens Valley in 1859, Davidson (1859) reported pupfish as common throughout the Owens River but absent from tributary streams. Fisheries surveys during the early 1900s documented pupfish in habitats throughout the Owens Valley, and concluded that Owens pupfish occupied most valley floor aquatic habitats from Fish Slough (approximately 19 km (12 mi) north of Bishop) south to Lone Pine (Kennedy 1916, Snyder 1917, Sumner and Sargent 1940, Miller 1948) (Figure 2). These observations indicate the pupfish occupied all of the Owens River, and possibly the Owens River delta in Owens Lake. Miller and Pister (1971) summarized field studies that showed pupfish were most abundant near the margins of marshes, from shallow sloughs bordering the Owens River, and from springs.

Pupfish occupy most available aquatic habitat where water is relatively warm and food is plentiful. Adults frequently occupy deeper water than juveniles, but all life stages utilize many microhabitats available in the environment with little preference (Sada and Deacon 1994). Male pupfish are territorial, defending areas of substrate from competing males (Soltz and Naiman 1978). Female Owens pupfish occupy habitats along the margins of areas defended by males, and females choose males for mating (Mire 1993). Females begin producing eggs when water temperatures are near 14° C, and spawning occurs over soft substrates in spring and summer (Mire 1993). Mire and Millett (1994) observed that female Owens pupfish may be involved in spawning acts up to 200 times per day, but they lay only one egg at a time and a few eggs are laid each day. Correlation between female size and fecundity was low. Eggs incubate for approximately 6 days before hatching in water temperatures ranging from 24° C to 27° C and that an average of 95 percent of spawned eggs were fertilized. Juvenile pupfish grow rapidly to sexual maturity in 3 to 4 months (Barlow 1961). They are usually able

to spawn before their first winter, and lifespan is rarely greater than 1 year (Soltz and Naiman 1978). Mire (1993), however, observed Owens pupfish living as long as 3 years in refuge habitats.

Few studies have examined the ecology of Owens pupfish; however, it is believed to be similar to other *Cyprinodon* species occupying interior basins of the southwest. Owens pupfish are opportunistic omnivores that consume a variety of plant and animal foods. Their diet changes seasonally and typically includes invertebrates and plants most abundant in the environment. Kennedy (1916) reported Owens pupfish to be primarily carnivorous based on dietary studies conducted on Owens pupfish collected during summer from shallow habitats bordering the Owens River near Laws. The abundance of chironomid larvae in fish examined and a scarcity of mosquitoes during visits to the area led him to suggest that pupfish are an effective biological control agent for mosquitoes. Recent studies examining the effectiveness of desert pupfish and Amargosa pupfish *(Cyprinodon nevadensis)* in controlling mosquitoes found both species superior to mosquitofish at controlling mosquito larvae (Castleberry and Cech 1989, Legner and Warkentin 1989).

Owens pupfish demography has been studied only in intensively managed refuge habitats. These studies indicate little seasonal variation in population size (Mire 1993); however, demographic studies of other Death Valley system pupfishes populations indicate that seasonal variation in population size may be large. Thus, Owens pupfish populations may undergo wide temporal variation outside of refuges, in habitats that are more representative of areas historically occupied. Salt Creek pupfish (*Cyprinodon salinus salinus*) and Cottonball Marsh pupfish (*C. s. milleri*) populations in wetlands on the floor of Death Valley, and a population of Amargosa pupfish (*Cyprinodon evadensis amargosae*) near Tecopa, California, vary by several orders of magnitude between their winter minimum and spring or summer maximum (Naiman 1976, Sada and Deacon 1994). Fluctuations in other pupfish populations occupying small, predictable, thermal

habitats are more limited, and the maximum size may be less than 3 times the annual minimum [e.g., the Devils Hole pupfish (*Cyprinodon diabolis*); Deacon 1979, Chernoff 1985].

There appear to be several differences between Owens Basin aquatic habitats and aquatic habitats occupied by other pupfish species in the southwest. Aquatic habitats in the Owens Basin are generally colder, frequently covered by ice during winter, and lower in conductivity and salinity than habitats occupied by pupfishes in other regions in North American deserts (Cole 1981). The comparatively unusual ability of Owens pupfish to withstand cold habitats was confirmed by Mire (1993) during behavioral studies of an Owens pupfish population that persisted through a winter in an ice-covered refuge pond.

Owens pupfish were scarce throughout their historical range by the early 1930s. This scarcity is attributed to establishment of non-native predatory fish [e.g., largemouth bass, smallmouth bass (*Micropterus dolomieui*), brown trout, bluegill], and water diversions to that decreased and altered Owens River flows, desiccating shallow pupfish habitats bordering the river (Miller 1948). Owens pupfish were believed to be extinct from 1942 (Miller 1969) until July of 1964 when a single population of approximately 200 fish was rediscovered in Fish Slough (Miller and Pister 1971). All extant populations have been propagated from this remnant stock.

Extant populations occur only in refuges at Fish Slough, BLM Spring, and Warm Springs (Figure 3) which includes less than 0.5 km of habitat covering less than 2,000 m^2. All these habitats are managed to protect Owens pupfish by isolating them from non-native fishes.

Owens Tui Chub **Recovery Priority 8**

Owens tui chub (*Gila bicolor snyderi*) (Figure 4) was listed as endangered on August 5, 1985 (50 FR 31592) because of factors adversely affecting biotic and abiotic characteristics of Owens Basin aquatic habitats, including:

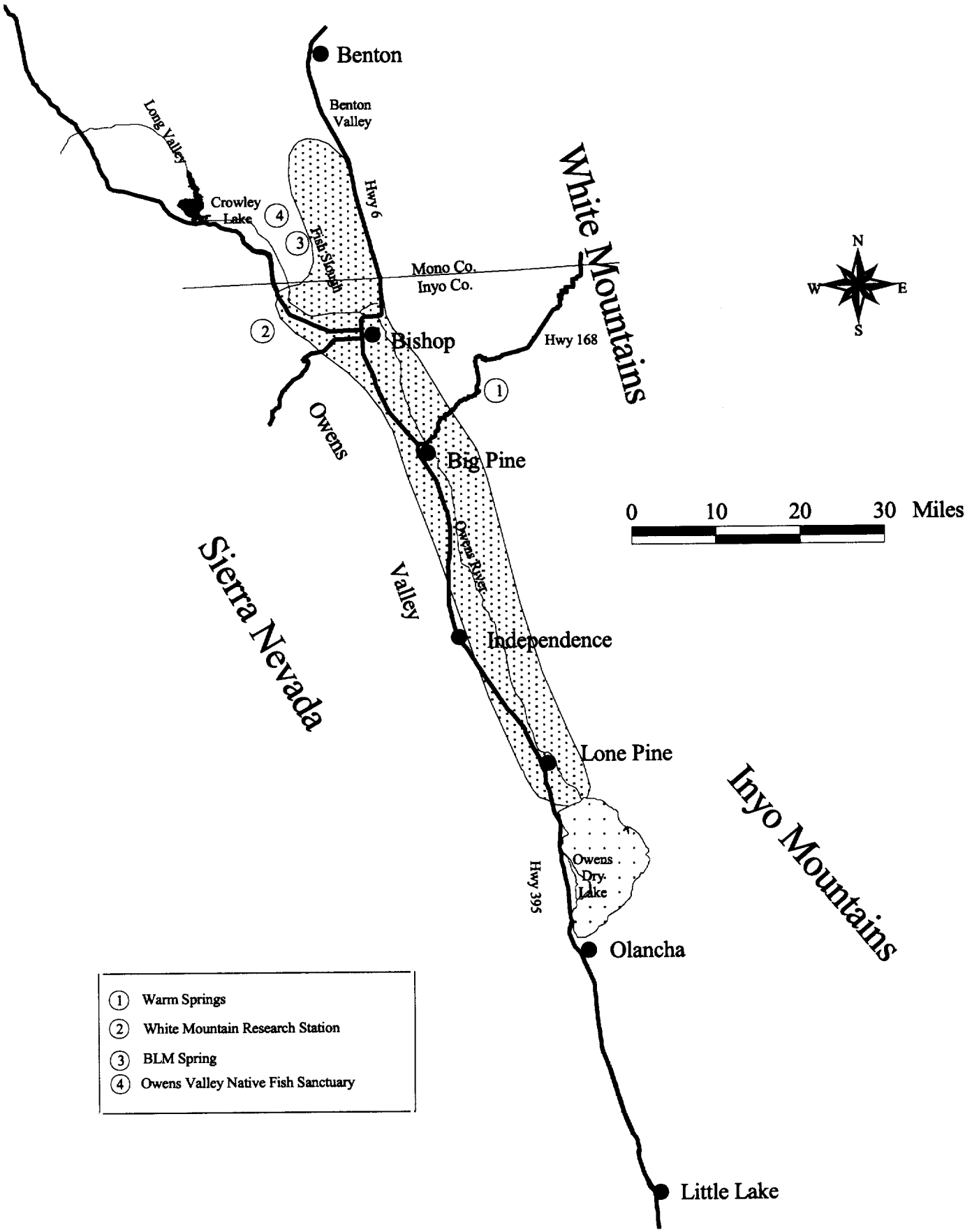

Figure 3. Historical (stippled) and extant (numbered sites) distribution of Owens pupfish.

1) introduction of non-native fish that affect Owens tui chub through competition, predation, and hybridization; and 2) diversion and impoundment of water for agricultural and municipal use (Miller 1973).

Critical Habitat has been designated at two sites for Owens tui chub: 1) 13 km (8 mi) of Owens River and 15 m (50 ft) of riparian vegetation on either side of the river, encompassing a total of approximately 39 ha (97 ac) in the Owens Gorge; and 2) two spring provinces, and 15 m (50 ft) of riparian vegetation on either side of spring brooks, encompassing approximately 2 ha (5 ac) at Hot Creek Fish Hatchery. Constituent elements of Critical Habitat include an high quality, cool water with adequate cover in the firm of rocks, undercut banks, or aquatic vegetation, and a sufficient insect food base.

The Owens tui chub was described in 1973 as a subspecies of *Gila bicolor* endemic to the Owens Basin (Miller 1973). It is distinguished from its closest relative, the Lahontan tui chub, by scales with a weakly developed or absent basal shield, lateral and apical radii that number 13 to 29, also by the structure of its pharyngeal arches, the number of anal fin rays, gill raker counts of 10 to 14, and 52 to 58 lateral line scales (Miller 1973). Dorsal and lateral coloration varies from bronze to dusky green, grading to silver or white on the belly. It may reach a total length of 30 cm (12 in.). Owens tui chub are believed to be derived from Lahontan Basin tui chub that entered the Owens Basin from the north during the Pleistocene Epoch (Miller 1973, Smith 1978).

Early fish collections in the Owens Basin documented tui chub in Owens Lake (Gilbert 1893), several sites along the Owens River from Long Valley to Lone Pine, tributary streams near the Owens River in Long Valley and Owens Valley, Fish Slough, and irrigation ditches and ponds near Bishop, Big Pine, and Lone Pine (Snyder 1917, Miller 1973). The scattered distribution of these localities and the ease with which researchers captured fish suggest that Owens tui chub were common and occupied all valley-floor wetlands near the Owens River in Inyo and Mono counties (Figure 5). Owens suckers, Owens speckled dace, and

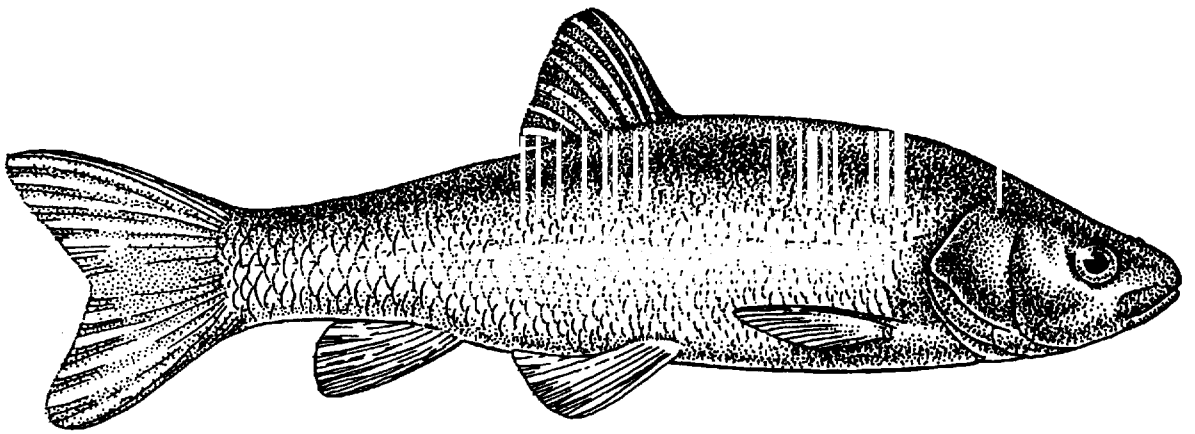

Figure 4. Tui chub. Illustration USFWS.

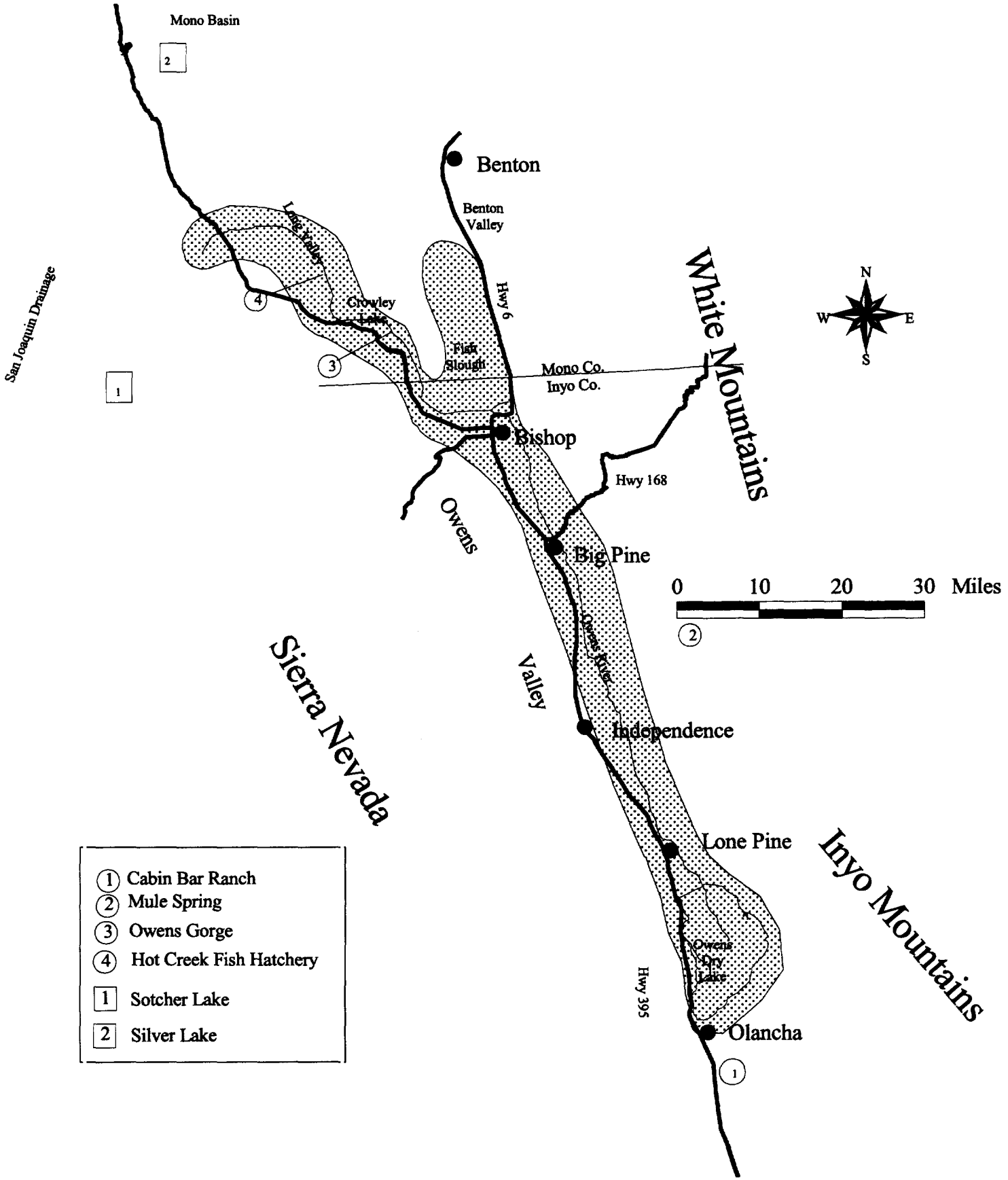

Figure 5. Historical (stippled) and current (numbered sites) distribution of Owens tui chub. Circled numbers show location of current populations within historical range, and squared numbers show location of current populations outside of native range.

Owens pupfish were frequently collected along with Owens tui chubs, suggesting a similar distribution for all these species. Tui chubs currently occupy many valley-floor habitats in the Owens River and its tributaries. However, few of these populations are genetically pure Owens tui chubs. Few populations of unhybridized Owens tui chubs exist, and occur only where suitable habitat is isolated from non-native fishes (particularly Lahontan tui chub and predatory fish). Habitats occupied by non-introgressed Owens tui chub populations include headsprings at Hot Creek Fish Hatchery (McEwan 1990), the Owens River downstream from Crowley Lake (Jenkins 1990), ponds at Cabin Bar Ranch near Lone Pine, and Mule Spring. Tui chub populations also occur in Sotcher Lake, Madera County (Middle Fork San Joaquin River drainage), and Silver Lake in the Mono basin, Mono County. Both of these populations are outside of Owens tui chub native range, and they were probably established during fish stocking from Hot Creek Fish Hatchery, and may consist of Owens tui chubs.

Recent genetic and morphological studies failed to identify consistent differences among Owens tui chubs, Lahontan tui chubs, and Lahontan tui chub X Owens tui chub hybrids (Berg and Moyle 1992). Additional studies using more exact genetic techniques (e.g., mitochondrial DNA, PCR, etc.) are needed to determine reliable characteristics to identify pure Owens tui chubs. Because of minor morphological differences between genetically pure and introgressed Owens tui chubs, it is not currently possible to identify genetically pure Owens tui chubs and estimate the amount of habitat they occupy. Although some of the populations mentioned above are believed to be genetically pure Owens tui chub, studies are necessary to confidently identify Owens tui chub and hybrid populations.

McEwan (1990) observed that Owens tui chubs prefer pool habitats with low current velocities and dense aquatic vegetation that provide adequate cover and habitat for insect food items. Gut analyses showed that Owens tui chubs also consume detritus and aquatic vegetation, which may be incidentally taken with

insects.

Although only a few studies have examined Owens tui chub behavior, life history, and habitat use, a number of aspects of its ecology can be generally surmised from studies of other tui chub subspecies. Tui chubs congregate from late winter to early summer to spawn over aquatic vegetation or gravel substrate (Kimsey 1954). Females may produce a large number of eggs. Kimsey (1954) found that a 28 cm (11 in.) female from Lake Tahoe contained 11,200 eggs. Tui chubs may reach sexual maturity at 2 years, and may live more than 30 years (Scoppettone 1988).

Fish Slough Milk-vetch **Recovery Priority 9**

Fish Slough milk-vetch (*Astragalus lentiginosus* var. *piscinensis*) was listed as threatened on October 6, 1998, without Critical Habitat (63 FR 53596). It was described in 1977 from a collection made by M. DeDecker near BLM Spring in Fish Slough, Mono County (Barneby 1977). It is a prostrate, herbaceous, perennial with stiff appressed hairs covering broadly separated, branching stems that may be up to 1 m (3 ft) long. Its stems radiate from a central root stock and cover an area as large as 2.7 m^2 (29 ft^2). Leaflets are reduced to only two lateral pairs with an elongate terminal leaflet longer than the leaf stalk. The flowers, arranged in loose racemes, are pale lavender and number from 5 to 12 per inflorescence. Fruits are brightly mottled, strongly inflated, leathery pods, with a complete septum and an incurved beak. Fish Slough milk-vetch is distinguished from other varieties of *Astragalus lentiginosus* by its three to five linear-oblanceolate leaflets, and its densely strigose, strongly inflated pods (Barneby 1977).

Fish Slough milk-vetch is endemic to Fish Slough where it occupies alkali flats along a 10 km (6 mi) stretch of spring-fed wetlands from the northeast spring almost to the Owens River (Figure 6). Although several colonies had been identified prior to the 1990s, biologists from LADWP and BLM conducted the

first thorough surveys of all potential habitat in 1992. They identified 8 colonies of varying size totaling approximately 3,200 plants (Novak 1992). These 8 colonies are grouped in three regions of the Slough. In 1992, the northern region of the Slough supported 63 percent of the total population, the middle region of the Slough supported about 34 percent of the population, and the southern region of the Slough supported the remaining 3 percent. Plants in the northern region of the Slough are entirely on LADWP lands while those in the middle and southern regions are on lands managed by both LADWP and BLM. Because the species was first described in 1977, there is no prior information on its historical distribution and abundance.

Ferren (1991) and Odion *et al.* (1991) characterized Fish Slough soils and plant communities and provided information about the habitat of Fish Slough milk-vetch. This taxon occurs in the alkali flats in *Spartina-Sporobolus* plant associations and in the transition zone between *Spartina-Sporobolus* and *Distichlis-Chrysothamnus* plant associations described by Odion *et al.* (1991). It is frequently found with alkali ivesia (*Ivesia kingii* var. *kingii*) but rarely in wetter alkali habitats.

Life history information is limited. What is known comes from a one-year study conducted by Mazer and Travers (1992). Fish Slough milk-vetch may grow as much as 30 cm (12 in.) per month during its growing season, which lasts from May to September. Flowering usually begins in late spring and bumblebees (*Bombus* sp.) are the only flower visitors that have been identified. Fruit is typically set in June and July. Pollinator exclusion experiments demonstrated that Fish Slough milk-vetch is not self-fertilizing. Reproductive output is correlated with plant size and differs between colonies in the north and middle areas of Fish Slough. Grazing of flowering and fruiting branches by jackrabbit (*Lepus californicus*) and rodents reduced reproductive output during the study period (Mazer and Travers 1992).

Threats to Fish Slough milk-vetch identified by Ferren (1991; *in litt.* 1992)

include physical changes in its wetland habitat due to fisheries enhancement programs and livestock grazing, off-road vehicle activity, and possibly ground water pumping. High herbivory by rabbits has also been found to reduce reproductive output (Mazer and Travers 1992). Seedling establishment apparently has been lower than adult mortality in the middle region of Fish Slough, at least since 1992 (A. Halford, BLM, pers. comm. 1998; Fish Slough Joint Management Committee meeting minutes 1998). One potential explanation for this is the expansion of Fish Slough Lake, which has caused increasing inundation of the alkali meadow habitat of the milk-vetch (Ferren *in litt.* 1992). This expansion may be a result of hydrologic changes caused by the construction of Red Willow Dam several decades ago or due to geologic processes (Ferren 1991, Ferren *in litt.* 1992). Demographic characteristics, such as seedling emergence and survival, also fluctuate in response to patterns of annual precipitation making it difficult to associate population trends with specific management actions.

The largest colonies of Fish Slough milk-vetch (in terms of plant numbers), which comprised 63 percent of the Fish Slough milk-vetch plants in 1992, are protected from livestock grazing within a 32 ha (80 ac) exclosure on LADWP land (Novak 1992). While these plants are protected from the direct impacts of livestock grazing and trampling, there is little information available to determine residual effects of past grazing on these populations and the indirect effects of grazing on adjacent parcels. These effects may include soil erosion, alteration of other commensel or other relationships (e.g. alteration of rabbit grazing areas or pollinator foraging patterns or abundance), increased densities of nonnative species and of early seral species that colonize disturbed soils. All other colonies of Fish Slough milk-vetch occur within Zone 1 of the Fish Slough Area of Critical Environmental Concern. Those on BLM land are excluded from livestock use; those on LADWP land are in areas used by livestock. Additional information is needed to define the critical characteristics of milk-vetch habitat and to determine the response of the milk-vetch to livestock grazing and to

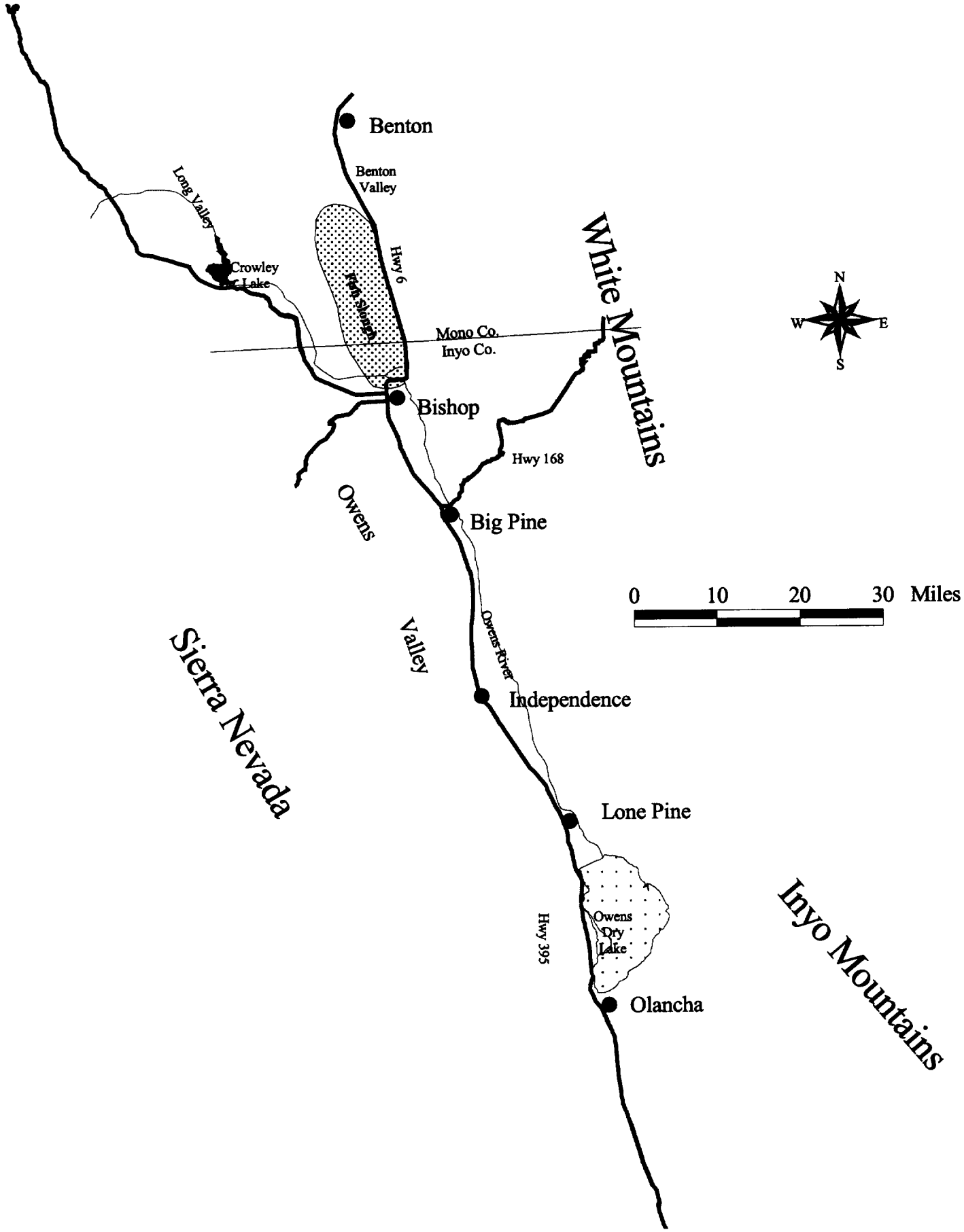

Figure 6. Distribution of the Fish Slough milk-vetch.

hydrologic and soil chemistry changes potentially caused by the expansion of Fish Slough Lake.

2. Species of Concern

Owens Valley Vole

Population trends and status of the Owens Valley vole (*Microtus californicus vallicola*) are unknown. Need for conducting a status survey throughout its range is high.

The Owens Valley vole was first collected and described in 1898 from specimens taken along Lone Pine Creek, Inyo County, at an elevation of 1,370 m (4,500 ft) (Bailey 1898). Comparatively small audital bullae, an abruptly truncate occiput, and a middle upper molar with a lobe at base of the fourth triangle that is often developed into a loop distinguish the Owens Valley vole from other *M. californicus* subspecies (Bailey 1898). The Owens Valley vole is also slightly larger and darker in color than other *M. californicus* subspecies (Bailey 1898). Adult Owens Valley voles are brown dorsally, frequently with a reddish tinge near the center of the back, and blue-gray to white underneath. Adult total length is approximately 20 cm (7 in.), including a short tail usually less than 5 cm (2 in.) long.

The Owens Valley vole is isolated from other *M. californicus* populations by the Sierra Nevada and Mojave Desert, which provide barriers to eastward and northward movement of other voles into the Owens Basin (Hall 1981). Isolation of this subspecies in meadow habitats, which are islands within xeric Mojave Desert plant communities, also prevents movement of animals between habitats. Presumably, entrance of voles into the Owens Basin occurred 14,000 to 17,000 years ago when moist habitats required by voles were contiguous with similar habitats south and west of the Sierra Nevada.

Figure 7. Illustration of Owens Valley vole.

Owens Valley vole populations appear to occur as a series of subpopulations distributed along wetlands adjacent to the Owens River and its tributaries (Figure 8). A thorough study of populations and distribution has not been conducted; however, recent and historic collections indicate the subspecies is rare but widespread. Of the 111 specimens held in the U.C. Berkeley Museum of Vertebrate Zoology, only 11 have been collected since 1935; eight from locations near Independence in 1942, one near Bishop in 1957, and two from Paoha Island in Mono Lake in 1990. The Mono Lake collection represents a substantial northward documentation of its range. MacMillen and Sada (ms) summarize recently collected information from agency reports, personal observations, and owl pellets and suggest that the vole occur in a number of valley-meadows between Independence and the northern Owens Valley (California Department of Fish and Game 1974, 1976). Additional information is needed to determine if its distribution is fragmented or continuous throughout this range.

Environmental characteristics of historical collection localities indicate that Owens Valley voles occupy wetlands and lush grassy meadows where soil is friable for burrowing, and where there are grasses, sedges, and herbaceous plants for food. Little else is known about Owens Valley vole natural history and habitat requirements, but studies of California voles in other areas may provide some insight into the ecology of this subspecies. Voles utilize a network of runways constructed through grass to connect feeding sites. California vole populations near San Francisco Bay undergo fluctuations that peak every 3 or 4 years then decline rapidly (Ingles 1965). Following these declines, populations may increase rapidly due to the high reproductive output; they may breed throughout the year and produce litters averaging 4.2 young. Females may ovulate and breed within 15 hours after young are born, and the young are weaned after 2 weeks (Ingles 1965). Populations and distribution are controlled by predators (hawks, owls, snakes, etc.) (Pearson 1985) and harsh environmental conditions (Tamarin 1985, Taitt and Krebs 1985).

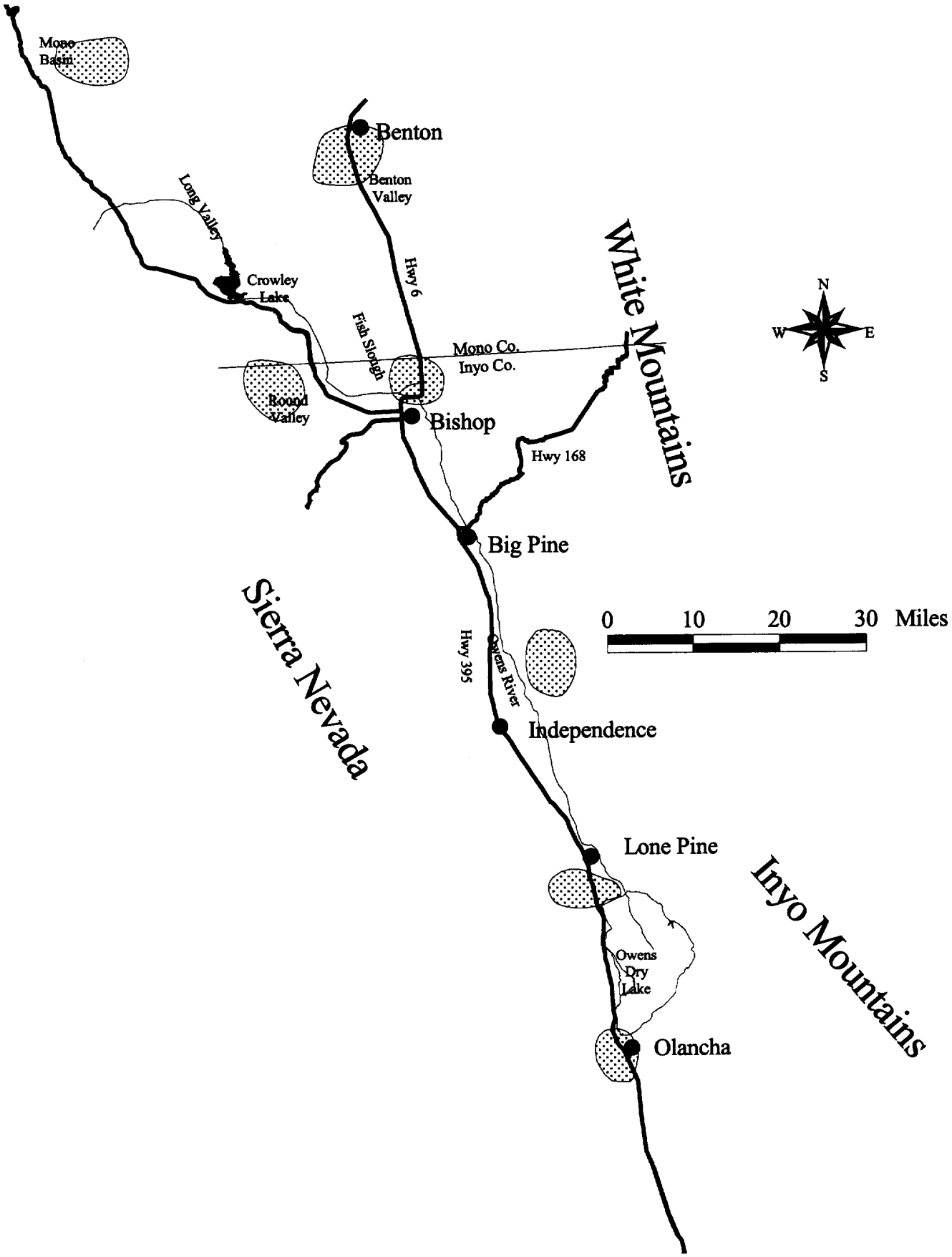

Figure 8. Collection locations (stippled areas) of Owens Valley vole.

Precise data on the range and status of Owens Valley vole are unavailable. Additional work is needed to determine if its sparse and patchy distribution is due to lack of collecting effort or if human-related factors are adversely affecting its habitat. Infrequent collection and probable deleterious impacts from intensive livestock grazing and lowering ground water tables suggest that the subspecies is declining. An intensive effort is needed to identify its present distribution and demographic characteristics of extant subpopulations. Owens Valley vole recovery will require protection and enhancement of habitat patches sufficiently large to support an adequate number of subpopulations. It is likely that Owens Valley voles occupy meadows that are also favorable habitat for Owens Valley checkerbloom and Inyo County mariposa lily, as well as areas that are immediately peripheral to aquatic habitats occupied by other endemic species.

Owens Speckled Dace and Long Valley Speckled Dace

Owens speckled dace (*Rhinichthys osculus* ssp.) and Long Valley speckled dace (*Rhinichthys osculus* ssp.) are species of concern. Populations of Owens speckled dace appear to be stable, whereas Long Valley speckled dace are declining. The estimated need for status surveys is high.

Speckled dace (Figure 9) occupy waters from Mexico to British Columbia, Canada, and from the Rocky Mountains to the Pacific Ocean, making it the most widely distributed freshwater fish in western North America (Miller 1958). Sada *et al.* (1995) compared genetics and morphology of extant speckled dace populations in the Death Valley system, lower Colorado River, and Lahontan basin and found that populations in Benton Valley, Long Valley, and northern Owens Valley appear to be distinct, both among themselves and from populations in surrounding basins. Populations in Long Valley and Benton Valley appear to be most closely related to *R. o. nevadensis* of the lower Amargosa River drainage; northern Owens Valley populations are more closely related to *R. o. robustus* of the Lahontan basin. Long Valley populations were most distinct, both genetically

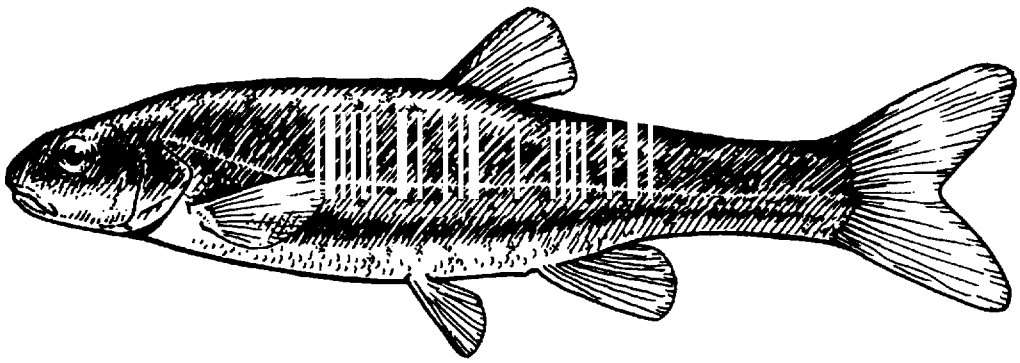

Figure 9. Speckled dace. Illustration USFWS.

and morphologically, indicating they may warrant taxonomic recognition. Distinctiveness of Long Valley, Benton Valley, and northern Owens Valley speckled dace populations indicates that each has uniquely differentiated from its ancestor.

Long Valley speckled dace are distinguished by high pectoral fin and pelvic fin ray counts, high lateral line scale count, low lateral line pore count, and the absence of maxillary barbels (Sada *et al.* 1995). This population was the only one examined in the Death Valley system, Lahontan basin, and lower Colorado River with a fixed allelic difference (at the D allele of the PEPA locus) (Sada *et al.* 1995). Owens speckled dace in the northern Owens Valley have maxillary barbels on at least one side, a high lateral line scale count, a moderate lateral line pore count, and moderately sized fins. Benton Valley populations have low lateral line scale and pore counts, maxillary barbels on at least one side, and a comparatively long pelvic fin.

Information compiled from museum records indicates that Owens speckled dace historically occupied springs and streams (including the Owens River and Fish Slough) throughout the Owens Valley, Long Valley, and Benton Valley, and springs at Little Lake (Sada 1989) (Figure 10). It is the only native fish known from Benton Valley and Little Lake.

Distributional studies conducted in the late 1980s found that speckled dace no longer occupy the Owens River, valley-floor springs, springs at Little Lake, two historic habitats near Benton, Fish Slough, the upper Owens River or Hot Creek. Populations persist in: 1) Long Valley at Whitmore Hot Springs and an unnamed spring tributary to Little Alkali Lake; 2) northern Owens Valley on lower Bishop Creek and irrigation ditches around Bishop, North McNalley Ditch near Laws, and lower Horton, Rock, and Pine Creeks; and 3) near Benton in springs adjacent to Marble Creek (Sada 1989) (Figure 10).

No studies have examined Owens Basin speckled dace ecology. Studies of other speckled dace populations outside the Owens Basin found that this

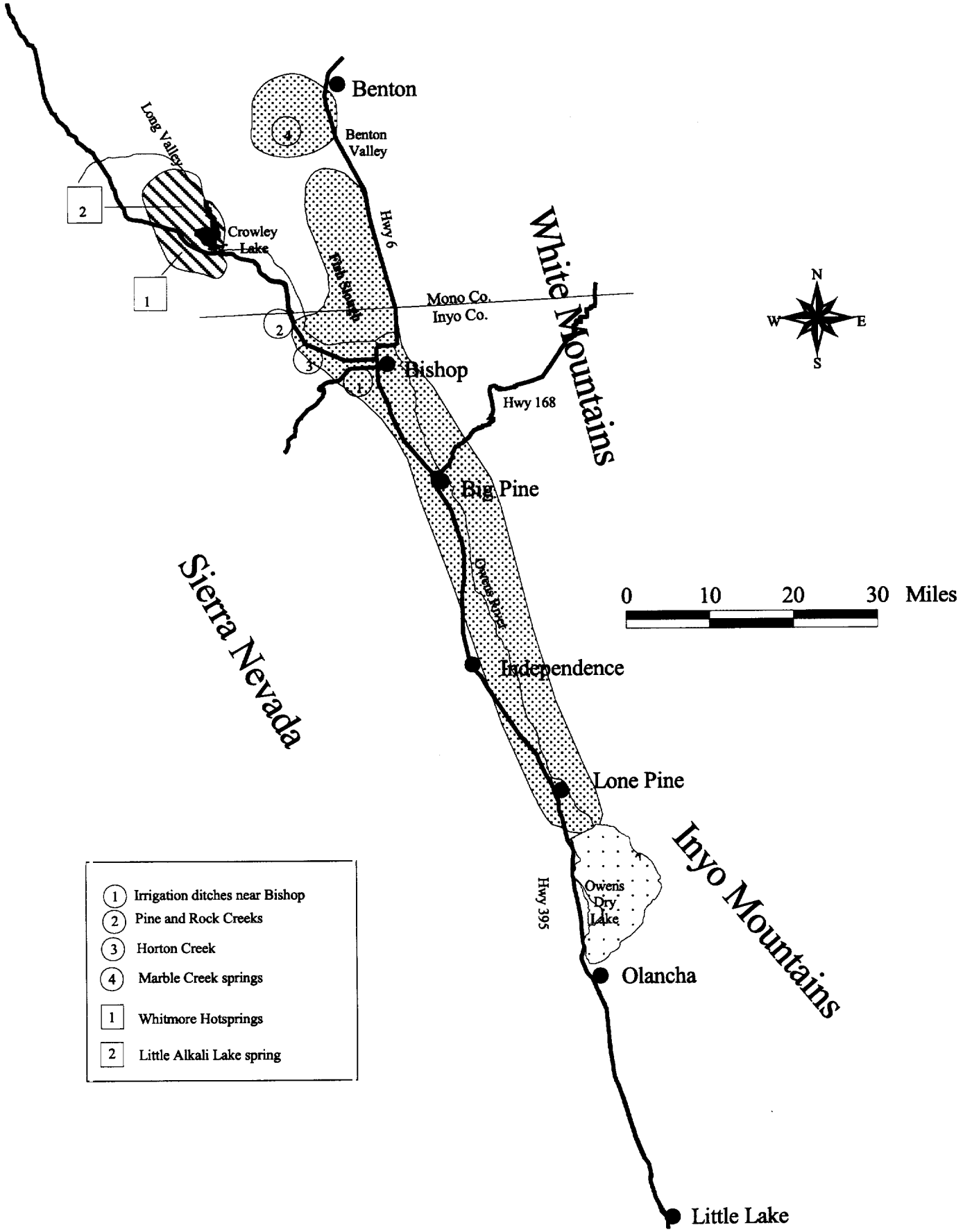

Figure 10. Historical distribution of Owens speckled dace (stippled) and Long Valley speckled dace (crossed). Circled numbers indicate location of current Owens speckeled dace populations, and squared numbers indicate current Long Valley speckled dace populations.

member of the minnow family (Cyprinidae) reaches a maximum length of 10 cm (4 in.) and feeds on insects that it picks from the substrate, water surface, and throughout the water column (John 1963, 1964; Baltz *et al.* 1982). It spawns in the spring over gravel substrates (Mueller 1984), and populations may undergo dramatic seasonal fluctuations in numbers (John 1964). The species is a habitat generalist, able to occupy habitats as diverse as thermal springs, headwater streams, and large rivers (Moyle 1976a).

Introductions of non-native fishes and habitat alteration by impoundment and disruption of valley-floor spring discharge by groundwater pumping caused the Owens speckled dace to disappear from most of its historical range (Sada 1989). Long Valley speckled dace populations and Owens speckled dace populations in Benton Valley are small and isolated, and especially vulnerable to extirpation.

Fish Slough Springsnail, Owens Valley Springsnail, and Aardhal's Springsnail

Fish Slough Springsnail (*Pyrgulopsis perturbata*), Owens Valley Springsnail (*Pyrgulopsis owensensis*), and Aardhal's Springsnail (*Pyrgulopsis aardahli*) are species of concern and the estimated urgency for status surveys for these species is high. Most populations are believed stable, but threatened by limited distributions, ground water pumping, and habitat modification for water diversion.

The Owens Valley springsnail (Figure 11) is small to moderate in size (1.5 mm to 2.8 mm high) (0.06 to 0.11 in.) and its shell is globose to ovate-conic with 3.0 to 4.25 whorls. Its penis is large, compared to head and foot size, and has two to six glandular ridges. The Fish Slough springsnail (Figure 11) is large (2.7 mm to 4.0 mm high) (0.11 to 0.16 in.) with 4.25 to 5.0 whorls on its low-conical shell. Its penis is large with ventral swelling and three or four glandular ridges. Aardhal's springsnail is also large (2.6 mm to 3.4 mm high) (0.1 to 0.13 in.) with a

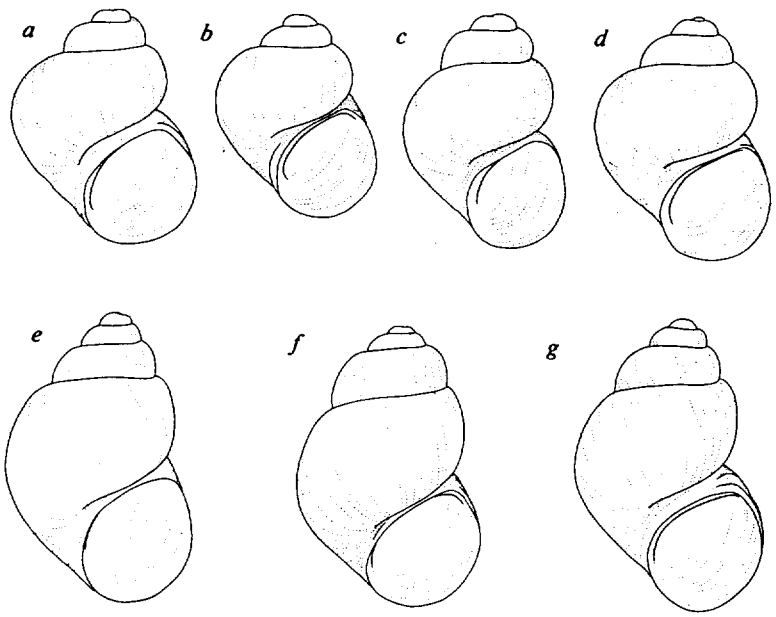

Figure 11. Drawings of shells of Fish Slough Springsnail: *a* - *d*, and Owens Valley Springsnail: *e* - *g*. *a* = Mule Spring; *b* = spring at Toll House; *c* = stream in canyon south of Piute Creek; *d* = spring at Graham Ranch; *e* = Fish Slough Northwest Springs; *f* = Fish Slough BLM Spring; *g* = Fish Slough NE Spring. Drawings from Hershler, 1989, with permission.

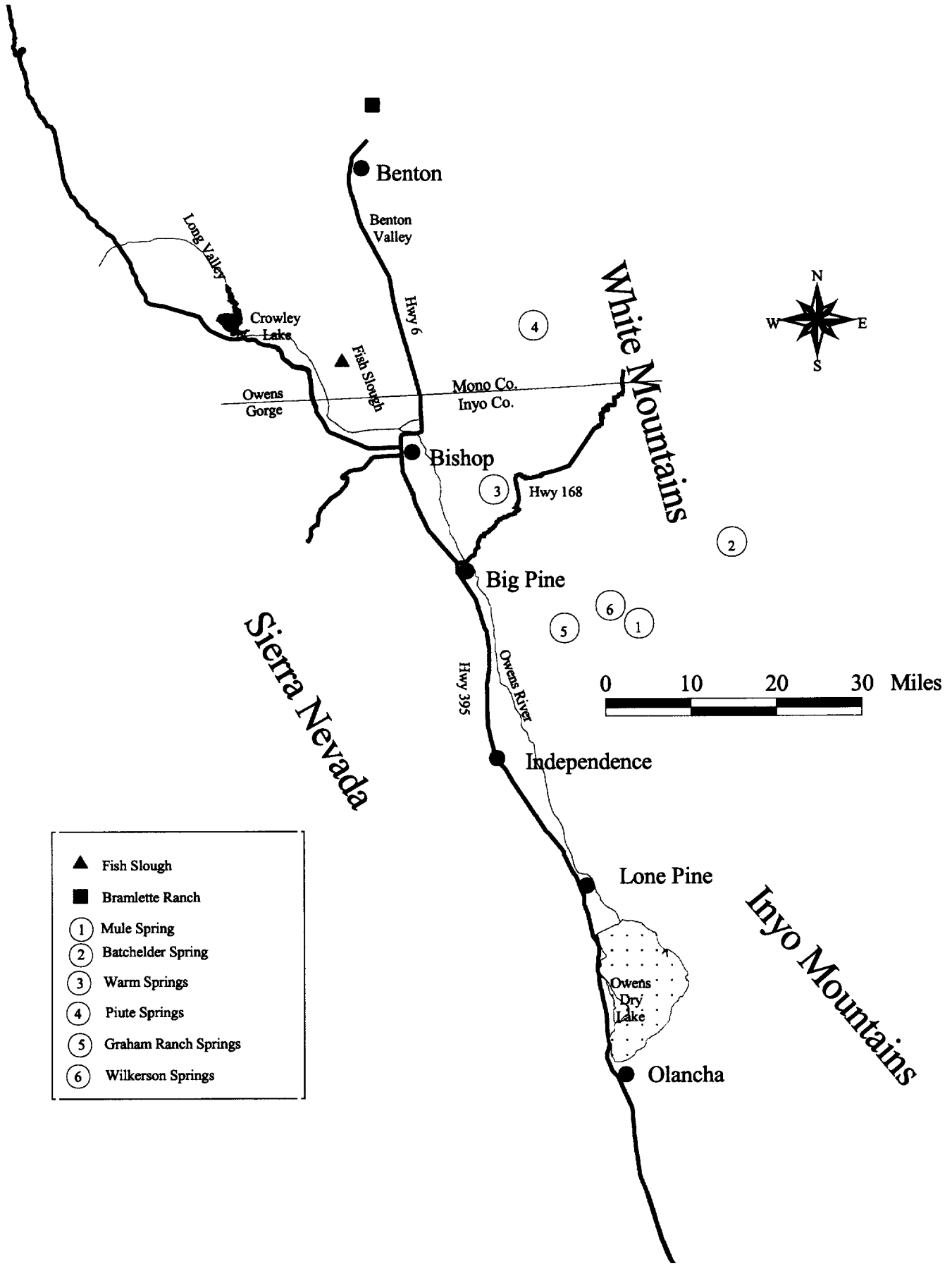

Figure 12. Location of Fish Slough springsnail (triangle), Aardhal's springsnail (square) and Owens springsnail (numbers) in Owens Basin.

broad, conical shell with 3.75 to 4.25 whorls. Penial characteristics include an elongate filament, ventral swelling and a very small lobe, and one to three glandular ridges (Hershler 1989).

Recent aquatic mollusk surveys in southern California and Nevada identified five springsnail species (Family Hydrobiidae) in the Owens Basin (Hershler 1989, Hershler 1994). Fish Slough and Aardhal's springsnails are endemic to the Owens Basin, and Owens springsnail is known from approximately 10 Owens Basin springs (Hershler 1989, 1998; Hershler and Pratt 1990) (Figure 12). Additional surveys are needed to completely document their distribution. Other biological surveys in the Death Valley system indicate that future studies are likely to discover additional, new spring-dwelling taxa, also possibly endemic to the Owens Basin (La Rivers 1948, 1953; Hershler and Sada 1987, Shepard 1990, 1992; Odion *et al.* 1991).

Owens Basin springsnail species are rarely sympatric. Fish Slough springsnails are found only in Fish Slough; Owens Valley springsnails inhabit eight springs along the Inyo Mountain and White Mountain escarpments on the east side of the Owens Valley; Aardhal's springsnail occupies a single spring in Benton Valley (Hershler 1989, 1994).

Knowledge of springsnail ecology comes mostly from observations made during taxonomic and distributional studies, and from field studies of *P. owensensis* conducted by Sada (*in litt.* June 25, 1994 memorandum to Mr. Terry Russi, U.S. Bureau of Land Management, Bishop, California). Springsnails in the genus *Pyrgulopsis* occupy habitats as varied as alkali lakes, rivers, and small springs throughout their range in western North America (Hershler 1994), but Owens Basin springsnails typically inhabit only springs and short sections of spring brook located below 2,286 m (7,500 ft) elevation with good water quality. Springsnails generally inhabit aquatic vegetation and gravel substrates in flowing water where they feed on algae. In population and habitat surveys of a single *P. owensensis* population during June and March, Sada (*in litt.* March 8, 1995

memorandum to Mr. Terry Russi, U.S. Bureau of Land Management, Bishop, California) observed that snail density at this site was positively correlated with water velocities of less than 18 cm per second (0.6 ft per second), and the presence of aquatic vegetation, detritus, and gravel substrate. Mean population density during June was approximately 0.5 snails/cm^2 (range 0 to 8.1) and in March it was approximately 0.9 snails/cm^2 (range 0 to 6.9). Other observations suggest that habitat use and density of all Owens Basin springsnails are similar (Sada field notes). Springsnails are oviparous, and it is believed that eggs are laid in spring. The springsnail probably lives less than 1 year.

Springsnails do not live outside of an aquatic environment, and appear to be sensitive to environmental degradation caused by overgrazing, impoundment, decreases in spring flow, and impacts caused by non-native mollusks (Hershler and Sada 1987). The sensitivity of springsnails to these factors suggests that they occupy habitats that have remained in nearly pristine condition over geologic time. Long persistence and habitat stability is also suggested by biogeographic studies documenting a wide diversity of endemic taxa inhabiting many endorheic basins throughout the Great Basin (Hershler and Sada 1987, Hershler and Pratt 1990, Hershler 1989, Hershler 1994). Distribution of fossil and extant springsnail populations has been used to explain prehistoric drainage patterns of river systems throughout the western U.S. (Taylor 1966, 1985; Hershler and Pratt 1990).

Owens Valley checkerbloom

Owens Valley checkerbloom (*Sidalcea covillei*) is a U.S. Fish and Wildlife Service species of concern and is listed as endangered by the State of California.

Owens Valley checkerbloom (Figure 13) was first collected at Haiwee Meadows by F.V. Coville in 1891 during the Death Valley Expedition. This member of the mallow family (Malvaceae) had a lengthy taxonomic history before being described as a species endemic to the Owens Valley (Hitchcock

Figure 13. Illustration of Owens Valley Checkerbloom. Illustration by Joy Fatooh.

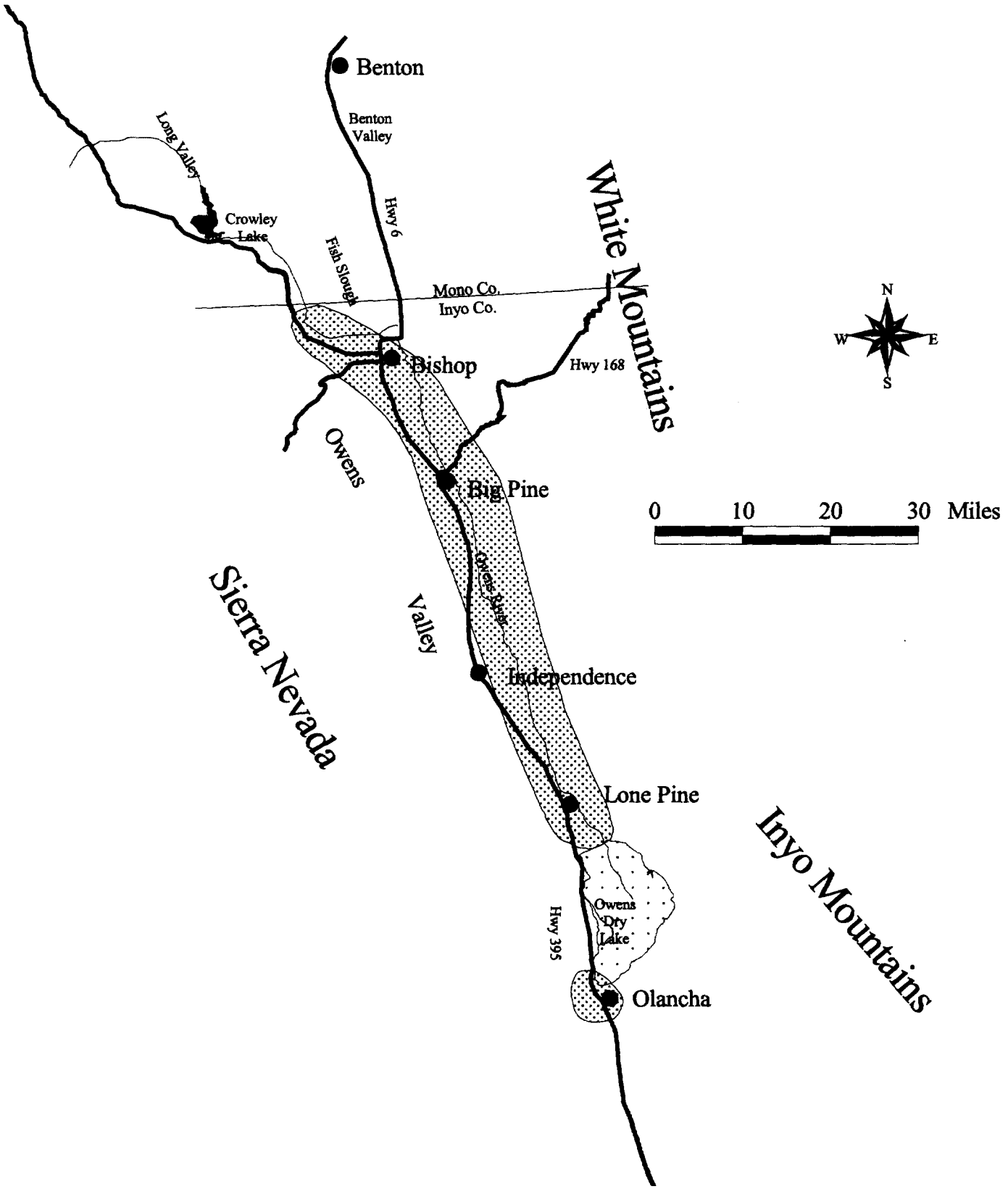

Figure 14. Current locations of Owens Valley checkerbloom populations.

1957). It is a tall, 30 to 90 cm (12 to 36 in.) perennial herb with pale pinkish-lavender flowers that blooms during May and June. Botanical surveys suggest that it occurs throughout the Owens Valley (Figure 14). There are presently 40 occurrences listed by CDFG's Natural Diversity Database (1998), seven of which are historical locations that could not be relocated, have been extirpated, or support only one or two plants. Monitoring of 15 to 20 occurrences in 1993 and 1994 by Inyo County and LADWP biologists, found that many occurrences include more than 1,000 individual plants, and that several occurrences include more than 100,000 plants (Manning 1995, P. Hubbard, pers. comm., LADWP, Bishop, CA, 1995). Manning (1995) estimated that the density in 20 different populations ranged from less than 0.1 plants/m^2 to 8.82 plants/m^2. Owens Valley checkerbloom inhabits alkaline meadows (*Distichlis spicata-Sporobolus airoides* association) that are seasonally or permanently watered by either lateral flow from nearby streams and springs, or ground water. Its large, fleshy root allows it to survive dry periods when soil moisture is low, but it cannot persist where the soil is continuously dry.

Little is known about other aspects of its habitat or demography. Halford (1994) conducted preliminary research on the relationships between vegetation cover, soil moisture and temperature, and seedling establishment at two populations in the northern Owens Valley. She found that seedling density and plant vigor were positively correlated with soil water availability (Halford 1994). Additional efforts to understand Owens Valley checkerbloom ecology and demography are needed.

The alteration of surface water drainage patterns, groundwater pumping and conversion of land to agricultural uses during the last century likely resulted in substantial loss of the moist alkali meadow habitats in which this species grows (Manning 1993). The location where Owens Valley checkerbloom was first collected is now inundated by Haiwee Reservoir, constructed in the early 1900s as a part of the Owens Valley Aqueduct System (DeDecker 1978). Most of the

locations where the Owens Valley checkerbloom has been recorded in the last 10 to 15 years appear to be relatively stable, in terms of plant numbers (Natural Diversity Data Base 1998; Manning 1995). However, many of the sites are grazed by livestock and many are in areas that may be affected by the pumping of groundwater (Manning 1993). Manning (1995) reported that about one-half of the 15 to 20 sites surveyed in 1993 and 1994 were in fair to poor condition based on abundance of non-native plant species, livestock use, plant vigor, and soil moisture indicators. Livestock will graze flowering stalks of this species; significantly reduced flowering has been recorded in populations subject to livestock grazing when compared to those ungrazed (Manning 1995). Ground water pumping may also have an increased effect on this taxon and its alkali meadow habitat during extended droughts (Manning 1994). These factors affect different occurrences to varying degrees; however, a number of large populations persist, several new populations have been located, and existing evidence suggests that few populations have recently disappeared (Natural Diversity Database 1998). The long-term consequences of human-induced threats on the continued viability of populations of Owens Valley checkerbloom need more consistent monitoring.

Inyo County mariposa lily

Inyo County mariposa lily (*Calochortus excavatus*) (Figure 15) is a species of concern. It is known from fewer than 50 localities and the number of plants found in most populations does not appear to have changed substantially in the past decade, however most populations are relatively small.

This lily was first collected in 1886 along Bishop Creek, west of Bishop. Greene (1890) described *Calochortus excavatus* in 1890. Some later authors included *C. excavatus* as synonymous with more wide-ranging species, but by the middle of this century it was described as endemic to the Owens Basin (Munz 1959).

Figure 15. Illustration of Inyo County mariposa lily. Illustration by Joy Fatooh.

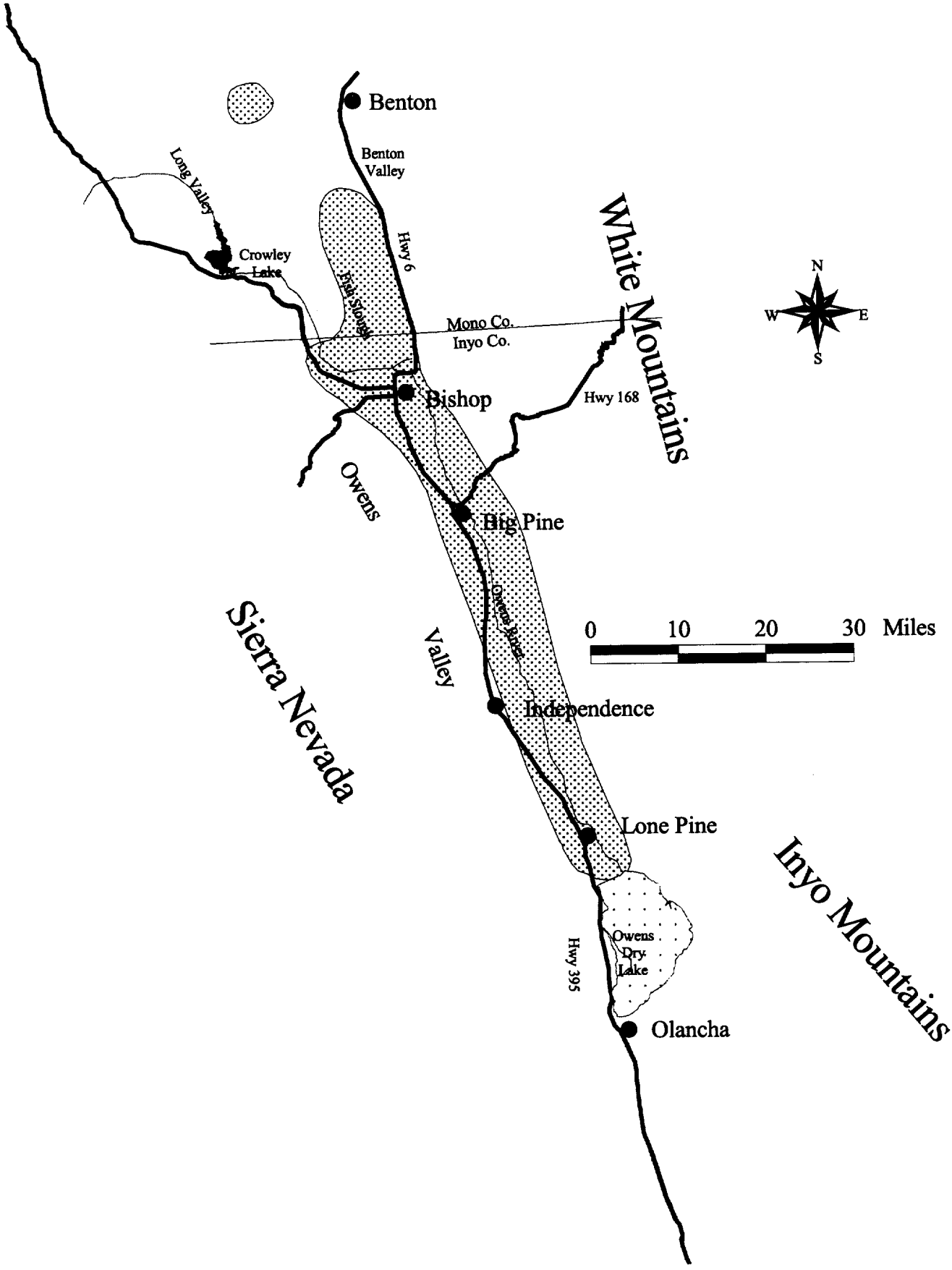

Figure 16. Current locations (stippled areas) of the Inyo County mariposa lily populations.

Inyo County mariposa lily is a perennial which grows from a bulb, and has few, long, linear leaves. It blooms during April and May. The ovary of Inyo County mariposa lily is linear and not winged, and the 3-angled capsules are linear-lanceolate and up to 4 cm (1.5 in.) long (Chronquist *et al.* 1977). Although it resembles the sego lily (*Calochortus bruneaunis* Nelson & J.F. MacBride) which also occurs in the eastern Sierra Nevada region, the Inyo County mariposa lily is distinguished by its greater height (up to 0.75 m (2.5 ft)), deeply depressed purple glands (Fiedler and Ness 1993), and oblong, reddish-brown anthers (Chronquist *et al.* 1977).

The plant is distributed throughout the Owens Basin in Inyo and Mono Counties between 1,100 m and 2000 m (3,800 ft and 6,600 ft) in elevation (Figure 16). The CDFG Natural Diversity Database (1998) lists 42 known localities. The lily is associated with moist alkali soils in meadows or ecotones between meadows and sagebrush scrub plant community types. It is difficult to determine its historical abundance and distribution; however, characteristics of its habitat and its wide distribution in the Owens Basin suggest that it may have been more abundant when alkali meadows were more extensive early in this century (Manning 1995). It is frequently found in association with Owens Valley checkerbloom. Surveys by LADWP and Inyo County biologists indicate that there can be great variation in the number of plants that produce above-ground parts in any given year and that dormancy of bulbs may fluctuate due to annual precipitation patterns and other, as yet unrecognized, environmental factors (P. Novak, pers. comm., LADWP, Bishop, CA, 1994, Manning 1995). Studies of other *Calochortus* species have revealed little about factors influencing dormancy rates (Fiedler 1987).

No studies have examined Inyo County mariposa lily ecology; however, studies have been conducted on other members of the genus. Reproduction in *Calochortus* is predominately sexual, although vegetative reproduction from daughter bulbs and bulbils developed in leaf axils is known throughout the genus

(Ownbey 1966). Fiedler (1987) found *Calochortus* species to have a wide variety of life histories. Her comparison of rare and wide ranging taxa indicated that rare species are typically climax species with populations in equilibrium with unique soil environments, whereas wide ranging species have life histories more typical of colonizing plants. Fiedler (1987) found that individual plants live up to 10 years, and may be dormant many years when annual precipitation is low.

Photosynthetic structures are small in many *Calochortus* species, and are frequently limited to a single leaf (Ownbey 1966), suggesting that damage to these structures may adversely affect bulb vigor and reproductive output. Fiedler (1987) observed herbivore damage to *C. obispoensis* and *C. tiburonensis* leaves from pocket gophers (*Thomomys bottae*), jackrabbits (*Sylvilagus audubonii*), brush rabbits (*Sylvilagus bachmani*), and mule deer *(Odocoileus hemionus*), and suggested that these impacts could limit reproductive success.

The species is believed to be threatened by ground water pumping, livestock grazing, and competition with nonnative plants; development and road maintenance may also affect some populations (Skinner and Pavlik 1994). Of the 16 sites that LADWP and Inyo County biologists surveyed in 1993 and 1994, about two-thirds were in fair to poor condition based on abundance of non-native plant species, livestock use, plant vigor, and soil moisture indicators. Indirect effects of livestock grazing, such as a potential reduction in pollinator foraging activity (Halford 1993) may also occur, but have not been studied. Additional information is needed to understand spatial and temporal characteristics of Inyo County mariposa lily abundance and the effects of ground water management and livestock use on population dynamics.

C. Conservation Measures

Various efforts by BLM, U.S. Forest Service (USFS), California Department of Fish and Game (CDFG), LADWP, University of California, and the Anheuser-Busch Company have attempted to protect endemic Owens Basin species by establishing new populations. Over the past 20 years, most of these programs have focused on Owens pupfish and Owens tui chub; as a result, extinction of these species has been prevented by establishing intensively managed refuges that are partially isolated from non-native fishes. Although extinction of Owens pupfish and Owens tui chub have been averted, the continual extirpation of refuge populations by either natural events (e.g., emergent vegetation growth, earthquakes) or vandalism shows that a reliance on refuges cannot accomplish recovery of these species.

Conservation programs for other rare species have primarily focused on activities at Fish Slough and on research examining their distribution, habitat requirements, and life history. BLM conducts annual rare plant surveys and is investigating the artificial propagation of Owens Valley checkerbloom; LADWP annually inventories rare plant populations; CDFG annually monitor rare fish; and Inyo County often monitors rare species. The CDFG, using Federal funds made available through section 6 of the Endangered Species Act, also contracted for baseline biological studies describing the vegetation and wildlife in Fish Slough and providing life history information on Fish Slough milk-vetch (Ferren and Davis 1991, Mazer and Travers 1992).

Many agencies have cooperated to protect and enhance terrestrial and aquatic habitats in Fish Slough. The LADWP and California Fish and Game Commission designated 8.5 ha (21 ac) as the Owens Valley Native Fishes Sanctuary in 1970. A total of 14,622 ha (35,926 ac) of Fish Slough and its surrounding hydrologic basin were designated by BLM as an Area of Critical

Environmental Concern in 1982, and the University of California recognizes Fish Slough as an Ecological Study Area Affiliate Site in its Natural Reserve System. The Service, CDFG, LADWP, BLM, and University of California cooperatively agreed in 1984 to protect and enhance the unique assemblage of endangered species, rare plants, wetlands, and archaeology in Fish Slough by implementing appropriate management actions (U.S. Bureau of Land Management 1984).

The City of Los Angeles and Inyo County recently agreed to manage groundwater resources and minimize long term impacts of ground water pumping on Owens Valley vegetation (EIP Associates 1991). This agreement should also facilitate protection and recovery of rare species in the Owens Basin.

D. Strategy of Recovery

Successful implementation of this recovery plan requires management activities on lands owned or administered by BLM, LADWP, and other private landowners and requires public participation in modifying (as necessary) the traditional uses and recreational activities occurring in many Conservation Areas. This can only be accomplished by working closely with local land and resources users, State and Federal agencies, and local governments. A substantial effort is necessary to educate the public about the goals, challenges, and potential adverse impacts of implementing and failure to implement the plan. The greatest strides toward security for Owens basin native wetlands and rare species they support will be made when the land owners and resource users fully understand this recovery program.

Past recovery programs in the Owens Basin have focused on protecting rare species populations, particularly native fishes, in small, isolated refuges. The goal of this recovery plan is to integrate rare species recovery and protection into a landscape with many existing land uses. Management to protect the diversity of

rare species (e.g., fishes, plants, aquatic mollusks, a mammal, and birds) that inhabit aquatic and wetland ecosystems in the Owens Basin should accomplish recovery for the listed species and arrest the decline of species of concern, thus, avoiding the need of future listings.

This plan describes tasks necessary to maintain healthy aquatic and wetland ecosystems and their associated native species in the Owens Basin using a two-tiered approach. Species in the first tier are Federally and State listed, and species of concern, endemic to the Owens Basin (Table 1). This recovery plan describes tasks necessary to accomplish their recovery. Species in Tier 2, although they may be listed by the Federal government and/or the State of California, or be species of special concern, do not have distributions restricted to the Owens Basin (Table 2). A set of management guidelines have been prepared to identify programs that are necessary to protect these species from further declines in the Owens Basin (see Appendix C). Although available for wide use throughout the Owens Basin, these guidelines should be used in the development the conservation plan(s) for the Conservation Areas.

Protection and recovery of rare species in aquatic and wetland ecosystems in the Owens Basin will be accomplished by establishing a system of managed Conservation Areas where protective strategies can be implemented with a high probability of success. A number of Conservation Areas have been identified throughout the basin; these Conservation Areas are landscape units that include habitat for rare species, characteristic Owens Basin valley-floor wetland landforms and soils, and sufficient buffers to maintain ecological and geological processes necessary to protect aquatic and mesic alkali meadow ecosystems. They are also ecologically diverse and encompass habitats where rare species richness is highest, impacts of existing land and water uses are minimal, and chances for recovery of listed species and protecting candidate species are greatest. Further evaluation may show that some of the identified Conservation Areas cannot be effectively used for recovery. These areas will be dropped from

further consideration. In a similar manner, future evaluations may indicate that other sites are suitable and should be considered as Conservation Areas (such as Warren Lake, lower Owens River, wetland improvements on Owens Dry Lake, and habitats adjacent to the Owens River near Big Pine). If appropriate, these Areas will be added to increase the likelihood of successful recovery and protection.

Sixteen Conservation Areas are recommended to achieve recovery and protection of target species. Conservation Areas were selected by first mapping the current distributions of Tier 1 and Tier 2 species using a Geographic Information System to identify sites rich in rare species diversity. All sites with high rare species richness were identified as potential Conservation Areas. A matrix analysis was then used to additionally examine this information and determine the utility of each potential Conservation Area as a site where recovery and protection of Tier 1 species could occur by conserving native plant and animal communities. The matrix analysis was used to rate each area for its value to rare species, ecological diversity, chances for successfully implementing recovery tasks, and the relative magnitude of conflicting uses that would decrease chances for successfully implementing recovery tasks. This analysis was not intended to be an absolute guide to Conservation Area identification, but it was used as a subjective tool to compare the relative value of different areas in the Owens basin for recovery and enhancement of rare species. Matrix variables are shown in Table 4, and a description of the matrix analysis is presented in Appendix A.

Table 4. Matrix variables used to analyze suitability of potential Conservation Areas for recovery of target and rare species occupying Owens Basin wetland and aquatic sites.*

Matrix Criterion	Analysis Scale
Number of listed or proposed species present	0 = none, 2 = 1 sp., 4 = 2 spp., 6 = 3 spp.
Number of species of concern present	1 for each species present
Number of Tier 2 species present	1 for each species present
Presence of aquatic habitat	0 = none, 2 = present
Presence of mesic alkali meadows	0 = none, 2 = present
Wetland species diversity evaluation	2 = low, 4 = medium, 3 = high
Historical listed or candidate species habitat	0 = none, 3 = present
Recoverability	1 = low, 2 = medium, 3 = high
Presence of conflicting uses	0 = many to 50 = none

* Listed species and species of concern are shown in Table 1, Tier 2 species are shown in Table 2. Definition of matrix variables and a description of matrix analysis are presented in Appendix A.

Several small Conservation Areas were also selected that were not examined by matrix analysis. These small areas (e.g., discrete spring systems, isolated riparian and stream systems) were included in the list of recommended Conservation Areas because they represent habitat types not occurring in areas examined by matrix analysis. They are necessary complements to the system of larger Areas because they included representative rare species and examples of wetland and aquatic habitat types that do not occur in larger Conservation Areas. Failure to protect these smaller Conservation Areas may also result in population declines that would necessitate future listings. Table 5 shows the location, rare species, and relative size of recommended Conservation Areas. Large Conservation Areas are greater than 2,850 ha (7,000 ac); medium Conservation Areas are 400 to 2,850 ha (1,000 to 7,000 ac), and small Conservation Areas are less than 400 ha (1,000 ac).

Implementation of this recovery plan will apply an adaptive management strategy to protecting target species and habitats in the framework provided by existing land uses. Research and monitoring are critical elements of the process. Management direction will be shaped by feedback from necessary studies.

Several assumptions have been made in the preparation of this recovery plan:

1. Recovery actions for Owens Basin rare fishes are most likely to succeed where impacts of non-native, deleterious aquatic species can be controlled through habitat manipulation or isolation;
2. Neither named tributaries to the Owens River nor the main-stem Owens River can be or will be reclaimed as habitat for the native fish assemblage. This approach to recovery is necessary because deleterious, non-native aquatic species are distributed throughout the system, and the difficulty and expense of moderating their impacts in these river habitats limits the likelihood for successful implementation of recovery tasks in these environments.
3. Sites exist where the structure of native Owens Basin terrestrial vegetation communities has been affected by livestock grazing, ground water pumping, off-road vehicles, and introduced species. However, many current land uses may still be acceptable within the recommended Conservation Areas provided that they are managed such that the natural persistence and resilience (sensu Pimm 1991) of Owens Basin plant and animal communities occupying aquatic and wetland ecosystems is maintained. It should be possible to recover and protect Tier 1 species entirely within the Conservation Areas identified in this plan if protection can be assured through binding management agreements for each Conservation Area.

Several features of the network of proposed Conservation Areas support the assumption that the network is adequate to recover and protect the target

species: 1) the proposed system of Conservation Areas includes at least 60 percent of all valley floor wetlands in the Owens Valley and all locations in the Owens Basin where the richness of listed species and other species of concern is high; 2) the proposed system includes many Conservation Areas encompassing all of the ecological and biological diversity known from wetland ecosystems in the Owens Basin, all soil types known from Owens Basin wetlands, all elevations where valley-floor wetlands occur, and the entire geographic range of wetlands from Long Valley and Benton Valley to the southern Owens Valley; 3) the proposed system is intended to include most of the known Inyo County mariposa lily localities and Owens Valley checkerbloom localities (including thousands of the lily and hundreds of thousands the checkerbloom plants), all Fish slough milk-vetch populations, all extant populations of Owens tui chub, and all extant Owens pupfish populations occupying natural habitats; 4) establishment of Owens pupfish and Owens tui chubs in Conservation Areas will increase their distribution by at least 1,000 percent and 1,850 percent, respectively, over current conditions; (see Table 6); and 5) these Conservation Areas also include all valley-floor wetland habitats where rare species richness is high and where management actions that control impacts of deleterious non-native species are likely to be successful. Even though Conservation Areas include a comparatively large amount of land, recovery and protection programs will protect rare species within only a small portion of their historical habitat. Following implementation, less than 1 percent of waters in the Owens Valley will be dedicated to native fish conservation, which is less than 1 percent of the historical distribution of these fishes. A greater proportion of historical habitats will be conserved for other Tier 1 species (e.g., approximately 75 percent of historical Owens Valley checkerbloom and Inyo County mariposa lily habitats). For species with limited historical distributions (e.g., Fish Slough milk-vetch, Owens Valley springsnail, and Long Valley speckled dace) all remaining habitat will be conserved and reintroduction may be attempted within Conservation Area habitats.

Within these Conservation Areas, population size and local distribution of listed species and species of concern will be allowed to fluctuate in response to natural and human-associated disturbance within the natural range of population variation. Specific management actions may be required to moderate disturbances so that population and community viability can be maintained within the limits of natural persistence and resiliency. Studies quantifying relationships between anthropogenic uses and community and population dynamics may be required to more precisely determine the amount of disturbance that can be tolerated while retaining the persistence of natural communities. Habitat management and future research in the Conservation Areas should be consistent with the Ecological Society of America's Sustainable Biosphere Initiative by recognizing that "achievement of sustainability often requires both minimal subsidization of managed systems so they are relatively self-sufficient, and restoration of damaged systems whose goods and services are essential to human well-being." (Lubchenco *et al.* 1991, page 394).

Limiting effects of non-native fishes on the Owens Basin native fish assemblage will be the greatest challenge to fish recovery. Past management activities have focused on maintaining native fishes in refuges where attempts have been made to eliminate conflicts between native and non-native fishes. Chemical treatment has been used to eradicate non-native species, and barriers have been constructed to segregate native and non-native fish. Repeated vandalous and unauthorized introductions of non-native species into these sanctuaries has compromised the effectiveness of these recovery programs and demonstrated that recovery is not possible using only this strategy. Implementing this recovery plan will require reestablishing Owens Basin native fishes in large portions of their native range while implementing management strategies that maintain habitats more suitable to native fishes than to non-native species. These management actions may consist of manipulating the extent and characteristics of aquatic habitats, maintaining native fish in areas where aquatic habitats may be

easily and efficiently managed, and isolating large areas of habitat using physical barriers to discourage invasion of non-native fishes. Under this strategy, non-native fishes need not be eliminated from a Conservation Area. However, management should be implemented to prevent dominance (expressed in community biomass) of the fish assemblage by deleterious non-native species.

Recovery of the Fish Slough milk-vetch will require activities only in the proposed Fish Slough Conservation Area, due to the very limited distribution of this taxon. Needed recovery actions include protection of spring discharges, modification of livestock grazing to ensure that its habitat is not being degraded, restoration of previously suitable habitat that no longer supports the milk-vetch, removal and control of nonnative species and other threats that may arise, protection of lands on which the milk-vetch occurs through a conservation easement or other permanent mechanism, and research to determine its critical life history and habitat components and how these are affected by management actions. Continued monitoring will also be needed.

Protection of species of concern should focus on securing their existing distribution and abundance within Conservation Areas and in any areas that may be deemed essential to these taxa in the future, that are not within this framework. Additional research will be necessary to determine distribution, abundance, and habitat requirements of rare species in each Conservation Area, and to develop appropriate management strategies that maintain native plant and animal community structure and persistence.

Implementing this recovery plan will require cooperation among many public agencies and private land owners including, but not limited to, LADWP, the Service, CDFG, BLM, USFS, the counties of Inyo and Mono, and private parties. The ownership pattern in each Conservation Area will be identified before boundaries are delineated and management plans are developed.

1. Conservation Areas

Sixteen Conservation Areas are identified as integral to this recovery plan. Table 5 lists the Conservation Areas and the Tier 1 and Tier 2 species found in each. General location of each Conservation Area is shown in Figures 17 through 22. Actual delineation of boundaries will be determined as part of future recovery plan implementation.

Table 5. General location, Tier 1 and Tier 2 species occurrence (known), approximate size, ownership, and matrix rating value of recommended Owens Basin Conservation Areas.

Conservation Area	Location	Species	Size[1]	Ownership	Matrix Value[2]
Little Hot Creek	Long Valley	Owens tui chub Alkali ivesia	Small	USFS, LADWP BLM	n/a
Whitmore	Long Valley	Long Valley speckled dace Alkali ivesia	Small	LADWP	n/a
Little Alkali	Long Valley	Long Valley speckled dace	Small	BLM, LADWP	n/a
Hot Creek	Long Valley	Owens tui chub Long Valley speckled dace* Owens sucker	Small	LADWP, USFS, BLM, Private	n/a
North Benton	Benton Valley	Owens speckled dace* Aardhal's springsnail	Small	Private	n/a
Mathieu	Benton Valley	Owens speckled dace	Small	Private	n/a

Conservation Area	Location	Species	Size[1]	Ownership	Matrix Value[2]
Round Valley	Owens Valley	Owens pupfish* Owens tui chub* Owens speckled dace Owens sucker Owens Valley vole Southwestern willow flycatcher Yellow warbler Yellow-breasted chat Inyo County mariposa lily Owens Valley checkerbloom Alkali ivesia Silverleaf milk-vetch	Large	LADWP	51
Fish Slough	Owens Valley	Owens pupfish Owens tui chub Owens speckled dace* Owens sucker* Fish Slough springsnail Fish Slough milk-vetch Inyo County mariposa lily Alkali ivesia Hot springs fimbristylis Silverleaf milk-vetch	Large	BLM, LADWP, CDFG	60

Conservation Area	Location	Species	Size[1]	Ownership	Matrix Value[2]
Paiute Creek	White Mountains	Owens springsnail Inyo County mariposa lily	Small	BLM, LADWP	n/a
Warm Springs	Owens Valley	Owens pupfish Owens tui chub* Owens speckled dace* Owens sucker* Owens springsnail Inyo County mariposa lily Owens Valley checkerbloom	Med.	LADWP	47
Baker Creek	Sierra Foothills	Southwestern willow flycatcher Yellow warbler Yellow-breasted chat Western yellow-billed cuckoo Owens Valley checkerbloom Inyo County mariposa lily	Small	LADWP	50
Toll House	White Mountains	Owens springsnail	Small	USFS	n/a
Mule Spring	Inyo Mountains	Owens tui chub	Small	BLM	n/a
Hogback	Sierra Foothills	Yellow-breasted chat Western yellow-billed cuckoo Inyo County mariposa lily	Small	LADWP, BLM	50

Conservation Area	Location	Species	Size[1]	Ownership	Matrix Value[2]
Blackrock	Owens Valley	Owens pupfish* Owens tui chub* Owens speckled dace* Owens sucker* Owens Valley vole Least bittern Inyo County mariposa lily Owens Valley checkerbloom	Large	LADWP	47
Southern Owens	Owens Valley	Owens pupfish* Owens tui chub Owens speckled dace* Owens sucker* Owens Valley vole Western snowy plover Inyo County mariposa lily Owens Valley checkerbloom	Large	LADWP, BLM, State Lands Commission, Private	43

[1]Size classes : small = less than 400 hectares (ha) (1,000 acres (ac)); medium = 400 to 2,800 ha (1,000 to 7,000 ac); large = greater than 2800 ha (7000 ac).
[2]Matrix values refer to numerical results of matrix analysis; maximum possible matrix rating = 91 points. Most small Conservation Areas were not evaluated using matrix criteria.
* denotes historic locality of taxa extirpated from a Conservation Area.

Conservation Area Summaries

Little Hot Creek Conservation Area lies at approximately 2,200 m (7,200 ft) elevation in Long Valley and includes source springs of Little Hot Creek, its outflow, and bordering meadows (Figure 17). The spring source and much of the spring brook of this small Conservation Area lie within the Inyo National Forest; the downstream end of the site is owned by BLM and LADWP. Little Hot Creek Conservation Area lies in MLRA 26, with potential vegetation and soils categorized as streambank, moist flood plain, sodic meadow, and wet meadow following NRCS Ecological Site Descriptions (Table 3). This thermal

aquatic habitat supports an Owens tui chub population that is currently restricted to USFS land. Recovery actions in this Conservation Area should include expanding Owens tui chub habitat, eliminating non-native fishes and installing a fish barrier to prevent upstream movement into Little Hot Creek, protecting spring discharge from adverse impacts of ground water pumping and geothermal development, protecting vegetation from excessive livestock grazing and restoring vegetation communities. Management of the Little Hot Creek site should be consistent with achieving potential vegetation conditions as described by the NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995).

Whitmore Conservation Area lies at approximately 2,100 m (7,000 ft) elevation in Long Valley and includes Whitmore Hot springs, and its outflow, wetlands, and adjacent meadows (Figure 17). This small Conservation Area is owned by LADWP. This Conservation Area is within MLRA 26, where potential vegetation and soils are categorized as sodic meadow and wet sodic meadow following NRCS Ecological Site Descriptions (Table 3). Long Valley speckled dace occupy all aquatic habitat where water temperatures are less than 28° C (Sada field notes). Recovery actions should focus on protecting this Conservation Area from ground water depletion, establishment of non-native species, and excessive livestock grazing. Management of grazing in wetlands surrounding the spring should be consistent with achieving potential vegetation conditions as described by the NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995).

Little Alkali Conservation Area lies at approximately 2,100 m (7,000 ft) elevation in Long Valley and includes an unnamed thermal spring, its outflow, wetlands, and adjacent meadows (Figure 17). The source spring and approximately one-half of the spring brook in this small Conservation Area is on BLM land. The remaining length of the spring brook, upstream from Little Alkali Lake, is owned by LADWP. Little Alkali Conservation Area is in MLRA 26, with vegetation and soils categorized as sodic meadow and wet sodic meadow following NRCS Ecological Site Descriptions (Table 3). Long Valley speckled dace are scarce and limited to less than 90 m (300 ft) of spring brook. Recovery actions should focus on protecting this Conservation Area from invasion by non-native species and adverse impacts caused by overgrazing and ground water pumping. Management in this Conservation Area should be consistent with achieving potential vegetation conditions as described by the NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995).

Hot Creek Conservation Area lies at approximately 2,100 m (7,000 ft) elevation in Long Valley and includes springs at CDFG's Hot Creek Fish Hatchery, Hot Creek, and adjacent meadows (Figure 17). Approximately 20 percent of this small Conservation Area is owned by LADWP, 40 percent is on USFS land, and the remainder is privately owned. Hot Creek Conservation Area includes MLRA 26, with potential vegetation and soils categorized as streambank, sodic meadow, moist floodplain, and wet sodic meadow, and MLRA 29 with wet meadow following NRCS Ecological Site Descriptions (Table 3). Species of interest at this site occupy aquatic habitats; there are no rare plant species known in this Conservation Area. Museum records indicate that rare aquatic species occupied Hot Creek headsprings and much of Hot Creek to the Owens River confluence. Recovery actions should rehabilitate and protect aquatic habitats,

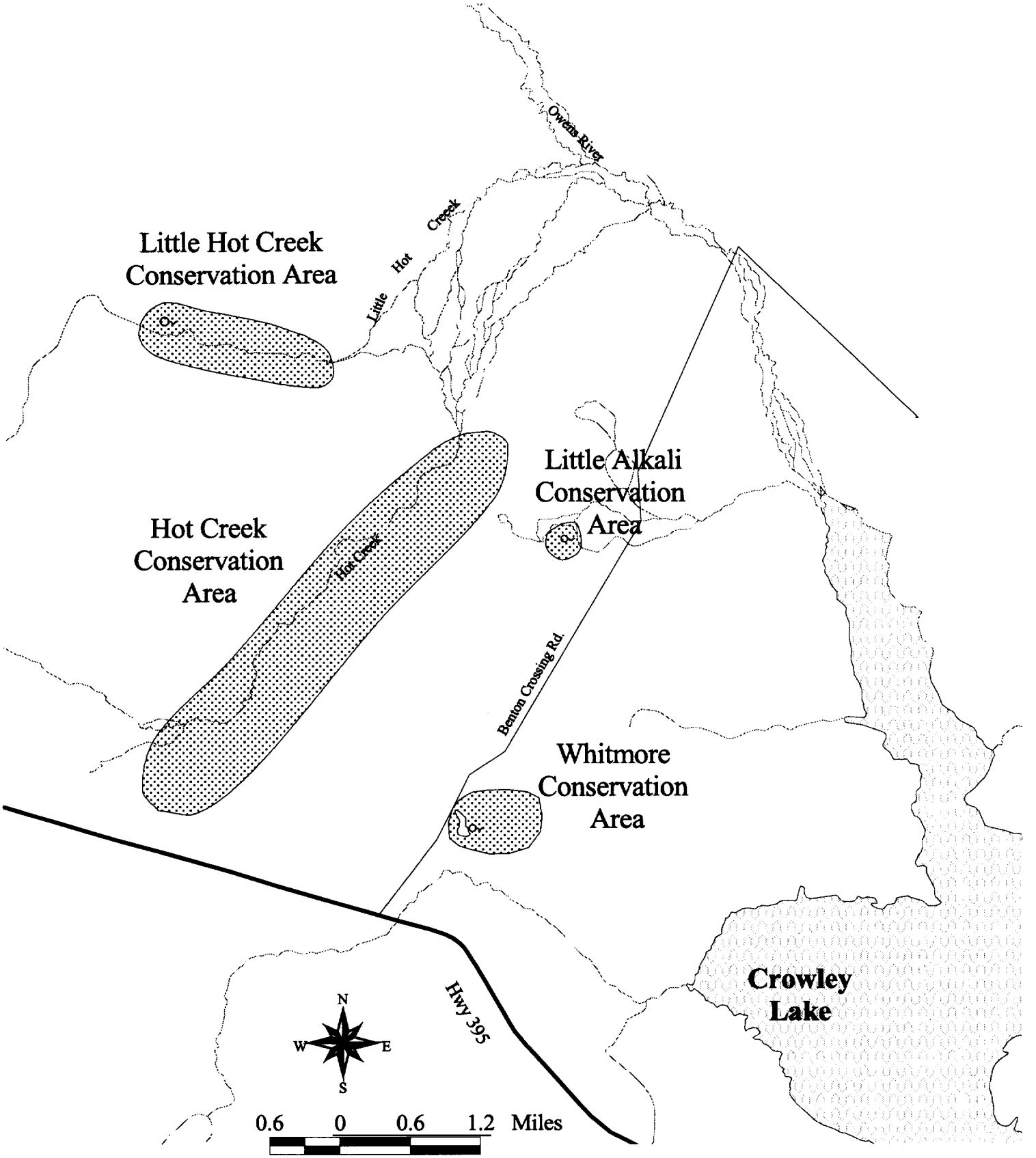

Figure 17. Approximate location of Little Hot Creek, Hot Creek and Whitmore Conservation Areas in Long Valley, Mono County, California.

maintain spring discharge, and reintroduce endemic species. Sports fishing should not be affected by recovery actions in this Conservation Area. Fishing should be allowed to continue at current levels.

North Benton Conservation Area is small and includes a province of small springs lying at approximately 1,700 m (5,600 ft) elevation in Benton Valley (Figure 18). This small Conservation Area is privately owned. North Benton Conservation Area includes MLRA 29, with potential vegetation and soils categorized as wet meadow and saline bottom following NRCS Ecological Site Descriptions (Table 3). Recovery actions should reestablish Owens speckled dace and protect the spring province from degradation.

Mathieu Conservation Area is small and includes a province of small springs and their outflow lying at approximately 1,700 m (5,500 ft) elevation along lower Marble Creek (Figure 18). This Conservation Area is privately owned. Mathieu Conservation Area includes MLRA 29, with potential vegetation and soils categorized as wet meadow and saline bottom following NRCS Ecological Site Descriptions (Table 3). Recovery actions at this site should protect the spring province by securing spring discharge and protecting the aquatic habitat from degradation.

Paiute Creek Conservation Area includes several small springs and spring provinces located north and south of Paiute Creek at approximately 1,700 m (5,500 ft) elevation at the base of the White Mountains (Figure 19). Approximately equal portions of this small Conservation Area are owned by LADWP and BLM. Paiute Creek Conservation Area includes MLRA 29, with potential vegetation and soils categorized as saline meadow and wetland within Mojave desert shrub vegetation following NRCS Ecological Site Descriptions (Table 3). Recovery actions should maintain current spring discharge, maintain

tamarisk eradication programs to ensure that reinvasion of the spring sites does not occur, and protect terrestrial and aquatic habitats from habitat alteration caused by water diversion. Management of this site should be consistent with achieving potential vegetation conditions as described by the NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995).

Round Valley Conservation Area includes lower Rock Creek, lower Pine Creek and several springs and meadows at approximately 1,300 m (4,300 ft) elevation in northern Owens Valley (Figure 19). This large-sized Conservation Area, approximately 2,023 ha (5,000 ac) in size, is owned by LADWP. Round Valley Conservation Area includes MLRA 29, with potential vegetation and soils categorized as wetland, wet meadow, and streambank following NRCS Ecological Site Descriptions (Table 3). This Conservation Area is believed to support the largest extant Owens speckled dace population, which is found in irrigation ditches and lower Rock and Pine Creeks. It also includes good quality riparian habitat of large willows (*Salix* sp.) and dense willow thickets. Recovery programs should protect habitats from excessive water diversion and the adverse effects of overgrazing, and should control nonnative species. Management should be consistent with achieving potential vegetation conditions as described by the NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995).

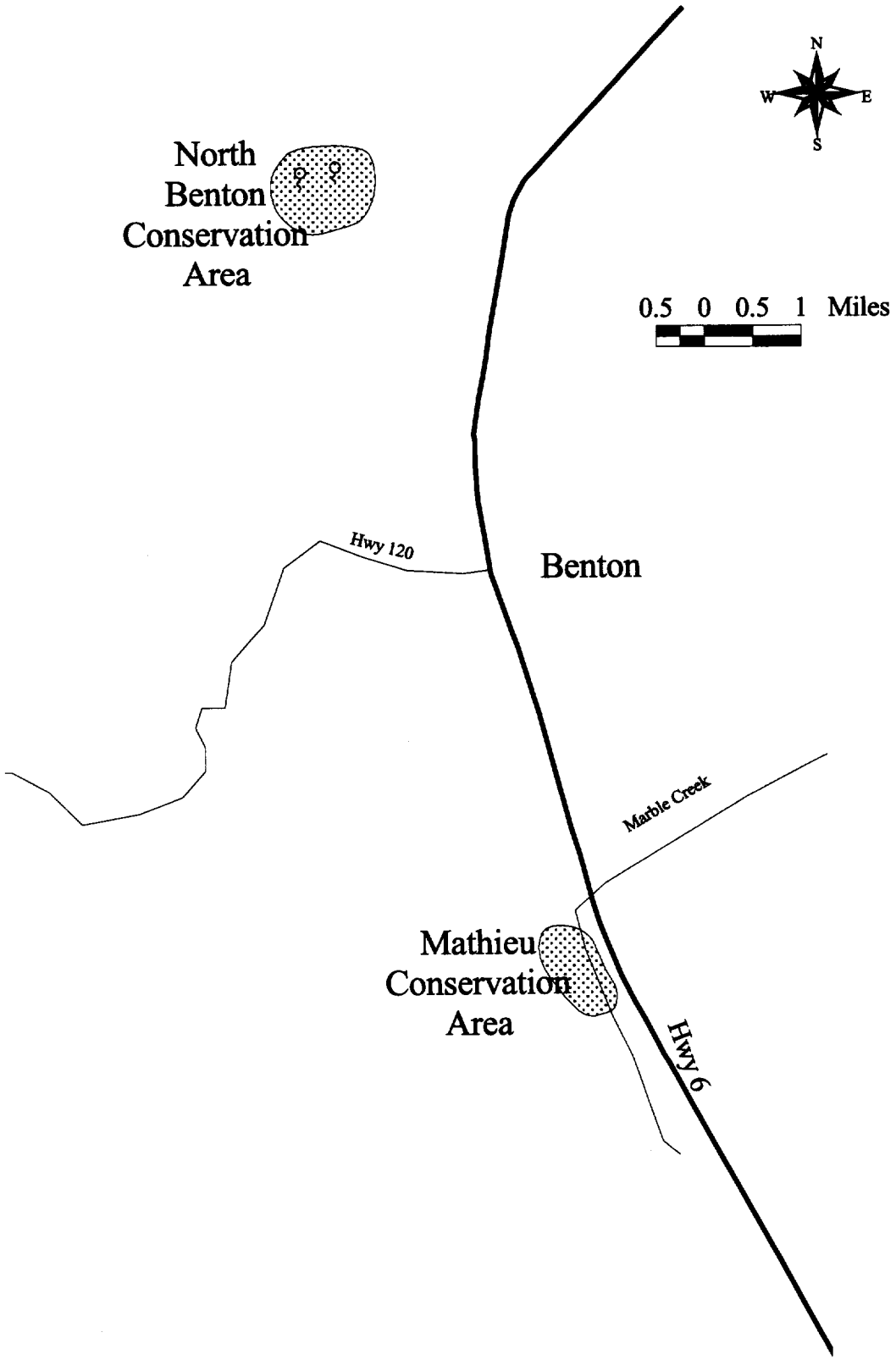

Figure 18. Approximate location of North Benton and Mathieu Conservation Areas, Mono County, California.

Fish Slough Conservation Area includes wetlands and meadows supported by several springs at approximately 1,300 m (4,300 ft) elevation in northern Owens Valley (Figure 19), and is described in detail in the Fish Slough Management Plan (U.S. Bureau of Land Management 1984). This Conservation Area should include the 14,622 ha (35,926 ac) described in the Fish Slough Management Plan; approximately 90 percent of this Conservation Area is BLM land, 8 percent is owned by LADWP, and 2 percent is owned by CDFG. This Conservation Area received the highest matrix score given to any Conservation Area. Fish Slough Conservation Area includes MLRA 26, with potential vegetation and soils categorized as wet sodic meadow and sodic meadow, and MLRA 29, with potential vegetation and soils categorized as wetland and saline meadow following NRCS Ecological Site Descriptions (Table 3). Historical collections document that this Conservation Area had a higher concentration of endemic plants and animals than any other Owens Basin wetland. Reestablishment of Owens Basin native fishes will increase its diversity of endemic species to natural conditions. Management of this Conservation Area is guided by an agreement between the State of California, LADWP, BLM, and the Service to "protect and/or enhance Fish Slough as an ecological natural area" (U.S. Bureau of Land Management 1984). Recovery actions should follow goals and objectives of this agreement; protect Fish slough milk-vetch from adverse impacts of herbivory; restore and enhance natural vegetation communities to achieve composition, structure and functioning as described in NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions for springs and wet meadows, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995); control invasive nonnative plants species (e.g. *Tamarix ramosissima, Lepidium latifolium, Bassia hyssopifolia, Elaeagnus angustifolius*); manipulate aquatic sites to reduce habitat suitable for exotic fish; and control deleterious non-native fish populations, such as largemouth bass, catfish, and

brown trout where advantages to conservation of native fishes are likely.

Warm Springs Conservation Area spans the width of the Owens Valley and includes aquatic habitats, wetlands, and meadows supported by irrigation ditches and springs at approximately 1,190 m (3,900 ft) elevation (Figure 20). Approximately 90 percent of this medium-sized Conservation Area is owned by LADWP, the remainder is BLM land. Warm Springs Conservation Area includes MLRA 29, with potential vegetation and soils categorized as wet meadow, saline meadow, and wetland following NRCS Ecological Site Descriptions (Table 3). Recovery goals in this Conservation Area requires maintaining vegetation in existing conditions in many parts of the Area, restoring or enhancing vegetation communities in some areas (as needed), controlling nonnative species, reestablishing the Owens Basin native fish assemblage in streams and ditches wherever feasible, and managing grazing to be consistent with achieving potential vegetation conditions as described by the NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995). Following delisting of pupfish and tui chubs, the Warm Springs refuge should be restored to natural condition.

Baker Creek Conservation Area includes riparian woodlands and meadow habitats located at approximately 1,370 m (4,500 ft) elevation in the Sierra foothills west of Big Pine (Figure 20). Baker Creek Conservation Area is small and is owned by LADWP. Baker Creek Conservation Area includes MLRA 29 with potential vegetation and soils categorized as saline meadow, wetland, and streambank following NRCS Ecological Site Descriptions (Table 3). Recovery activities needed for this site include maintaining and enhancing habitats, controlling nonnative species, and implementing grazing strategies that are

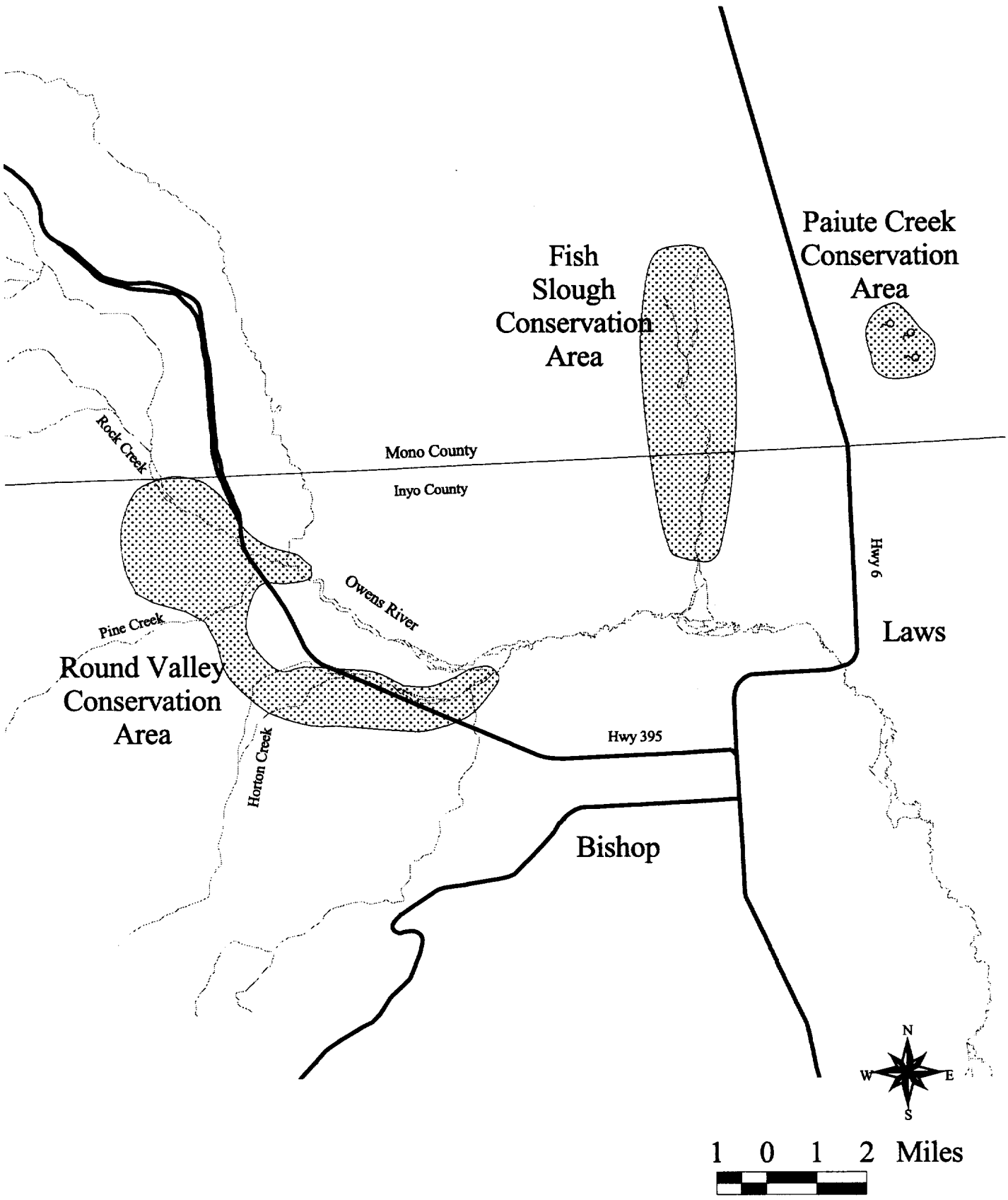

Figure 19. Approximate location of Paiute Creek, Round Valley, and Fish Slough Conservation Areas in Mono and Inyo Counties, California.

consistent with achieving potential vegetation conditions as described by the NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995).

Toll House Conservation Area includes Batchelder spring and associated riparian woodlands located at approximately 1,900 m (6,300 ft) elevation in the White Mountains east of Big Pine (Figure 20). This small Conservation Area is on USFS land. Toll House Conservation Area includes MLRA 29, with potential vegetation and soils categorized as a wetland intrusion within Mojave desert shrub vegetation following NRCS Ecological Site Descriptions (Table 3). Recovery actions for this area should maintain aquatic habitats in existing condition and enhance vegetation communities if needed.

Mule Spring Conservation Area includes a spring and riparian woodland located at approximately 1,340 m (4,400 ft) elevation in the Inyo Mountains east of Big Pine (Figure 20). This small Conservation Area is on BLM land. Mule Spring Conservation Area includes MLRA 29, with potential vegetation and soils categorized as a wetland intrusion within Mojave desert shrub vegetation following NRCS Ecological Site Descriptions (Table 3). This Conservation Area includes an artificially created Owens tui chub refuge. Recovery actions should maintain existing conditions of the aquatic refuge, ensuring that adequate open water habitat is available, until the Owens tui chub is recovered within other Conservation Areas. Following recovery, the habitat may be returned to natural condition.

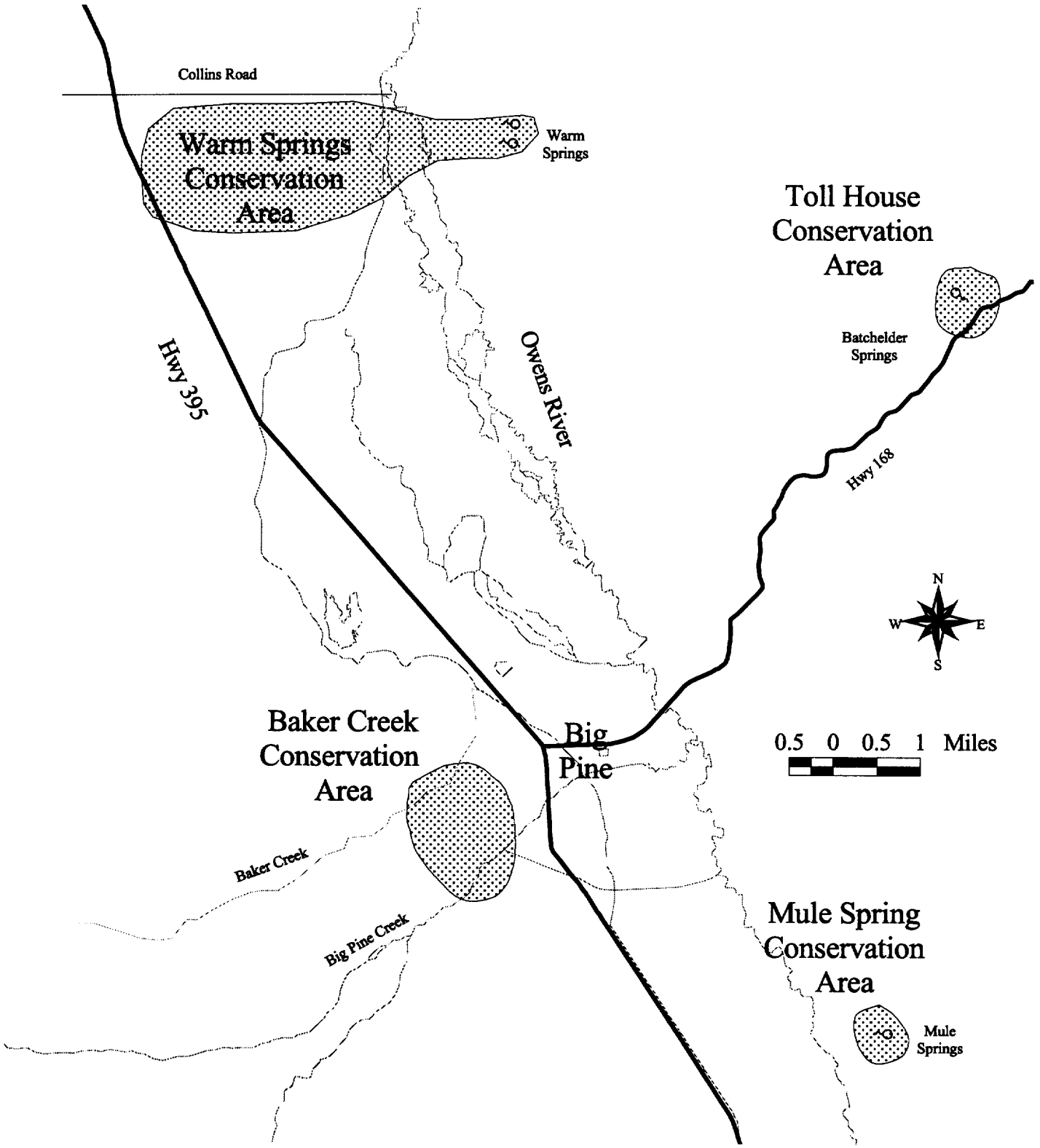

Figure 20. Approximate locations of Warm Springs, Baker Creek, Toll House and Mule Spring Conservation Areas in Inyo County, California.

Hogback Conservation Area includes springs, riparian woodlands, and meadow habitats located at approximately 1,340 m (4,400 ft) elevation in the Sierra foothills (Figure 21). Approximately 80 percent of this small Conservation Area is owned by LADWP and the remainder is BLM land. Hogback Conservation Area includes MLRA 29, with potential vegetation and soils categorized as wetland and streambank following NRCS Ecological Site Descriptions (Table 3). Recovery actions for this site are to maintain most of the area in existing condition, enhance vegetation communities as needed, control deleterious non-native species, and maintain existing stream and spring discharge conditions. The area should be managed to protect riparian and terrestrial vegetation consistent with the NRCS Ecological Site Descriptions, the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995).

Blackrock Conservation Area is owned by LADWP and includes aquatic habitat, riparian woodland, and meadows located at approximately 1,160 m (3,800 ft) elevation (Figure 21). This large Conservation Area is located east of the Los Angeles Aqueduct and west of the Owens River channel. Blackrock Conservation Area includes MLRA 29, with potential vegetation condition and soils categorized as saline meadows, saline bottom, and sodic terrace following NRCS Ecological Site Descriptions (Table 3). Aquatic habitats in this Conservation Area consist of regulated canals and wetlands. The recovery program for this Conservation Area should address water regime management to create native fish habitat and reduce non-native fish habitat and should restore vegetation communities. All of the species in the Owens Basin native fish assemblage should be reintroduced to this Conservation Area. Tamarisk control and removal is particularly needed. Management of the Blackrock site should be consistent with achieving vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S.

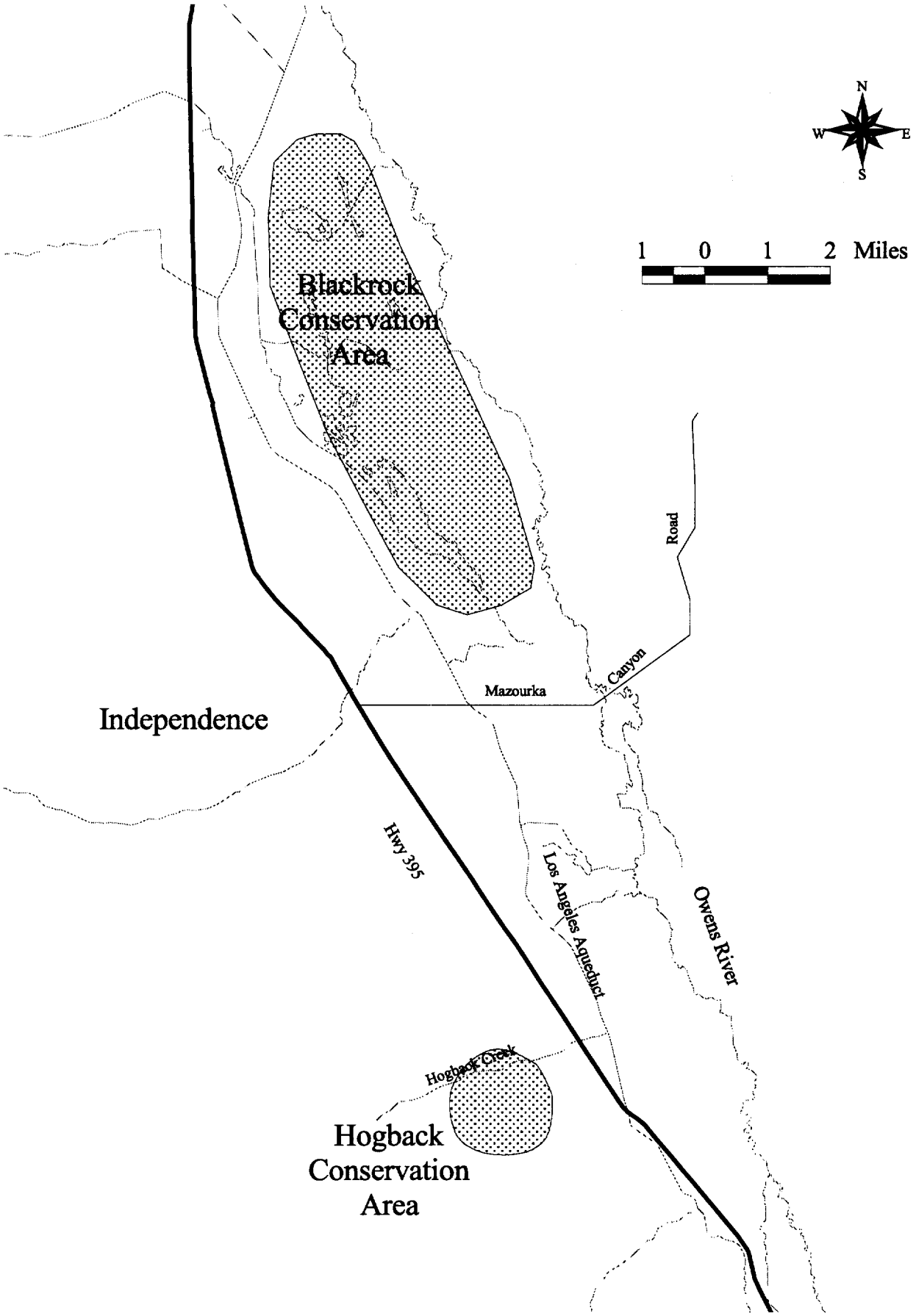

Figure 21. Approximate locations of Blackrock and Hogback Conservation Areas in Inyo County, California.

Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995). Management at this site may also enhance waterfowl and shorebird habitat.

Southern Owens Conservation Area is a long, slender Conservation Area that includes springs and meadows located at approximately 1,100 m (3,600 ft) from Lubkin Creek to Olancha (Figure 22). It is owned by LADWP, the State of California, BLM, and private individuals. This large Conservation Area includes MLRA 29, with potential vegetation and soils categorized as saline meadows, saline bottom, and streambank, with wetland and wet sodic bottom inclusions, and MLRA 30, dry sodic terrace, and sodic terrace following NRCS Ecological Site Descriptions (Table 3). Southern Owens Conservation Area includes a wide variety of habitats including mudflats, meadows and springs near Lubkin Creek, Diaz Lake, and Olancha, and western snowy plover (*Charadrius alexandrinus nivosus*) nest sites along the west side of Owens Lake. Recovery actions should seek to enhance habitat and reestablish extirpated plant and animal populations and control and remove nonnative plant species, especially tall whitetop (*Lepidium latifolium*) and Tamarisk. Management should be consistent with achieving vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995).

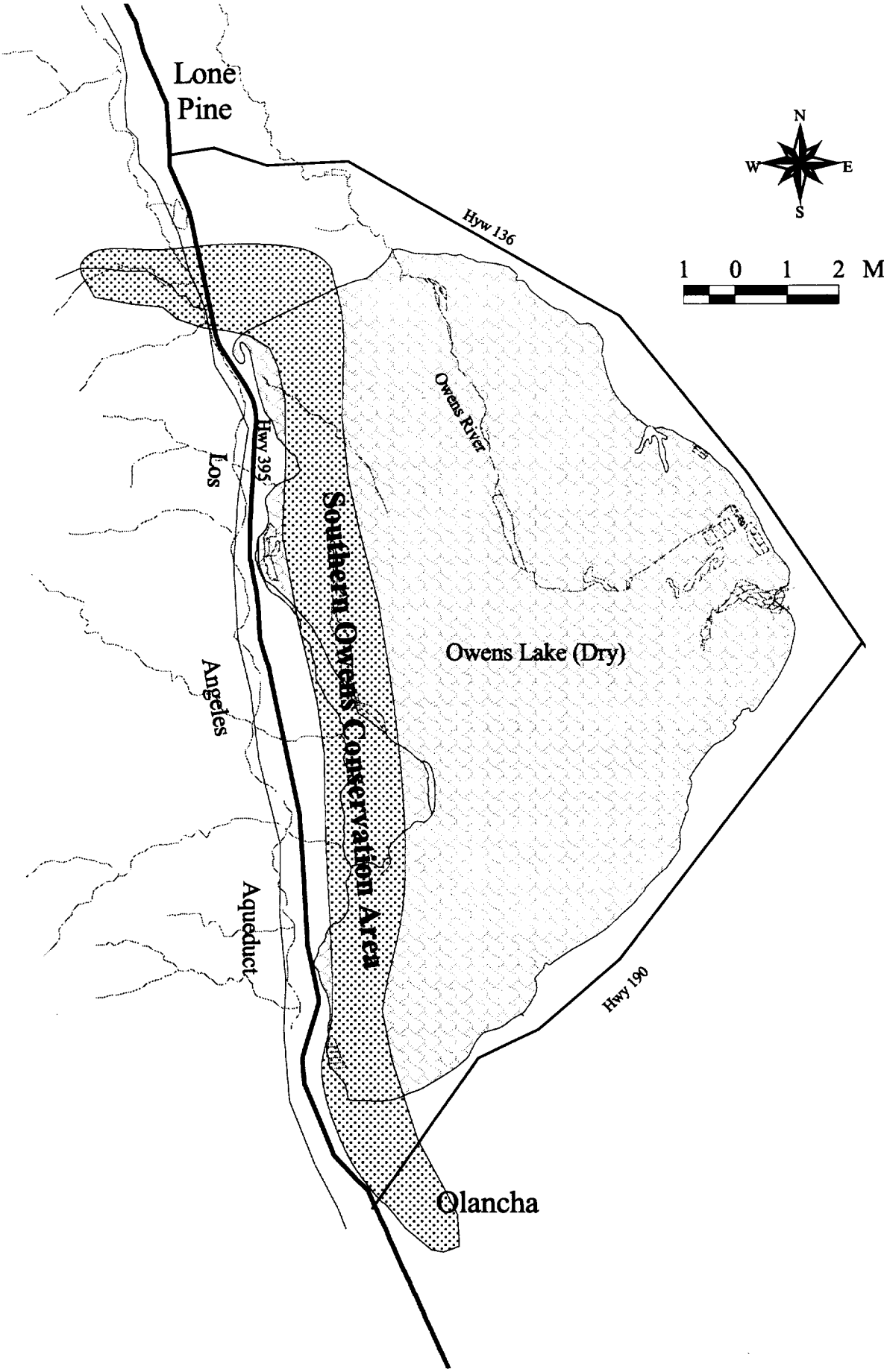

Figure 22. Approximate location of Southern Owens Conservation Area, Inyo County, California.

II. RECOVERY

Objective

The objective of this recovery plan is to recover the Owens pupfish, Owens tui chub, and Fish Slough milk-vetch such that delisting is appropriate and to address management of protected areas sufficient to ensure lasting viability of listed species and species of concern within the wetland and aquatic ecosystems of the Owens Basin. This objective may be accomplished within the recommended Conservation Areas described in Table 5. When habitats and populations are restored, enhanced, and protected in biotic communities characterizing natural Owens basin wetland and aquatic ecosystems, the Owens pupfish, Owens tui chub, and Fish Slough milk-vetch may be delisted. Species of concern should benefit to the extent that the need for future listings is eliminated. Interim objectives for the Owens pupfish and Owens tui chub are to prevent extinction and achieve downlisting to threatened status.

Prevent Extinction

The creation and maintenance of small, often intensively managed, refuges have prevented extinction of Owens pupfish and Owens tui chub. These refuges should be maintained until both species have been securely reestablished in Conservation Areas identified in this plan. Refuge localities include, but are not limited to, Warm Springs, Cabin Bar Ranch, the Owens Gorge, White Mountain Research Station, Fish Slough, Hot Creek Hatchery, and Little Hot Creek. Additional localities may be identified in the future.

Owens pupfish

Maintain four secure refuge populations.

Owens tui chub

Maintain four secure refuge populations.

Downlisting Criteria

Endangered species will be considered for downlisting to threatened status when the following goals have been reached:

Owens Pupfish

Reproducing populations of Owens pupfish occupy all potential habitat in three Conservation Areas in which threats are controlled for 5 consecutive years. Priority order for establishing Conservation Area populations is as follows: 1) Fish Slough, 2) Warm Springs, 3) Round Valley. The area occupied by Owens pupfish within each of these Conservation Areas should approximate the amount shown in Table 6. Each Conservation Area must have an approved management plan and implementing agreement between the landowner and the U.S. Fish and Wildlife Service. Successful establishment of these populations should occur when demography follows an annual pattern in which adults dominate spring and autumn populations, and juveniles dominate early summer populations, and when the biomass of Owens pupfish exceeds the biomass of deleterious non-native fish.

Owens Tui Chub

Reproducing populations of Owens tui chub are established as part of a self-sustaining native fish assemblage throughout six Conservation Areas in which threats are controlled. Two Conservation Areas must be in Long Valley, and four must be in Owens Valley. Priority order for establishing Conservation Area populations is as follows: 1) Little Hot Creek, 2) Hot Creek, 3) Fish Slough, 4) Southern Owens, 5) Warm Springs, and 6) Round Valley. The area to be occupied in each of these Conservation Areas should approximate the amount shown in Table 6. Each Conservation Area must have an approved management plan and implementing agreement between the landowner and the U.S. Fish and Wildlife Service.

Establishment of these populations will be judged successful when each one includes juveniles and at least three additional age classes, when hybrid tui chubs have been eliminated, and when Owens tui chub biomass exceeds the biomass of deleterious non-native fishes at each site.

Once populations of Owens pupfish and Owens tui chub have been securely established within Conservation Areas and downlisting criteria have been met for these species, maintenance of the small, artificial refuges may be discontinued.

Table 6. Estimated area of potential native fish habitat in the Conservation Areas. Estimates include stream and marsh habitat. Estimates are made only for Conservation Areas with native fish habitat known from historical collections.

Conservation Area	Water Surface Area Hectares (acres)	Linear Habitat Kilometers (miles)
A) Target Species: Owens tui chub		
Little Hot Creek	0.6 (1.6)	3 (2)
Hot Creek	0.6 (1.6)	1 (0.6)
B) Target Species: Owens pupfish and Owens tui chub		
Fish Slough	3.2 (8)	11.2 (7)
Round Valley	2.4(6)	8 (5)
Warm Springs	2 (5.5)	3 (2)
Blackrock	200 (500)	8 (5)
Southern Owens	1.6 (0.6)	3 (2)
C) Target Species: Owens speckled dace and Long Valley speckled dace		
Whitmore	1.6 (3)	1.5 (0.9)
North Benton	0.8 (2)	0.7 (0.5)
Mathieu	0.5 (0.2)	0.7 (0.5)
Round Valley	2.4 (6)	8 (5)

Note: Reestablishment of native fish should be into manageable habitats.

Delisting Criteria

Owens Pupfish

Owens pupfish can be considered for delisting when reproducing populations are established as part of self-sustaining native fish assemblages throughout all aquatic habitats in four Conservation Areas for a period of 7 consecutive years during which threats are controlled. Priority order of Conservation Areas in which populations should be established is as listed in the section above with the addition of the Blackrock Conservation Area. The area occupied by Owens pupfish within each Conservation Area should approximate the amount shown in Table 6. Each Conservation Area must have an approved management plan and implementing agreement between the landowner and the U.S. Fish and Wildlife Service. Successful establishment of these populations will occur when demography follows an annual pattern in which adults dominate spring and autumn populations, and juveniles dominate early summer populations, and when the biomass of Owens pupfish exceeds the biomass of deleterious non-native fish.

Owens Tui Chub

Owens tui chub can be considered for delisting when reproducing populations of genetically pure Owens tui chub are established as part of self-sustaining native fish assemblages in seven Conservation Areas for a period of 5 consecutive years during which threats are controlled. Two Conservation Areas must be in Long Valley, and five in Owens Valley. Priority order of Conservation Areas where populations should be established is as given in the section above with the addition of the Blackrock Conservation Area. The area to be occupied in each Conservation Area should approximate the amount shown in Table 6. Each Conservation Area must have an approved management plan and implementing agreement between the landowner and the U.S. Fish and Wildlife Service. Establishment of these populations will be judged successful when each one

includes juveniles and at least three additional age classes, when hybridized tui chubs have been eliminated and when Owens tui chub biomass exceeds the biomass of deleterious non-native fish.

Fish Slough milk-vetch

Fish Slough milk-vetch can be considered for delisting when all of the following have been achieved: (1) the Fish Slough vegetation communities are restored and are being managed to maintain conditions such as those described in the NRCS Ecological Site Descriptions, and U.S. Bureau of Land Management's Desired Plant Community Definitions for springs and wet meadows, and guidelines for riparian zone proper functioning condition (U.S. Bureau of Land Management 1993 and 1995); (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; (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; (4) unless research and monitoring show otherwise, population targets for juvenile and adult plants should be a minimum of 2,100 plants in the north region of Fish Slough and 1200 in the middle region of Fish Slough; these targets assume that habitat restoration will increase carrying capacity beyond 1992 population levels and thus these targets have been set at 10 percent over those 1992 levels.

If implementation of tasks identified in the recovery plan proceeds as scheduled, Owens pupfish and Owens tui chub recovery is expected to take 12 years and recovery of Fish Slough milk-vetch at least 15 years.

Conservation of Species of Concern

Implementation of actions recommended in this plan should result in protection of species of concern in Tier 1, stabilizing and enhancing their populations and averting the necessity of future listings. Management of

Conservation Areas through Habitat Conservation Plans or conservation agreements with Federal and State agencies is expected to: 1) secure and protect native vegetation communities, spring and riparian habitats occupied by rare species in Conservation Areas throughout their historical distribution in the Owens Basin; 2) protect Owens Valley checkerbloom and Inyo County mariposa lily populations in Conservation Areas throughout their native range; 3) reestablish speckled dace in Conservation Areas within its historical range as a part of the native fish assemblage; 4) protect Owens, Aardhal's and Fish Slough springsnails in Conservation Areas throughout their historical distribution; and 5) protect populations of Owens Valley voles in Conservation Areas throughout the lower elevations of the Owens Basin.

Monitoring is integral to the adaptive management strategy that will be applied in this recovery plan. Careful monitoring will reveal the success or failure of management practices in maintaining existing native plant and animal communities. Management within each Conservation Area should be modified when monitoring and research programs indicate that existing land uses are 1) detrimentally affecting Tier 1 species, 2) causing undesirable changes in vegetation communities, or 3) failing to achieve the desired community composition and functioning condition.

Narrative Outline for Recovery Actions

Tasks in this recovery plan will focus on the 16 Conservation Areas identified. Recovery tasks and protection strategies should enhance existing populations of target species, reestablish extirpated populations, enhance habitat quality where necessary, and prevent degradation of native plant and animal community structure. Conservation Areas encompass, and are distributed over, a substantial portion of the target listed and candidate species' historical ranges. These areas are large and ecologically diverse; implementation of management plans for Conservation Areas would maintain wetland, aquatic, riparian, and alkali

meadow ecosystems, rather than focusing on enhancement for any single species. Conservation Areas are also believed to be sufficiently large to permit traditional land uses, so long as these uses are conducted in a manner that does not adversely affect community structure by causing the decline of native species or establishment of non-native species. Management actions causing temporary adverse effects to listed, proposed and other species of concern may be permissible when permits, if necessary, are issued, and no long-term adverse effect on target species or their ecosystems would result. Management targets for maintaining vegetation communities should be in accordance with NRCS Ecological Site Descriptions, and U.S. Bureau of Land Management desired plant communities for springs and wet meadows and riparian zone proper functioning condition (U.S. Bureau of Land Management 1991 and 1995).

Our existing knowledge is sufficient to prescribe preliminary management actions within each Conservation Area. However, development of management plans with research and monitoring elements will be essential to the success of this program. An adaptive management strategy will continually modify management actions within Conservation Areas as new data become available.

Conservation Areas have been ranked in priority order (Table 7). Factors considered in determining priority include: 1) high rare species richness, 2) immediate or imminent threats to rare taxa, 3) high likelihood for successful implementation of recovery tasks, and 4) existence of an ongoing protective management program.

The following outline of recovery tasks describes actions necessary to prevent extinction, provide for recovery of listed species, provide for the conservation of species of concern and accumulate information required for successful management. Tasks 1 and 2 should be implemented immediately. Remaining tasks should be implemented within the next 5 years.

Table 7. Priority ranking for implementation of recovery and protection tasks by Conservation Area.

Priority Number	Conservation Area
1	Fish Slough
2	Little Hot Creek
3	North Benton
4	Hot Creek
5	Warm Springs
6	Whitmore
7	Paiute Creek
8	Round Valley
9	Southern Owens
10	Mathieu
11	Little Alkali
12	Blackrock
13	Baker Creek
14	Hogback
15	Mule Spring
16	Toll House

TASK 1. Maintain Owens Pupfish and Owens Tui Chub Refuges.

Maintain existing refuges to prevent extinction and provide stock for reestablishing recovery populations in Conservation Areas.

Task 1.1 Maintain Owens pupfish in refuges at Fish Slough, Warm Springs, BLM Spring, Mule Spring, and Well #368. Perform habitat maintenance activities as needed.

Task 1.2 Maintain Owens tui chub in refuges at Cabin Bar Ranch and Mule Spring, Little Hot Creek, Hot Creek hatchery, and Owens Gorge. Perform habitat maintenance activities as needed.

TASK 2. Initiate Conservation Area Management

Although there is much to be determined about appropriate management of Conservation Areas, there is sufficient information to recommend preliminary management actions for each Conservation Area. These tasks should be implemented in accordance with requirements necessary to maintain the persistence and resilience of Owens Basin wetland communities, as discussed in the Introduction. Management of Conservation Areas will likely be modified as information is provided by implementation of Tasks 3 through 7.

Task 2.1. Fish Slough Conservation Area.

Task 2.1.1. Control deleterious non-native species. The presence of several non-native predatory fish species limits native fish distribution in Fish Slough to small habitats near spring sources. These predators should be removed from Fish Slough and kept out by changing fishing regulations (i.e., close the area to sport fishing), and constructing barriers to prevent them from moving back into the area from downstream habitats. Non-native plants should also be eliminated or controlled.

Task 2.1.2. Reestablish native fish assemblage. Owens pupfish, Owens tui chub, Owens speckled dace and Owens sucker should be reestablished throughout Fish Slough into available and appropriate habitats.

Task 2.1.3. Evaluate livestock grazing practices and modify as necessary. Cattle are excluded from grazing in portions of Fish Slough. Grazing practices should be modified and, eventually eliminated if necessary where livestock are changing vegetation

structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Management should be consistent with achieving vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S. BLM 1993, 1995)

Task 2.1.4. Identify and restore or enhance potentially suitable habitat for rare species that has been degraded by human activities. For example, dredge spoils deposited in habitat of Fish Slough milk-vetch should be removed and Fish Slough milk-vetch re-established in restored areas, if possible.

Task 2.1.5. Control off-road vehicle use. Off-road vehicle use may be adversely affecting vegetation and rare plant communities. Vehicles should be permitted only on existing roads, following provisions of the high desert off-highway vehicle project (U.S. Bureau of Land Management 1990).

Task 2.1.6. Protect spring discharge. Ground water pumping in areas adjacent to Fish Slough may alter the aquifer supplying water to springs in Fish Slough. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.2. Little Hot Creek Conservation Area.

Task 2.2.1. Control deleterious non-native species that are detrimental to Owens Basin native fish. Barrier construction may be necessary to control their reintroduction.

Task 2.2.2. Expand aquatic habitat and fish populations. Native

fish populations should be expanded downstream to include all of the aquatic habitat suitable to native fish. Long Valley speckled dace should be introduced into this habitat.

Task 2.2.3. Evaluate livestock grazing practices and modify as necessary. Livestock grazing may affect alkali ivesia populations and the quality of the aquatic habitat. Grazing practices should be modified and, eventually eliminated if necessary where livestock are changing vegetation structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S. BLM 1993, 1995).

Task 2.2.4. Protect spring discharge. Geothermal development in Long Valley may be altering aquifer dynamics. Springs supporting Little Hot Creek should be protected from adverse impacts of decreased discharge, and changes in the thermal and chemical characteristics of water. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.3. North Benton Conservation Area.

Task 2.3.1. Control deleterious non-native species. Deleterious non-native species should be controlled in springs occupied by Aardhal's springsnail and springs that are historical habitat for Owens speckled dace.

Task 2.3.2. Manage aquatic habitats. Management actions should be implemented to protect spring discharge and maintain aquatic habitats that are historical habitat for rare species. Spring sources should be maintained in natural condition and spring brooks should be allowed to flow at least 100 m (325 ft) before being diverted. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.4. Hot Creek Conservation Area.

Task 2.4.1. Expand native fish habitat and distribution. The Long Valley native fish assemblage should be reestablished in the Hot Creek drainage. Successful reestablishment of this assemblage is probably most feasible near headsprings where non-native deleterious fish species can be most easily managed. Reestablishing native fish in the drainage will require preventing fish pathogens from affecting Hot Creek Hatchery fish by ensuring that they are absent in donor fish. Impacts of hatchery activities on native fish populations should be identified and mitigation programs implemented.

Task 2.4.2. Protect spring discharge. Geothermal development and groundwater pumping in Long Valley may alter aquifer dynamics. Springs supporting Hot Creek should be protected from adverse impacts of decreased discharge, and changes in the thermal and chemical characteristics of water. Monitoring programs should be determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions

should be taken to protect discharge at 1998 levels. Natural spring discharge should continue to be used as the source providing for natural and naturalized aquatic habitats in the Conservation Area.

Task 2.5. Warm Springs Conservation Area.

Task 2.5.1. Control deleterious non-native species. Successful establishment of the Owens basin native fish assemblage in this Conservation Area depends on management programs that control deleterious non-native fishes. These non-native species should be controlled in habitats occupied by native fishes by chemical treatment or water management and barriers constructed to discourage their reintroduction. Non-native plant species should be controlled.

Task 2.5.2. Reestablish Owens Valley native fish assemblage. The Owens pupfish is currently the only native fish in this Conservation Area. All members of the native fish assemblage should be reestablished in historical habitats, which include waters on the west side of the Owens Valley.

Task 2.5.3. Evaluate livestock grazing practices and, modify as necessary. Grazing practices should be modified and eventually eliminated if necessary where livestock are changing vegetation structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S. BLM 1993, 1995).

Task 2.5.4. Protect spring discharge. Springs in this Conservation Area provide water for the Warm Springs refuge. Discharge from

these springs should be maintained in current conditions to prevent declines in rare fish, and springsnail populations. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.6. Whitmore Conservation Area.

Task 2.6.1. Protect spring discharge. Geothermal development and ground water pumping in Long Valley may alter aquifer dynamics. Whitmore Hot Springs should be protected from adverse impacts of decreased discharge, and changes in the thermal and chemical characteristics of water in this Conservation Area. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.6.2. Evaluate livestock grazing practices and modify as necessary. Livestock grazing may affect alkali ivesia populations and the quality of the aquatic habitat. Grazing practices should be modified and, eventually eliminated if necessary where livestock are changing vegetation structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S.

BLM 1993, 1995).

Task 2.6.3. Prevent entrance of chemical pollutants. Some water from Whitmore Hot Springs is currently diverted into a swimming pool where it is used for recreation. Management actions should be taken to prevent entrance of chemical pollutants into the aquatic habitat located downstream from the swimming pool. It may also be possible to work with the owners/managers of the recreational facility to change to a non-toxic chemical to disinfect water. Small springs that are currently unaffected by recreational use and diversion should be maintained in natural condition.

Task 2.7. Paiute Creek Conservation Area.

Task 2.7.1. Protect spring discharge and aquatic habitat. All rare species in Paiute Conservation Area depend on water from springs. Discharge from these springs should be maintained in current condition. Some water diversion from spring brooks may be acceptable if it can be accomplished without negative effects to rare species. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.7.2. Control deleterious non-native species. Non-native plant species that adversely affect rare plant populations should be controlled.

Task 2.8. Round Valley Conservation Area.

Task 2.8.1. Control deleterious non-native species. Successful establishment of the Owens Basin native fish assemblage in this Conservation Area depends upon management programs that control deleterious non-native fishes and allow native fish

populations to persist. Control programs should not occur in Pine Creek or Rock Creek because sport fishes are believed to prevent maintaining the entire native fish assemblage in these streams. Speckled dace, and Owens sucker populations should be maintained in these streams, however. Habitats occupied by native fishes should be controlled by chemical treatment or water management and barriers that are constructed to discourage deleterious non-native fish reintroduction.

Task 2.8.2. Reestablish Owens Valley native fish assemblage. Owens sucker and Owens speckled dace are the only native fishes currently occupying this Conservation Area. Other members of the Owens Basin native fish assemblage should be reintroduced.

Task 2.8.3. Determine water management practices necessary to maintain the Owens Valley native fish assemblage and native plant vigor. Native fish are most likely to be successfully reestablished in habitats where water can be managed to the detriment of deleterious non-native species. Also, actions should be taken to protect spring discharge at 1998 levels. Several springs and their spring brooks have been dredged in the past. This activity should not continue.

Task 2.8.4. Evaluate livestock grazing practices and modify as necessary. Grazing practices should be modified and, if necessary eventually eliminated where livestock are changing vegetation structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper

functioning condition (U.S. BLM 1993, 1995).

Task 2.9. Southern Owens Conservation Area.

Task 2.9.1. Control deleterious non-native species. The deleterious non-native fish species that are established in historical Owens tui chub habitat should be controlled by chemical treatment and management that degrades their habitat and improves tui chub habitat. Non-native plant species that adversely affect rare plant populations should also be controlled.

Task 2.9.2. Enlarge habitat suitable for Owens tui chub on Cabin Bar Ranch, and reestablish Owens tui chub in historical habitat.

Task 2.9.3. Evaluate livestock grazing practices and modify as necessary. Grazing practices should be modified and, if necessary eventually eliminated where livestock are changing vegetation structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S. BLM 1993, 1995).

Task 2.9.4. Protect spring discharge. Recent increases in ground water pumping may adversely affect spring discharge. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.10. Mathieu Conservation Area.

Task 2.10.1. Prevent invasion by deleterious non-native species.

No non-native species currently occupy habitats inhabited by rare species. Introduction of non-native species should be prevented.

Task 2.10.2. Protect spring and spring brook habitat. Spring discharge should be protected in current conditions. The spring and spring brook have been dredged in the past. This activity should not continue. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.11. Little Alkali Conservation Area.

Task 2.11.1. Control deleterious non-native species. Aquatic habitat in this Conservation Area is periodically occupied by mosquitofish. They should be controlled, and their reintroduction by natural movement into the habitat prevented by constructing a barrier.

Task 2.11.2. Evaluate livestock grazing practices and modify as necessary. Grazing practices should be modified and, if necessary eventually eliminated where livestock are changing vegetation structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S. BLM 1993, 1995).

Task 2.11.3. Protect spring discharge. Geothermal development in Long Valley may alter aquifer dynamics. Aquatic habitats in this Conservation Area should be protected from adverse impacts of

decreased discharge, and changes in the thermal and chemical characteristics of water. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.12. Blackrock Conservation Area.

Task 2.12.1. Control deleterious non-native species. The fish fauna in the Blackrock Conservation Area is entirely non-native species. Management actions are needed to control these populations. This task may be most easily accomplished by employing methods such as chemical treatment or temporarily drying aquatic habitats and using barriers to discourage reintroduction of non-natives. Programs should also be initiated to control non-native plant species (i.e., saltcedar) that adversely affect rare species habitats.

Task 2.12.2. Reestablish the Owens Valley native fish assemblage and determine water management practices necessary for its maintenance. Reestablishment of native fish is most likely to be successful in habitats where water can be managed to the detriment of deleterious non-native species. This task may be accomplished in areas used for waterfowl management where large areas are periodically dried and rewatered. Frequent evaluation of management practices may be necessary to maximize opportunities for the native fish assemblage in this Conservation Area.

Task 2.12.3. Evaluate livestock grazing practices and, modify as necessary. Grazing practices should be modified and eventually eliminated if necessary where livestock are changing vegetation structure and function or adversely affecting aquatic habitats or

populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S. BLM 1993, 1995).

Task 2.13. Baker Creek Conservation Area.

Task 2.13.1. Control deleterious non-native species. Non-native plant species should be controlled in this area to protect native plant communities and avian habitats.

Task 2.13.2. Evaluate livestock grazing practices and, modify as necessary. Grazing practices should be modified and eventually eliminated if necessary where livestock are changing vegetation structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S. BLM 1993, 1995).

Task 2.14. Hogback Conservation Area.

Task 2.14.1. Control deleterious non-native species. Non-native plant species should be controlled to protect native plant communities and avian habitats.

Task 2.14.2 Reintroduce Owens tui chub and Owens speckled dace.

Task 2.14.3. Evaluate livestock grazing practices and modify as necessary. Grazing practices should be modified and, eventually eliminated if necessary where livestock are changing vegetation

structure and function or adversely affecting aquatic habitats or populations of rare plants and animals. Livestock management should be consistent with achieving and maintaining vegetation potential as described in the NRCS Ecological Site Descriptions, in the U.S. Bureau of Land Management's Desired Plant Community Definitions, and BLM documents on riparian area proper functioning condition (U.S. BLM 1993, 1995).

Task 2.14.4. Prevent off-road vehicles from adversely affecting rare species habitats. Management strategies may be necessary to prevent proliferation of off-road vehicle use that adversely impacts vegetation.

Task 2.15. Mule Spring Conservation Area.

Task 2.15.1. Maintain spring discharge. All habitats occupied by rare species at Mule Spring depend upon spring discharge. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

Task 2.16. Toll House Conservation Area.

Task 2.16.1. Maintain spring discharge. All rare species in this Conservation Area rely on discharge from Batchelder Spring. Management programs should prevent spring discharge from falling below 1998 levels.

Task 2.16.2. Protect spring habitat. Some water is currently diverted from Batchelder Spring. Continued viability of this spring as habitat for rare species depends upon limiting this diversion to 1998 levels. Monitoring programs should be initiated to determine characteristics (temporal, chemical, physical) of natural spring

discharge, if spring discharge is being affected, and the location of activities causing adverse effects. Actions should be taken to protect discharge at 1998 levels.

TASK 3. Research

The results of research tasks will be used to modify management of Conservation Areas and accomplish other recovery tasks.

Task 3.1. Determine rare species distribution, abundance and habitat requirements. A number of studies document current and historical distribution of many Owens Basin rare species. Additional information is necessary to delineate Conservation Area boundaries, identify stocks for use in reestablishing extirpated populations, and assist in determining appropriate Conservation Area management. These needs are believed to be greatest for the Owens Valley vole.

Task 3.2. Conduct genetic and morphological studies to quantify differences between Owens tui chub and Lahontan tui chub. Miller (1973) described Owens tui chub as a derived form of Lahontan tui chub that entered the Owens Basin during pluvial periods of the Pleistocene Epoch. He identified several differences between these taxa that are difficult to distinguish in field and laboratory investigations, which prohibits easy identification of true Owens tui chubs. Berg and Moyle (1992) conducted allozyme analyses also indicate that differences between these taxa are small, and that this technique cannot accurately discern between the two chubs. May et al. (1997), however, located distinguishing genetic characteristics in some Owens tui chub populations while assessing the subspecific status of the Mojave tui chub (*Gila bicolor mohavensis*). Additional studies (e.g., mtDNA, PCR, etc.) are needed to expand and clarify these studies so that non-introgressed Owens tui chubs can be reliably identified and used to reestablish extirpated populations.

Task 3.3. Determine Owens speckled dace genetic integrity. Studies by Sada *et al.* (1995) found all Death Valley system speckled dace populations are morphologically and genetically distinct. These studies also suggested that Death Valley system populations are derived from lower Colorado River speckled dace, except for populations in northern Owens Valley, which appear to be more closely related to Lahontan basin speckled dace. Information is needed to determine if extant speckled dace populations in northern Owens Valley are native or introduced. The anomalous origin of these populations (along with common introduction of Lahontan tui chub into the Owens Basin) brings into question the genetic integrity of extant speckled dace populations in the northern Owens Valley. If extant populations are not native, they should not be introduced into Conservation Areas. Genetic integrity of these populations may be determined with additional genetic studies (e.g., mtDNA, PCR, etc.). This work is currently being conducted by scientists at Arizona State University.

Task 3.4. Conduct studies on the habitat factors that influence seed germination, seedling establishment, survival, and reproduction of Fish Slough milk-vetch. Analyze soil chemistry data collected by Ferren et. al (1991) and conduct additional research on soil chemical and hydrologic factors within and among the colonies of this taxon. Examine effects of herbivory on Fish Slough milk-vetch, Mazer and Travers (1992) and Ferren (1991) reported that jackrabbits, cattle, and insects adversely affect Fish Slough milk-vetch reproductive success. Studies are needed to determine the extent of these effects, why these effects are limited to specific populations, and whether these levels of herbivory affect the viability of the Fish slough milk-vetch populations. Studies should also be conducted to determine the pollinators of Fish Slough milk-vetch and any specific habitat needs of these pollinators.

Task 3.5. Determine whether the hydrologic changes causing increased inundation of the habitat of Fish Slough milk-vetch are a result of human activities, in particular the construction of Red Willow Dam, or due to natural geologic processes.

Task 3.6 Determine demographic characteristics of Owens Valley checkerbloom and Inyo County mariposa lily populations to better assess the effects of human activities on these species. Management-oriented research, such as that conducted by Halford (1994) on Owens Valley checkerbloom, and surveys (Manning 1995) provide insight into pertinent demographic factors that should be examined.

Task 3.7. Assess baseline conditions at each Conservation Area. Additional information is necessary to implement management for recovery. Information that will assist in development of management plans for individual Conservation Areas includes: 1) knowledge of natural spatial and temporal variability in native plant abundance; 2) baseline studies to determine existing Conservation Area plant and animal community composition and structure, so that the influences of land and water use on aquatic, mesic alkali meadow, and riparian ecosystems can be assessed and appropriate management strategies implemented; and 3) habitat utilization information to determine how aquatic habitats can be manipulated to benefit native fish species and adversely affect non-native species.

Task 3.8. Conduct management-oriented research on the dispersal and establishment abilities of nonnative fish and plant species in order to design effective strategies to control them. Appropriate barrier designs that will successfully prevent natural movement of non-native species into Conservation Area aquatic habitats should be explored.

Task 3.9. Conduct studies to determine habitat requirements for the native fish assemblage. General information exists about habitat use by Owens

basin native fishes, however additional information is needed to more throughly guide habitat rehabilitation programs and develop adaptive management strategies. Accumulation of this information should also include quantification of habitat requirements for non-native aquatic species so that restoration efforts can be designed to restore habitat that is more suitable for native fishes than it is for non-natives.

TASK 4. Delineate Conservation Area Boundaries

Analysis of ecosystem characteristics, rare species richness, conflicting uses, and the potential for each Conservation Area to successfully accomplish recovery tasks (as analyzed by matrix variables) indicates that Conservation Areas shown in Table 5 are sites where recovery and protection of rare Owens Basin valley floor wetland species is most likely to be successful. Boundaries for each Conservation Area should be delineated through cooperation of Federal and State agencies and private land owners. Wherever possible, these boundaries should be based on natural characteristics of landscape, rather than political considerations. Determination of these boundaries should follow concepts described in the Conservation Area definition and the rating matrix (Table 4, Appendix A), although boundary placement should also consider other geographic and biotic features including: 1) encompassing an adequate area to protect and secure listed and rare species populations in each Conservation Area as indicated by distribution of extant populations and past collection records; 2) circumscribing the area required to implement management actions necessary for recovery (e.g., canals and waterways necessary to support aquatic habitat in a Conservation Area, providing for sufficiently large populations to minimize threats from demographic and stochastic events, etc.); 3) evaluating elevation and/or edaphic boundaries that create geographic boundaries to alkali meadow and riparian ecosystems (e.g., rimrock geology bordering some Conservation Areas, and the limits of hydric soils); 4) barriers to inhibit movement of non-native species; and 5) providing

sufficient area to eliminate adverse impacts of edge effects (i.e., buffer zones) (Saunders *et al.* 1991). Boundaries based on such features will maximize chances for recovery and delisting. Some management actions may commence before boundaries are fully delineated.

Task 4.1. Determine boundary delineation criteria. Utilize abiotic (e.g., soils, elevation, water distribution, etc.) and biotic (e.g., distributional, demographic, community, edge effects, etc.) information to determine pertinent factors that should be used to delineate Conservation Area boundaries.

Task 4.2. Coordinate boundary delineation with affected private parties and Federal, State, and local agencies. Boundaries should be determined with full participation of affected parties.

TASK 5. Prepare Conservation Area Management Plans

Appropriate uses and management should be described in management plans prepared for each Conservation Area. The goal of each plan should be to describe compatible uses and management necessary to secure and protect aquatic, riparian, and mesic alkali ecosystems and their rare species.

The results of monitoring and the research described above will be used to design management programs and strategies, and determine feasibility of recovery in each Conservation Area. For instance, the results of the assessment of baseline conditions (Task 3.7) would indicate for which Conservation Areas the following task will be needed:

Example Task: Develop and implement methods to restore existing vegetation communities to preferred vegetation conditions where needed. NRCS Ecological Site Descriptions and U.S. BLM's Desired Plant Community Definitions for springs and wet meadows, and guidelines for riparian zone proper functioning condition (U.S. BLM 1993 and 1995) should be used as guides to preferred conditions.

Table 8 summarizes possible factors that may threaten recovery in each Conservation Area. Management plans should describe ownership, land uses, management, and restoration/protection programs that are necessary to conserve native plant and animal communities in each Conservation Area. Uses and management of each Conservation Area should be limited to practices that maintain or enhance biotic integrity by preventing the loss of species or deleterious shifts in native species community structure. Information from monitoring programs and future studies should be used to modify management strategies and maximize opportunities for recovery and protection.

Task 5.1. Prepare management plan for Fish Slough Conservation Area.

Task 5.2. Prepare management plan for Little Hot Creek Conservation Area.

Task 5.3. Prepare management plan for North Benton Conservation Area.

Task 5.4. Prepare management plan for Hot Creek Conservation Area.

Task 5.5. Prepare management plan for Warm Springs Conservation Area.

Task 5.6. Prepare management plan for Whitmore Conservation Area.

Task 5.7. Prepare management plan for Paiute Creek Conservation Area.

Task 5.8. Prepare management plan for Round Valley Conservation Area.

Task 5.9. Prepare management plan for Southern Owens Conservation Area.

Task 5.10. Prepare management plan for Mathieu Conservation Area.

Task 5.11. Prepare management plan for Little Alkali Conservation Area.

Task 5.12. Prepare management plan for Blackrock Conservation Area.

Task 5.13. Prepare management plan for Baker Creek Conservation Area.

Task 5.14. Prepare management plan for Hogback Conservation Area

Task 5.15.. Prepare management plan for Mule Spring Conservation Area

Task 5.16.. Prepare management plan for Toll House Conservation Area.

Table 8. A partial list of possible conflicting uses and threats in recommended Conservation Areas. Other conflicts may be identified in the future as management plans are prepared for each Conservation Area.

Conservation Area	Livestock grazing	Non-native species		Off-road vehicles	Water diversion	Ground water use
		Animals	Plants			
Little Hot Creek	x	x				x
Whitmore	x			x		x
Little Alkali	x	x		x		x
Hot Creek		x		x		x
North Benton	x	x			x	x
Mathieu		x			x	x
Fish Slough	x	x	x	x		x
Paiute Creek			x		x	x
Round Valley	x	x	x	x	x	
Warm Springs	x	x	x		x	x
Baker Creek	x	x				
Toll House					x	
Mule Spring		x	x			
Blackrock	x	x	x		x	x
Hogback	x		x	x		
Southern Owens	x	x	x		x	x

TASK 6. Implement Conservation Area Management Plans

Recovery tasks should be implemented within Conservation Areas through cooperation of government agencies and private parties. Management plans should be implemented in perpetuity to ensure recovery and prevent population declines that may result in future listings.

Task 6.1. Federal and State agencies. Federal and State agencies should make formal agreements to ensure successful implementation of management plans in Conservation Areas under their jurisdiction or statutory responsibility.

Task 6.2. Private lands. Private land owners should be encouraged to implement management plans by participating in preparation of Habitat Conservation Plans consistent with requirements of Section 10(a) of the Endangered Species Act. Fee acquisition of lands or conservation easements from willing sellers may be used to secure management plan implementation.

TASK 7. Monitoring Programs

Task 7.1. Population and habitat monitoring. Successful implementation of management plans should be measured by studies quantifying trends in Tier 1 species population size, demography, habitat characteristics, and community structure. Monitoring programs should be designed and implemented for Tier 1 species (including their respective communities) in each taxonomic group (e.g., fishes, plants, mammals, springsnails, etc.) in each Conservation Area and described in monitoring plans that identify goals, schedules, and salient factors that indicate trends in population size and habitat viability. These programs should be included in Conservation Area management plans. Information from these programs will also be used to modify management to enhance recovery potential.

To effectively determine population status and community

structure, monitoring programs should include at least five replicate sites of the habitats within a Conservation Area that may be occupied by Tier 1 species or by non-native species believed to be deleterious to Tier 1 species. In aquatic habitats, samples should be made in pools (preferred habitats for Owens tui chubs), in the shallow margins along fluvial habitats (likely to be occupied by Owens pupfish), and riffle and run habitats (favored by Owens speckled dace and Owens suckers). Sampling these habitats should also determine if deleterious species are present. Estimates of community structure and population size should be quantified. For fish taxa, quantification may be expressed in terms of the number and biomass of each fish species per unit of sample effort or the number and biomass of each fish species per unit area. Community structure should be expressed in terms of the relative abundance and biomass of each species in the fish assemblage. Monitoring should occur at the same season annually until baseline information is available to indicate that other sampling schedules may be adequate to determine trends in population size and community structure.

All public and private agencies should coordinate their monitoring programs to maximize efforts to accurately accumulate information.

Task 7.1.1. Monitor rare species in Fish Slough Conservation Area.

Task 7.1.2. Monitor rare species in Little Hot Creek Conservation Area.

Task 7.1.3. Monitor rare species in North Benton Conservation Area.

Task 7.1.4. Monitor rare species in Hot Creek Conservation Area.

Task 7.1.5. Monitor rare species in Warm Springs Conservation Area.

Task 7.1.6. Monitor rare species in Whitmore Conservation Area.

Task 7.1.7. Monitor rare species in Paiute Creek Conservation Area.

Task 7.1.8. Monitor rare species in Round Valley Conservation Area.

Task 7.1.9. Monitor rare species in Southern Owens Conservation Area.

Task 7.1.10. Monitor rare species in Mathieu Conservation Area.

Task 7.1.11. Monitor rare species in Little Alkali Conservation Area.

Task 7.1.12. Monitor rare species in Blackrock Conservation Area.

Task 7.1.13. Monitor rare species in Baker Creek Conservation Area.

Task 7.1.14. Monitor rare species in Hogback Conservation Area.

Task 7.1.15. Monitor rare species in Mule Spring Conservation Area.

Task 7.1.16. Monitor rare species in Toll House Conservation Area.

Task 7.2. Genetic monitoring. Many authors recognize the importance of maximizing genetic heterozygosity to conserve rare species and to design recovery programs (Allendorf and Leary 1986, Ledig 1986, Echelle 1991, Moyle and Sato 1991). Periodic sampling is necessary to gauge genetic integrity of target populations at risk of introgressive hybridization with non-native species (i.e., Owens tui chub and Owens speckled dace). Conservation Area populations found to be introgressed should be eliminated. Enhancement of population heterozygosity may be attained by periodic transplantation of true Owens tui chubs among Conservation Areas.

Task 7.3. Spring discharge monitoring. The viability of aquatic and mesic

alkali meadow ecosystems in several Conservation Areas depend on spring discharge (e.g., Fish Slough, North Benton, Mathieu, Paiute Creek, Southern Owens). Reduction in spring discharge may be the single greatest threat to these Conservation Areas. This threat is demonstrated by the vulnerability of spring discharge and by impacts of decreased spring discharge on riparian and aquatic plants and animals in other regions of the southwestern United States (Hubbs and Springer 1957, Brune 1975, Johnson and Hubbs 1989, Miller *et al.* 1989, Stromberg and Patten 1990, Stromberg *et al.* 1992). For example, changes in the size and location of inundated areas has already been identified as a possible reason for loss of Fish Slough milk-vetch habitat and plants. Monitoring programs are necessary to determine natural temporal variation in discharge and to document decreases and alterations that may occur because of nearby ground water use. Monitoring may consist of installing stream gauges in spring brooks, gauging water levels in observation wells, or other appropriate methods. These monitoring programs may also be incorporated into Conservation Area management plans, as well as existing LADWP and Inyo County monitoring programs.

TASK 8. Recovery Information and Education

An information and education program is necessary to involve and inform the public, resource agencies, and others about the purposes, goals, and accomplishments of the Owens Basin multi-species recovery program. This program must be broad based and be designed to continuously inform the public about the challenges, impacts, implementation methods, and progress of implementing the plan. The public is very interested in protection and recovery of Owens basin rare species as well as maintaining other resource uses such as sports fishing, ranching, and access to open space. Substantial effort is required to keep the public informed and part of the recovery process.

Task 8.1 Develop and implement an outreach program regarding the status of conservation and recovery efforts including videotape and slide presentations, brochures and pamphlets, seminars, and/or informational meetings in a public forum. This program should begin by fully describing the general purposes of recovery and protection and requirements that are necessary for their success. The program should be continuously updated to describe work that has been accomplished, what is planned in the near future, and how these accomplishments relate to complete implementation of the plan. The program should target both residents and visitors to the Owens Basin.

Task 8.2 Develop and implement a public education program to educate the public about causes for decline and reduced abundance of Owens Basin rare species, and what future activities are likely to threaten their existence. It should also work to develop public awareness so that transplantation of non-native species into and within the Owens Basin is discouraged, spring discharge and spring brook health are protected, and management is implemented to maintain large areas where Owens Basin native plant communities are free from adverse levels of disturbance.

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IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
Need 1: Protect and expand Owens pupfish and Owens tui chub refuges until Conservation Area populations are secure											
1	1.1	Maintain existing refuges for Owens pupfish	10	SE		1	1	1	1	1	Coordinate with PVT
					CDFG	3	3	3	3	3	
					BLM	1	1	1	1	1	
1	1.2	Maintain existing refuges for Owens tui chub	10	SE		1	1	1	1	1	Coordinate with PVT
					CDFG	3	3	3	3	3	
					BLM	1	1	1	1	1	
					USFS	2	2	2	2	2	
Need 1 Totals						12	12	12	12	12	
Need 2: Delineate Conservation Area boundaries											
2	4.1	Determine Conservation Area boundary criteria	1	SE		5					
					CDFG	5					
					BLM	5					
					USFS	3					
2	4.2	Delineate Conservation Area boundaries	2	SE		5	5				Coordinate with PVT
					CDFG	5	5				
					BLM	5	5				
					USFS	5	5				
Need 2 Totals						38	20	0	0	0	

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
Need 3: Manage Conservation Areas to control deleterious non-native plants and animals, rehabilitate habitats, reestablish populations, and protect habitats											
2	2.1.1	Control non-native species from Fish Slough/build fish barriers	2	SE CDFG BLM		10 20 5	1 1 1 1				Coordinate with PVT
2	2.1.2	Reestablish native fish assemblage in Fish Slough Conservation Area	1	SE CDFG		1 1	1 2				Coordinate with PVT
2	2.1.3	Evaluate livestock grazing practices in Fish Slough Conservation Area	4	SE CDFG BLM			1 3 2	1 3 2	1 3 2	1 3 2	Coordinate with PVT
2	2.1.4	Identify and restore or enhance potentially suitable habitat	5	SE	CDFG BLM	5	2	1	1	1	Coordinate with PVT
2	2.1.5	Control off-road vehicles in Fish Slough Conservation Area	continuous	SE CDFG BLM		1 1 1	1	1	1	1	Coordinate with PVT
2	2.1.6	Protect spring discharge in Fish Slough Conservation Area	continuous	SE CDFG BLM		1 5 5	5 5	5 5	5 5	5 5	Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	2.2.1	Control non-native species in Little Hot Creek Conservation Area/build fish barriers	1	SE	CDFG USFS	1 2 12	1 2 2	1	1	1	Coordinate with PVT
2	2.2.2	Expand aquatic habitat and fish distribution in Little Hot Creek Conservation Area	1	SE	USFS CDFG	1 2 1					Coordinate with PVT
2	2.2.3	Evaluate livestock grazing in Little Hot Creek Conservation Area	3	SE	CDFG USFS	.5 .5 .5	.5 .5 .5	.5 .5 .5			Coordinate with PVT
2	2.2.4	Protect spring discharge in Little Hot Creek Conservation Area	continuous	SE	CDFG USFS	1 1 1	1 1 1	1	1	1	Coordinate with PVT
3	2.3.1	Control non-native species in North Benton Conservation Area	1	SE	CDFG	1 1					Coordinate with PVT
3	2.3.2	Manage aquatic habitats in North Benton Conservation Area	continuous	SE	CDFG	.25	.25	.25	.25	.25	Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	2.4.1	Expand native fish habitat in Hot Creek Conservation Area	1	SE	 CDFG USFS	20 20 10					Coordinate with PVT
2	2.4.2	Protect spring discharge in Hot Creek Conservation Area	continuous	SE	 CDFG USFS	1 .5 1	1 .5 1	 .5 1	 .5 1	 .5 1	Coordinate with PVT
2	2.5.1	Control non-native aquatic and plant species/build fish barriers in Warm Springs Conservation Area	2	SE	CDFG			5 10	5 10		Coordinate with PVT
2	2.5.2	Reestablish native fish assemblage in Warm Springs Conservation Area	1	SE	CDFG					1 5	Coordinate with PVT
2	2.5.3	Evaluate livestock grazing in Warm Springs Conservation Area	3	SE	 CDFG BLM		1 1 1	1 1 1	1 1 1		Coordinate with PVT
2	2.5.4	Protect spring discharge in Warm Springs Conservation Area	continuous	SE	 CDFG BLM	1 .5 .5	1 .5 .5	 .5 .5	 .5 .5	 .5 .5	Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
3	2.6.1	Protect spring discharge in Whitmore Conservation Area	continuous	SE CDFG		1 1	1 1	1	1	1	Coordinate with PVT
3	2.6.2	Evaluate livestock grazing in Whitmore Conservation Area	3	SE CDFG				.5 .5	.5 .5	.5 .5	Coordinate with PVT
3	2.6.3	Control pollution in Whitmore Conservation Area	continuous	SE CDFG		1 1	1	1	1	1	Coordinate with PVT
3	2.7.1	Protect aquatic habitat in Paiute Creek Conservation Area	continuous	SE CDFG BLM		1 1 1	1	1	1	1	Coordinate with PVT
3	2.7.2	Control deleterious non-native species	2	SE	BLM	2	1	1	1		Coordinate with PVT
2	2.8.1	Control non-native species in Round Valley Conservation Area	2	SE CDFG			10 20	5 5			Coordinate with PVT
2	2.8.2	Reestablish native fish assemblage in Owens Valley Conservation Area	1	SE CDFG				1 1	1 5		Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	2.8.3	Determine water management appropriate for Owens Valley Conservation Area	3	SE	CDFG				1 5	1 5	Coordinate with PVT
2	2.8.4	Evaluate livestock grazing in Round Valley Conservation Area	3	SE	CDFG				5 5	5 5	Coordinate with PVT
2	2.8.5	Control off-road vehicles in Round Valley Conservation Area	continuous	SE	CDFG	1 1	1 1	1 1	1 1	1 1	Coordinate with PVT
2	2.9.1	Control non-native species in Southern Owens Conservation Area	3	SE	CDFG BLM		5 5	1 1	1 1		Coordinate with PVT
2	2.9.2	Expand habitat for Owens tui chub at Cabin Bar Ranch in Southern Owens Conservation Area	1	SE	CDFG			1 1			Coordinate with PVT
2	2.9.3	Evaluate livestock grazing in Southern Owens Conservation Area	3	SE	CDFG			2 2	2 2	2 2	Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	2.9.4	Protect spring discharge in Southern Owens Conservation Area	continuous	SE	CDFG	2 2	2 2	1 1	1 1	1 1	Coordinate with PVT
3	2.10.1	Prevent invasion of non-native species in Mathieu Conservation Area	1	SE	CDFG					2	Coordinate with PVT
3	2.10.2	Protect spring and spring brook habitat in Mathieu Conservation Area	continuous	SE	CDFG	1 .5	.5	.5	.5	.5	Coordinate with PVT
3	2.11.1	Control non-native species/build fish barrier in Little Alkali Conservation Area	1	SE	CDFG BLM				5 5 5		Coordinate with PVT
3	2.11.2	Evaluate livestock grazing in Little Alkali Conservation Area	3	SE	CDFG BLM USFS				1 1 1	1 1 1	Coordinate with PVT
3	2.11.3	Protect spring discharge in Little Alkali Conservation Area	continuous	SE	CDFG	1 1	1	1	1	1	Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	2.12.1	Control non-native species in Blackrock Conservation Area	2	SE	CDFG					10 30	Coordinate with PVT
2	2.12.2	Reestablish native fish assemblage in Blackrock Conservation Area	1	SE	CDFG					2 2	Coordinate with PVT
2	2.12.3	Evaluate livestock grazing in Blackrock Conservation Area	3	SE	CDFG				1 1	1 1	Coordinate with PVT
3	2.13.1	Control non-native species in Baker Creek Conservation Area	1	SE	CDFG	1 .5					Coordinate with PVT
3	2.13.2	Evaluate livestock grazing in Baker Creek Conservation Area	3	SE	CDFG				1 1	1 1	Coordinate with PVT
3	2.14.1	Control non-native species in Hogback Conservation Area	continuous	SE	CDFG	1 .5	1 .5	.5	.5	.5	Coordinate with PVT
3	2.14.2	Evaluate livestock grazing in Hogback Conservation Area	3	SE	CDFG						Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
3	2.15.1	Control deleterious non-native species in Mule Spring Conservation Area	1	SE	CDFG					1 .5	Coordinate with PVT
3	2.15.2	Reintroduce Owens tui chubs and Owens speckled dace into Hogback Conservation Area	3	SE	CDFG					5	Coordinate with PVT
3	2.15.3	Evaluate livestock grazing in Hogback Conservation Area	3	SE	CDFG				1	1	Coordinate with PVT
3	2.15.4	Control off-road vehicles in Hogback Conservation Area	continuous	SE	CDFG	1 1	1 1	1	1	1	Coordinate with PVT
2	2.16.1	Protect spring discharge in Toll House Conservation Area	continuous	SE	CDFG BLM	1 1 1	1	1	1	1	
3	2.17.1	Maintain spring discharge in Toll House Conservation Area	continuous	SE	CDFG USFS	1	1	1	1	1	
3	2.17.2	Protect aquatic habitat in Toll House Conservation Area	continuous	SE	CDFG USFS	1 1 .5	.5	.5	.5	.5	

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	5.1	Prepare management plan for Fish Slough Conservation Area	2	SE CDFG BLM		2 2 2	2 2 2				Coordinate with PVT
2	5.2	Prepare management plan for Little Hot Creek Conservation Area	2	SE CDFG USFS BLM			1 1 1 1	1 1 1 1			
2	5.3	Prepare management plan for North Benton Conservation Area	2	SE CDFG			1 1	 1			Coordinate with PVT
2	5.4	Prepare management plan for Hot Creek Conservation Area	2	SE CDFG USFS		1 1 1	1 1 1				Coordinate with PVT
2	5.5	Prepare management plan for Warm Springs Conservation Area	2	SE CDFG			1 1	1 1			Coordinate with PVT
2	5.6	Prepare management plan for Whitmore Conservation Area	2	SE CDFG			1 1	1 1			Coordinate with PVT
2	5.7	Prepare management plan for Paiute Creek Conservation Area	2	SE CDFG BLM				1 1 1	1 1 1		Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	5.8	Prepare management plan for Round Valley Conservation Area	2	SE	CDFG		1 1	1 1			Coordinate with PVT
2	5.9	Prepare management plan for Southern Owens Conservation Area	2	SE	CDFG BLM		1 1 1	1 1 1			Coordinate with PVT
2	5.10	Prepare management plan for Mathieu Conservation Area	2	SE	CDFG			1 1	1 1		Coordinate with PVT
2	5.11	Prepare management plan for Little Alkali Conservation Area	2	SE	CDFG BLM USFS			1 1 1 1	.5 .5 .5 .5		Coordinate with PVT
2	5.12	Prepare management plan for Blackrock Conservation Area	2	SE	CDFG				2 2	2 2	Coordinate with PVT
2	5.13	Prepare management plan for Baker Creek Conservation Area	2	SE	CDFG				1 1	1 1	Coordinate with PVT
2	5.14	Prepare management plan for Hogback Conservation Area	2	SE	CDFG			1 1	1 1		Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	5.15	Prepare management plan for Mule Spring Conservation Area	2	SE	CDFG BLM				1 1	1 1	Coordinate with PVT
2	5.16	Prepare management plan for Toll House Conservation Area	2	2	CDFG USFS	1 1 1	1 1 1	1 1 1			Coordinate with PVT
Need 3 Totals						178.3	130.8	103.8	123.3	130.8	
Need 4: Research											
2	3.1	Rare species status and distribution studies	5	SE	 CDFG BLM USFS	10 10 5 5	5 5 2 2	2 2 2 2	2 2 2 2	2 2 2 2	
2	3.2	Owens tui chub genetics	1	SE	 CDFG USFS	5 15 5					
2	3.3	Owens dace genetics	1	SE	 CDFG USFS	1 15 5					
2	3.4	Examine effects of herbivory on Fish Slough milk-vetch	4	SE	 CDFG BLM	5 5 5	2 2 2	2 2 2	1 1 1		Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	3.5	Accumulate information needed to manage for ecosystem integrity	2	SE		1					Coordinate with PVT
					CDFG	3	3				
					BLM	3	3				
					USFS	3	3				
2	3.6 Tasks 3.7-3.8 also	Determine demographic characteristics of Owens Valley checkerbloom and Inyo County mariposa lily	5	SE		3	2	2	1	1	
					CDFG	10	5	5	5	5	
					BLM	5	5	5	5	5	
					USFS	5	2	2	1	1	
Need 4 Totals						134	43	28	23	20	
Need 5: Implement population and habitat monitoring in Conservation Areas											
2	6.1	Coordinate with Federal and State agencies to implement management plans	Continuous	SE		3	3	3	1	1	
					CDFG	3	3	3	1	1	
					BLM	1	1	1	1	1	
					USFS	1	1	1	1	1	
2	6.2	Coordinate with private land owners to implement management plans/prepare HCP	Continuous	SE		3	3	3	1	1	Coordinate with PVT
					CDFG	2	2	2	1	1	

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	7.1	Prepare population and habitat monitoring plans	2	SE	 CDFG BLM USFS	5 15 5 5	5 15 5 5				
2	7.1.2	Monitor rare species in Little Hot Creek Conservation Area	continuous	SE	 CDFG USFS	.5	.5	.5	.5	.5	Coordinate with PVT
3	7.1.3	Monitor rare species in North Benton Conservation Area	continuous	SE	CDFG	.25	.25	.25	.25	.25	Coordinate with PVT
2	7.1.4	Monitor rare species in Hot Creek Conservation Area	continuous	SE	 CDFG USFS	 .25 .25	 .25 .25	 .25 .25	 .25 .25	 .25 .25	Coordinate with PVT
2	7.1.5	Monitor rare species in Warm Springs Conservation Area	continuous	SE	CDFG	.25	.25	.25	.25	.25 .25	Coordinate with PVT
3	7.1.6	Monitor rare species in Whitmore Conservation Area	continuous	SE	 CDFG	.25 .25	.25 .25	.25 .25	.25 .25	.25 .25	Coordinate with PVT
3	7.1.7	Monitor Tier 1 species in Paiute Creek Conservation Area	continuous	SE	CDFG						Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
2	7.1.8	Monitor Tier 1 species in Round Valley Conservation Area	continuous	SE CDFG		1 1	1 1	1 1	1 1	1 1	Coordinate with PVT
2	7.1.9	Monitor Tier 1 species in Southern Owens Conservation Area	continuous	SE	CDFG	1	1	1	1	1	Coordinate with PVT
3	7.1.10	Monitor rare species in Mathieu Conservation Area	continuous	SE CDFG		.2 .2	.2 .2	.2 .2	.2 .2	.2 .2	Coordinate with PVT
3	7.1.11	Monitor rare species in Little Alkali Conservation Area	continuous	SE	CDFG BLM	.2 .2	.2 .2	.2 .2	.2 .2	.2 .2	Coordinate with PVT
2	7.1.12	Monitor Tier 1 species in Blackrock Conservation Area	continuous	SE	CDFG					1	Coordinate with PVT
3	7.1.13	Monitor rare species in Birchim Conservation Area	continuous	SE	CDFG	.5	.5	.5	.5	.5	Coordinate with PVT
3	7.1.14	Monitor rare species in Baker Creek Conservation Area	continuous	SE	CDFG				1	1	Coordinate with PVT

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
3	7.1.15	Monitor rare species in Hogback Conservation Area	continuous	SE	CDFG						Coordinate with PVT
2	7.1.16	Monitor rare species in Mule Spring Conservation Area	continuous	SE	CDFG BLM	.2	.2	.2	.2	.2	Coordinate with PVT
2	7.2.1	Monitor rare species in Fish Slough Conservation Area	continuous	SE	 CDFG BLM	.5 .5 .5	.5 .5 .5	.5 .5 .5	.5 .5 .5	.5 .5 .5	Coordinate with PVT
2	7.2	Genetic monitoring	continuous	SE	 CDFG USFS	 10 2	 10 1	 5 1	 5 1	 5 1	
2	7.3	Spring discharge monitoring	continuous	SE	 CDFG BLM USFS	 5 10 10	 5 10 10	 5 10 10	 5 10 10	 5 10 10	Coordinate with PVT
Need 5 Totals						91.6	89.6	54.6	48.6	50.6	
Need 6: Public information and education program											
3	8.1	Recovery information and education program	3	SE	 CDFG BLM USFS	1 .5 .5 .5	1 .5 .5 .5	1 .5 .5 .5			

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimate ($000s)*					Comments
				USFWS Program	Other	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	
3	8.2	Public education program to discourage transplantation of non-native species within the Owens Basin	5	SE		.5	.5	.5	.5	.5	
					CDFG	.25	.25	.25	.25	.25	
					BLM	.25	.25	.25	.25	.25	
					USFS	.25	.25	.25	.25	.25	
Need 6 Totals						3.8	3.8	3.8	1.3	1.3	
Total Costs						**449.7**	**296.2**	**200.2**	**206.1**	**213.7**	**1365.9**

IMPLEMENTATION SCHEDULE DEFINITIONS AND ABBREVIATIONS

Priorities in Implementation Schedule column 1 are assigned as follows:

1. Priority 1. An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

2. Priority 2. An action that must be taken to prevent a significant decline in species/habitat quality or some other significant negative impact short of extinction.

3. Priority 3. All other actions necessary to meet recovery objectives.

Key to Abbreviations used in Implementation Schedule

PVT- Private landowner
HCP - Habitat Conservation Plan
BLM - U.S. Bureau of Land Management
CDFG - California Department of Fish and Game
USFS - U.S. Forest Service
USFWS - U.S. Fish and Wildlife Service
SE - Endangered Species Division, U.S. Fish and Wildlife Service

APPENDIX A

Conservation Area Selection Matrix and Analysis Summary

The following discussion describes the process used to select Conservation Areas. This process also quantifies the importance, suitability, and feasibility of Conservation Areas to successfully function as sites where Owens Basin listed, proposed, and candidate species in aquatic and mesic alkali meadow ecosystems can be protected and recovered.

1. Identification of Potential Areas

Potential Conservation Areas were first identified by mapping extant populations of Owens Basin rare species. Locations of extirpated populations were not mapped because it is usually difficult to accurately describe their locations. However, these historical sites are important to programs that would reestablish extirpated populations, and this element was considered in matrix analysis. Preliminary examination of these maps suggested several factors believed to be important to recovery and protection of Owens Basin rare species.

Maps of the location of extant populations show that some areas are occupied by a single rare species, whereas several areas are habitat for many rare species. These maps also show that extant populations of most rare species are scattered throughout the Owens Basin valley floor. Examination of these maps indicates that two types of Conservation Areas are necessary to protect valley-floor wetland species:

(A) Small Conservation Areas to protect aquatic species with extremely limited historical and current distributions (e.g., Long Valley speckled dace, Owens springsnail, Aardhal's springsnail); and

(B) Large Conservation Areas where widely distributed rare species can be recovered and protected. These areas are generally ecologically diverse aquatic and terrestrial environments occupied by several rare species.

2. Selection of Recommended Conservation Areas

A matrix (Table 4) was developed to systematically assess the values of potential Conservation Areas in the Owens Basin, and to determine the probable utility of an area in providing suitable habitats for recovery and protection of target species. A potential Conservation Area's suitability was rated by summation of all matrix variable values. A maximum value of 91 points was possible for a Conservation Area that was rated highest for all matrix variables; however, no potential Conservation Area received the maximum value. Conservation Areas that achieved a matrix value of greater than 42 points were classified as suitable for recovery and protection. Potential Conservation Areas with lower scores tended to

have low rare species richness and an overwhelming array of conflicting uses (i.e., popular recreation areas where non-native sport fish could not be controlled were judged to be unsuitable for recovery).

The following matrix variables were used in the analysis of potential Conservation Areas:

A. Number of Listed or Proposed Species Present

A tally of listed or proposed species within an area. A value of 2 is given for each species, with a maximum of 6.

B. Number of Other Tier 1 Species Present

A tally of Tier 1 species, other than those tallied for matrix variable 1 above. Each species is valued as 1.

C. Number of Tier 2 Species Present

A tally of Tier 2 species. Each species is valued as 1.

D. Presence of Aquatic Habitat

Areas with aquatic habitat received a matrix value of 2; areas without aquatic habitat received 0.

E. Presence of Mesic Alkali Meadow

Areas with mesic alkali meadow habitat received a matrix value of 2, areas without these meadows received 0.

F. Wetland Species Diversity Evaluation

The diversity of wetland species was subjectively evaluated by considering the types of habitat found in a Conservation Area. Habitats considered included riparian vegetation, ponds, meadows, reservoirs, irrigation ditches, springs, and flowing creeks. Diversity was considered low when few of these habitats occurred in a Conservation Area. In these cases, a value of 2 was given. Conservation Areas including a moderate diversity of these habitats, were given a value of 4. Areas with a wide variety of wetland habitats were given a value of 6.

G. Historical Listed or Candidate Species Habitat

Locations of extirpated populations of target species were not mapped, however, descriptions in historical documents were usually adequate to determine if collections

were made within potential Conservation Areas. Collection records were studied for each rare taxon, and a matrix value of 3 given to Areas with historical populations of Tier 1 and Tier 2 species. Areas with an absence of historic records were given a value of 0.

H. Recoverability

Feasibility to accomplish recovery and protection within each Conservation Area was subjectively analyzed. Areas where complicated and possibly ineffective management would be required to accomplish recovery tasks were given a matrix value of 1. Areas were management could be implemented with relatively great success were given a matrix value of 2. Areas where successful recovery and protection management could be easily implemented were given a value of 3.

I. Presence of Conflicting Uses

No valley floor wetland habitats in the Owens Basin are in pristine condition. Public and private uses of these habitats include recreation (e.g., fishing, hiking, hunting), off-road vehicle trails, livestock grazing, irrigation, etc. Low matrix values were given to Conservation Areas where a subjective evaluation of these uses concluded that there was an overwhelming possibility that these uses would prevent successful implementation of recovery and protection tasks. Most potential Conservation Areas were given moderate values of around 25 points, because even though many conflicting uses occur within potential Conservation Areas, most are not likely to prevent protection and recovery. A value of 50 was possible in Conservation Areas with virtually no conflicting uses.

APPENDIX B

The Recovery Priority System uses degree of threat, recovery potential, and taxonomic distinctiveness to assign a recovery priority number of 1-18 to all listed taxa. A fourth factor, conflict with construction or development projects, gives priority within each category.

A detailed discussion of the Recovery Priority System can be found in the Federal Register Vol. 48, No. 221, Pg 51985 of the issue Wednesday, September 21, 1983.

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic genus	1	1C 1
	High	Species	2	2C 2
	High	Subspecies	3	3C 3
	Low	Monotypic genus	4	4C 4
	Low	Species	5	5C 5
	Low	Subspecies	6	6C 6
Moderate	High	Monotypic genus	7	7C 7
	High	Species	8	8C 8
	High	Subspecies	9	9C 9
	Low	Monotypic genus	10	10C 10
	Low	Species	11	11C 11
	Low	Subspecies	12	12C 12
Low	High	Monotypic genus	13	13C 13
	High	Species	14	14C 14
	High	Subspecies	15	15C 15
	Low	Monotypic genus	16	16C 16
	Low	Species	17	17C 17
	Low	Subspecies	18	18C 18

Recovery Priority System Matrix.

APPENDIX C

Owens Basin Sensitive Wetland and Aquatic Species Management Guidelines

TABLE OF CONTENTS

I. INTRODUCTION

These Management Guidelines were prepared for the U.S. Fish and Wildlife Service (Service), in cooperation with the California Department of Fish and Game (Department), U.S. Bureau of Land Management, U.S. Forest Service, and the Los Angeles Department of Water and Power as management strategies to enhance and protect Owens Basin rare wetland and aquatic species not discussed in the Owens Basin Wetland and Aquatic Species Recovery Plan (U.S. Fish and Wildlife Service [USFWS] 1998). Development and implementation of these Guidelines are not mandated by any State of California or Federal statute. They have been developed to alert land managers to the presence of sensitive species and to identify "best management practices" that will conserve and increase populations of these species as important components of Owens Basin wetland and aquatic ecosystems. Implementation of these Guidelines will not only possibly help prevent future declines in species and preclude future threatened or endangered listings, but will also help contribute to the recovery of those species in Tier 2 (in Owens Basin recovery plan) that are already listed. Table 1 lists plant and animal species, and their status, to which these Management Guidelines apply.

Recommendations made in this document apply only to populations occurring in the Owens Basin, Inyo and Mono counties, California. Most species discussed in these guidelines also occur in other parts of California and the western United States, but all species inhabit only wetlands and they including taxa as diverse as fishes and aquatic snails, birds, and alkaline meadow plants. These Guidelines are intended to serve a compliment to the Owens Basin Wetland and Aquatic Species Recovery Plan (USFWS 1996), and they rely heavily upon management with Conservation Areas identified in that document for their successful execution. Conservation plan(s) developed for the Conservation Areas (pursuant to the Owens Basin Wetland and Aquatic Species Recovery Plan) will delineate the specific area of each Conservation Area, and the specific management actions and protocols for restoration of habitat and recovery of species within each Conservation Area. Approval of the conservation plan will include necessary permits for management action, including the incidental take of listed species,

and will also include assurances that no additional requirements will be imposed upon the landowners.

II. GENERAL MANAGEMENT STRATEGIES

These Management Guidelines identify several widely distributed Owens Basin sensitive wetland species, describe characteristics of their habitats, and recommend practices for maintaining and enhancing their populations. This information is provided to assist in development of management strategies to protect and enhance Owens Basin wetlands. Although there is no regulatory authority requiring implementation of these recommendations, their implementation is encouraged as a means to conserve all biological components of Owens Basin wetlands.

Descriptions of habitat requirements, management suggestions, and establishment of monitoring programs to examine demography and distribution of each rare species are central themes in these Guidelines. Most of these species also occur in habitats occupied by other plants and animals that are endemic to the Owens Basin, and that are subjects of protective actions discussed in the Owens Basin Wetland and Aquatic Species Recovery Plan (USFWS 1996). This indicates that many of the conservation and monitoring programs described in these Guidelines may be integrated into implementation of recovery plan tasks. Programs for some species (ergo riparian birds) may require unique management programs that are not identified as recovery tasks.

For aquatic animals (e.g., fishes and mollusks), maintaining water quality and discharge, and controlling deleterious non-native aquatic animals are the most important management elements. Major management challenges for some birds (e.g., yellow rail, least bittern, osprey, bank swallow, snowy plover) consist of improving nesting and feeding habitats, and riparian bird conservation (e.g., yellow warbler, yellow-billed cuckoo, least Bell's vireo, yellow-breasted chat) requires minimizing brown-headed cowbird (*Molothrus ater*) nest parasitism and enhancing natural characteristics (e.g., dominance by native species and high structural diversity) of riparian

vegetation cover. The southwestern willow flycatcher, the yellow warbler, and the yellow-breasted chat utilize dense riparian thickets for nesting and feeding.

Abundance and distribution of the brown-headed cowbird has increased more than any other species in the far western United States over the last century, and its control is an important component of riparian bird conservation throughout the region (Rothstein 1994). On the east slope of the Sierra Nevada cowbirds were rare into the 1930s, but became increasingly common thereafter, and now are widespread throughout the eastern Sierra (Rothstein ibid) and Mono and Owens Basins (MacMillen pers. obs.). Concomitant with the increase in cowbirds has been a decline in abundance and distribution of at least 10 songbird species in California, attributable partly or mainly to cowbird nest parasitism (Gaines 1974).

Brown-headed cowbird nest parasitism and excessive livestock grazing appear to be the greatest threats to Owens Basin populations of riparian birds (Laymon and Williams 1994). Without implementing a program to reduce cow bird populations, the birds whose nests they parasitize may continue to decline toward extinction in the Owens basin. Laymon and Williams (ibid.) advocated a cowbird removal program during the breeding season (spring and early summer), but we also recommend an intensive year-round removal program at the primary feeding sites of cowbirds, stables, corrals, feed lots, and heavily-grazed pastures. Controlling populations at their feeding sites will be logistically easier to carry out because they aggregate in large flocks while foraging in the afternoon. Treatment at nesting sites would be less effective because cowbirds have large home ranges and nest in single pairs or in small groups (Rothstein 1994). Monitoring will be required to determine when populations need control and control program efficacy. We also recommend that starlings (*Sturnus vulgaris*) should be removed during this control program because it is non-native and it often displaces and reduces populations of native hole-nesting birds (e.g., flickers and bluebirds).

Good riparian bird habitat has high structural diversity created by dense undergrowth of tangled vegetation and debris, more open vegetation at midlevel, and an comparatively open canopy provided by large trees (Naiman and Rogers 1997). In the Owens basin, riparian structure is attribute to a dense undergrowth of shrub willow and debris, willows at midlevel, and a willow and cottonwood tree canopy. It has been reduced in most of the Owens basin by stream

diversion, burning, vegetation control, and excessive livestock grazing. These activities have reduced riparian vegetation along many stream miles and opened formerly dense vegetation. As a result, suitable riparian habitat has been eliminated or degraded so that species such as brown-headed cowbirds can more easily invade nesting areas.

Major threats to sensitive plant species discussed in these Guidelines include livestock grazing (either direct or indirect effects) and habitat modification caused by off-road vehicles. Grazing impacts by cattle and sheep can be reduced to tolerable levels by managing grazing intensity and timing. Off-road vehicle use in areas supporting sensitive plant populations should be prohibited, as this is exceedingly detrimental to population stability and growth. An excellent source for information about requirements of these sensitive plants is Cronquist *et al.* (1984).

Many of the healthiest populations of species addressed in these Guidelines occur in Conservation Areas identified in the Owens Basin Wetland and Aquatic Species Recovery Plan (USFWS 1996). This provides an opportunity to integrate management protocols for each of these species into Conservation Area management. Where species addressed in these Guidelines occur outside of these Conservation Areas, we recommend that land managers also view their activities as they affect wetland habitats and that they integrate recommendations in these Guidelines into a multispecies management strategy. Observations by Laymon and Williams (1994) indicate that highest priority areas for bird conservation include the Owens River through Pleasant Valley, riparian habitat upstream from Tinemaha Reservoir, the Islands areas east of Alabama Gates, and lower Baker Creek. To expedite management, we also recommend that these Guidelines be incorporated into City and County Planning decisions within the Owens Basin, and that a series of public meetings and workshops be held to familiarize interested and involved parties with these Guidelines. It is particularly essential to include private landowners in these discussions to facilitate their understanding and include their interests in decision making.

Table 1. Sensitive wetland species that occur in Inyo and Mono Counties, California and are considered in these Management Guidelines.

Common Name	Scientific Name	Status
Owens sucker	*Catastomus fumeiventris*	CSC
Wongs springsnail	*Pyrgulopsis wongi*	FSC, CSC
Desert tryonia	*Tryonia protea*	CSC
Least Bell's vireo	*Vireo bellii pusillus*	FE, SE
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	SE
Least bittern (rookery sites only)	*Ixobrychus exilis*	CSC
Osprey (breeding sites only)	*Pandion haliaetus*	CSC
Yellow rail	*Coturnicops noveboracensis*	CSC
Western snowy plover (breeding sites only)	*Charadrius alexandrinus nivosus*	FSC, CSC
Yellow warbler (breeding sites only)	*Dendroica petechia brewsteri*	CSC
Yellow-breasted chat (breeding sites only)	*Icteria virens*	CSC
Bank swallow	*Riparia riparia*	ST
Silverleaf milkvetch	*Astragalus argophyllus* var. *argophyllus*	CSC, CNPS-2
Hotsprings fimbristylis	*Fimbristylis (spadicea) thermalis*	FSC, CSC, CNPS-2
Alkali ivesia	*Ivesia kingii*	CSC, CNPS-1B
Inyo phacelia	*Phacelia inyoensis*	CSC, CNPS-4

FE - Federally listed as Endangered
FSC - Federal Species of Concern
SE - State Listed as Endangered
ST - State Listed as Threatened
CSC - State Species of Special Concern
CNPS-1B - California Native Plant Society's list of plants, rare, threatened, or endangered in California and elsewhere
CNPS-2 - California Native Plant Society's list of plants, rare, threatened, or endangered in California, but more common elsewhere
CNPS-4 - California Native Plant Society's list of plants with limited distribution

III. SPECIES ACCOUNTS AND MANAGEMENT RECOMMENDATIONS

A. Owens Sucker (*Catostomus fumeiventris*). Status: California Department of Fish and Game (CDFG)—Special Concern; U.S. Fish and Wildlife Service (USFWS)—None.

Miller (1973) described *Catostomus fumeiventris* from collections made at Hilton Creek in Long Valley, Mono County, during 1952. It is endemic to the Owens Basin (Inyo and Mono Counties), California. Miller (1973) also examined paratypes collected throughout Mono County, including material from the upper springs and a distributary of Hot Creek, the western headspring of Fish Slough, Whiskey Creek at its mouth into Crowley Lake, June Lake, and the Owens River approximately 0.5 mi (1 km) downstream from Crowley Lake Dam. Inyo County paratype localities include an Owens River tributary located several miles north west of Laws, irrigation ditches near Bishop, 8 mi (11 km) south of Bishop, and near Big Pine, from upper (e.g., Sabrina Lake) and lower Bishop Creek, and the Owens River approximately 6 mi (8 km) south of Big Pine, at Laws (CDF&G SNA INY-027), and near Aberdeen (Miller 1973). These localities, early fisheries surveys, and museum collections show that Owens suckers were relatively abundant throughout Owens Basin valley floor aquatic habitats in Owens and Long Valleys during historical times (Snyder 1917).

The Owens sucker is colored slate gray on the back, that fades to faint blue reflections laterally (particularly on breeding males), then to a dusky white belly. Paired fins may be faintly colored red-amber (Moyle 1976). Owens suckers have a subterminal mouth, thick caudal peduncle, large head and long snout, and large scales. Pectoral fins have 16-19 rays, pelvic fins from 9-10 rays, and dorsal fins have 10 rays. Lateral line scales usually number between 75-78, scales above and below the lateral line range between 13-16 and 9-11, respectively. Its subterminal mouth is large with a papillose, deeply incised lower lip (Miller 1973).

It is closely related to the Tahoe sucker (*Catostomus tahoensis*), a widely distributed species occupying the Lahontan Basin of northeastern California and northern Nevada. The Owens sucker is distinguished by its dusky abdomen and the absence of a red lateral stripe that characterizes males of most western United States species of sucker (Miller 1973). Structure of

its mandible, pharyngeal arch, and tripus, and low lateral line scale count (usually less than 80) also distinguish it from the Tahoe sucker (Miller 1973).

Although no studies have examined Owens sucker habitat requirements, life history, abundance, or current distribution, substantial information can be gathered from recent and historical Owens Basin fisheries studies and knowledge of Tahoe sucker ecology. Owens suckers occupy lakes and streams, and, like Tahoe suckers, they probably require gravel substrates in fluvial habitats for spawning (La Rivers 1962, Moyle 1976). Springtime spawning by Tahoe suckers, and the presence of Owens sucker and Tahoe sucker larvae and juveniles during May and June, indicates that spawning occurs during spring (Miller 1973, La Rivers 1962). Tahoe suckers reach sexual maturity as early as age four (Willsrud 1971), and they are known to live as long as 27 years (Scoppettone 1988). Tahoe sucker fecundity varies with size. Willsrud (1971) reported females from Lake Tahoe measuring 6 in. (15 cm) and 17 in. (43 cm) fork length carried 2,415 and 35,556 eggs, respectively. Both species also feed nocturnally on invertebrates (e.g., insects, mollusks, etc.), vegetation, and detritus gleaned from the substrate. Dienstadt *et al.* (1985, 1986) reported Owens suckers in fluvial habitats were most common in runs located where riffles are small and scarce. In lakes, larval and juvenile Owens suckers occupy shallow littoral habitats (Miller 1973).

Four species comprise the Owens Basin native fish assemblage, including Owens sucker, Owens tui chub (*Gila bicolor snyderi*), Owens pupfish (*Cyprinodon radiosus*), and Owens speckled dace (*Rhinichthys osculus* ssp.). No ecological studies have examined this assemblage, but studies of other western Great Basin stream fishes (with assemblages consisting of trout (*Salmo* spp.), suckers, tui chubs, speckled dace, and Lahontan redside (*Richardsonius egregius*)) indicate that there is little interaction among native members of the Owens Basin assemblage. Moyle and Vondracek (1985) found niche overlap was low among fishes in the Martis Creek assemblage in the Truckee River system. They also concluded that populations in this assemblage are regulated mostly by environmental factors, rather than by predation and competition. In these studies, Tahoe suckers preferred habitats close to the substrate in deep, slow moving water. Similar conclusions were reached by Sada (1990) in studies of a Great Basin stream fish assemblage that was dominated by Tahoe sucker, speckled dace, and Lahontan

redside. His microhabitat observations documented moderate niche overlap among species, but that available habitats were partitioned by each species. Experimental studies examining effects of density and species composition on habitat use indicated that competitive interactions are minimal and that changes in habitat use are density dependent (Sada 1990). These studies, probable ecological requirements of Owens Basin native fishes (as determined from knowledge about closely related species), and low species diversity all indicate that interactions between Owens Basin native fishes is low.

Recent lake and stream surveys in Long Valley and northern Owens Valley document Owens sucker populations from several areas. They are common in Crowley and Convict Lakes in the upper Owens River drainage (including Mammoth Creek and Hot Creek in Long Valley), and in Owens Valley from Bishop Creek, Rock Creek, irrigation canals near Bishop, and the Owens River through Pleasant Valley (Deinstadt *et al.* 1985, 1986). Knapp (pers. comm. March 25, 1995) reported them as uncommon in Mammoth Creek, and Jenkins (1990) reported them as common in the Owens Gorge near Crowley Lake Dam. In 1988 and 1989, Sada (field notes) found Owens suckers in lower Horton Creek, lower Rock Creek and Pine Creek, lower Bishop Creek, north and south McNally canals near Laws, lower Hot Creek, and in upper Owens River near the Mono Basin portal. Kratz *et al.* (1991) did not find suckers in Fish Slough during 1990, and they have not been recently documented from southern Owens Valley. Owens suckers also occur in several locations outside their native range, including June Lake in the Mono Basin, Sabrina Lake in upper Bishop Creek, and in Sespe Creek of the Santa Clara River Basin in southern California (Wells and Dianna 1975).

These surveys indicated that Owens suckers persist in natural and regulated habitats (e.g. irrigation canals and reservoirs) and fish assemblages dominated by introduced trout (e.g., brown trout, *Salmo trutta*, and rainbow trout, *Oncorhynchus mykiss gairdneri*) and cyprinids (e.g., carp, *Cyprinus carpio*), but not in assemblages dominated by strong predators (e.g., members of the Family Centrarchidae such as largemouth bass, *Micropterus salmoides*, smallmouth bass, *Micropterus dolomieui*, and bluegill, *Lepomis macrochirus*). Dominance of the southern Owens Basin fish assemblage by these predators may explain why native fish no longer occur in this area.

Management Recommendations. No conservation programs have been implemented to enhance Owens sucker status, however, protection of populations in Pleasant Valley, Warm Springs, Fish Slough, Birchim Canyon, Hot Creek, and Blackrock Conservation Areas is identified in the Owens Basin Wetland and Aquatic Species Recovery Plan (U.S. Fish and Wildlife Service 1996). Moyle *et al.* (1995) did not recommend any protective measures for Owens sucker populations, but they recommend that populations be monitored to determine if there are future declines in its status. Threats to Owens sucker include impacts of non-native fishes and water management strategies that dry habitats. Deleterious non-native fishes include predators and competitors, and introduced species that may hybridize with Owens suckers. Management guidelines recommended to ensure continuing viability and population and distributional increases for the Owens sucker are:

1--Reestablish populations in Conservation Areas described in the Owens Basin Wetland and Aquatic Species Recovery Plan.

2--Manage aquatic habitats in Conservation Areas to protect Owens suckers as a part of the Owens Basin native fish assemblage by minimizing impacts of deleterious non-native fishes.

3--Reestablish populations within its native range, and outside Conservation Areas whenever possible.

4--Maintain minimum flow in major irrigation canals to provide for parental Owens sucker populations that will repopulate smaller ditches that are frequently dried by diversion.

B. Wongs springsnail (*Pyrgulopsis wongi*). Status: CDFG— Special Concern; USFWS—Species of Concern.

Pyrgulopsis wongi was described from collections made from springs in Birchim Canyon, Inyo County during 1988 (Hershler 1989). It is a moderate to small-sized species with a low conical to globose shell. The shell is 1.2 - 3.0 mm high with 3.25 - 4.5 well rounded whorls bordered by slightly angulated shoulders. Its penis is 'massive' with a large filament and moderately sized lobe. Two large swellings with 7-12 glandular ridges distinguish the ventral

penis (Hershler 1989). Wongs springsnail is currently known from approximately 50 spring habitats scattered throughout the eastern Sierra region in California and Nevada (Table 2). Owens Basin populations are scattered from Little Lake to the Mono Basin (including Benton and Long Valleys). Outside the Owens Basin it occurs in Deep Springs, Teels Marsh, and Huntoon Valleys (Hershler 1989, Hershler and Pratt 1990, Sada field notes 1992). Additional surveys are needed to accurately determine its entire distribution. Wongs springsnail is one of four mollusks in the Family Hydrobiidae occupying Owens Basin waters. Distribution of these species rarely overlap. Wongs springsnail is syntopic with Owens springsnail (Pyrgulopsis owensensis) only at Toll House spring in the White Mountains.

Knowledge of springsnail ecology exists mostly from observations made during taxonomic and distributional studies, and ecological studies of an Owens springsnail population (June 25, 1994 memorandum from D. Sada to T. Russi, U.S. Bureau of Land Management, Bishop, CA and March 8, 1995 memorandum from D. Sada to T. Russi, U.S. Bureau of Land Management, Bishop, CA). Springsnails occupy habitats as varied as alkali lakes, rivers, and small springs and streams throughout North America. Recent examination of many spring habitats throughout the Great Basin indicates that a number of new species occupy many endorheic basins (Hershler 1994). *Pyrgulopsis wongi* is known to occupy only small, persistent, cold water springs and streams located below 7,500 ft (2,286 m) with good water quality. These characteristics also characterize habitats occupied by other springsnail species throughout the Great Basin (Hershler and Sada 1987, Hershler 1994). Close taxonomic relationship between Owens and Wongs springsnails indicates that demography and habitat requirements of both species may be similar. Recent work indicates there is little difference between winter and summer Owens springsnail population sizes in the White Mountains (June 25, 1994 memorandum from D. Sada to T. Russi, U.S. Bureau of Land Management, Bishop, CA and March 8, 1995 memorandum from D. Sada to T. Russi, U.S. Bureau of Land Management, Bishop, CA).

Table 2. Location of *Pyrgulopsis wongi* habitats in Inyo and Mono Counties, California. Information compiled from Hershler (1989) and Hershler and Pratt (1990).

Site Name	Valley	Legal Description
INYO COUNTY		
Little Lake	Owens	NW1/4 Sec. 17, T23S, R36E
Spgs. along Hogback Ck.	Owens	T20S, R36E (unmapped)
Spgs. along Summit Ck	Owens	NE1/4 Sec. 7, T20S, R37E
Cabin Bar Ranch	Owens	SW1/4 Sec. 6, T19S, R37E
Spgs. along Lubkin Ck.	Owens	SE1/4 Sec. 16, T16S, R36E
Spgs. along Tuttle Ck	Owens	NE1/4 Sec. 6, T16S, R36E
Spgs. along Hogback Ck	Owens	NW1/4 Sec. 2, T15S, R35E
Boron Spgs.	Owens	NW1/4 Sec. 22, T13S, R34E
Stream in Charlie Cyn.	Owens	SW1/4 Sec. 3, T13S, R34E
Spgs. S. of Warren Lake	Owens	NE1/4 Sec. 16, T9S, R33E
Spgs. S. of Shannon Cyn.	Owens	SW1/4 Sec. 23, T8S, R33E
Spgs. along upper Pine Ck.	Owens	NE1/4 Sec. 26, T6S, R30E
Spgs. in Birchim Cyn.	Owens	SE1/4 Sec. 9, T6S, R31E
Spg. in Owens Gorge	Owens	SW1/4 Sec. 31, T4S, R31E
French Spg.	Owens	NW1/4 Sec. 31, T14S, R37E
Barrel Spgs.	Owens	NE1/4 Sec. 19, T12S, R36E
Spg. at Toll House	Owens	NE1/4 Sec. 24, T8S, R34E
Corral Spg.	Owens	SW1/4 Sec. 3, T8S, R26E
Spgs. at Alabama Gates	Owens	SE1/4 Sec. 31, T14S, R36E
Reinhackle Spgs	Owens	SE1/4 Sec. 30, T14S, R36E
Round Valley Spgs.	Owens	NW1/4 Sec. 25, T5S, R31E
Round Valley Spgs.	Owens	SE1/4 Sec. 31, T6S, R31E
Spgs. in Marble Cyn.	Owens	SE1/4 Sec. 35, T7S, R35E
Spgs. north of Big Pine	Owens	NW1/4 Sec. 16, T9S, R33E
McMurry Meadow	Owens	NW1/4 Sec. 22, T10S, R33E
Spgs. north side of Red Mtn.	Owens	SE1/4 Sec. 31, T11S, R34E

Table 2., Cont.

Site Name	Valley	Legal Description
McGann Spg.	Owens	NW1/4 Sec. 4, T13S, R34E
Spgs. north of McGann Spg.	Owens	NW1/4 Sec. 36, T12S, R33E
Tub Spgs.	Owens	SE1/4 Sec. 17, T13S, R34E
Spgs. north of Independence Ck.	Owens	SW1/4 Sec. 21, T13S, R34E
Spgs. southwest of Lone Pine	Owens	SE1/4 Sec. 2, T16S, R36E
Spgs. along lower Diaz Ck.	Owens	SE1/4 Sec. 5, T16S, R36E
Spgs. along upper Diaz Ck.	Owens	Sec. 15, T16S, R36E
Spgs. south of Carrol Ck.	Owens	Sec. 31, T16S, R36E
Stream in Talus Cyn	Owens	T21S, R37E (unmapped)
Spgs. in Johnson Cyn.	Owens	T21S, R37E (unmapped)
Spgs. north of Johnson Cyn	Owens	T21S, R37E (unmapped)
Tunawee Cyn. stream	Owens	T21S, R37E (unmapped)
Spgs. south of Tunawee Cyn.	Owens	T22S, R37E (unmapped)
Sacatar Cyn. stream	Owens	Secs. 3 & 4, T23S, R37E
Antelope Spgs.	Deep Springs	NW1/4 Sec. 24, T7S, R35E
MONO COUNTY		
Spgs. along Marble Ck.	Hammil	SE1/4 Sec.28, T2S, R32E
Spg. in Blind Spgs. Valley	Benton	SW1/4 Sec. 36, T1S, R31E
Spg. in West Queen Cyn	Benton	SW1/4 Sec. 16, T1N, R32E
Truman Spg	Benton	SW1/4 Sec. 7, T1N, R32E
Conway Summit Spg.	Mono Basin	NW1/2 Sec. 2, T2N, R25E
Layton Spgs.	Long	SE1/4 Sec. 36, T3S, R29E
River Spgs.	Adobe	NE1/4 Sec. 19, T1N, R31E
Pizona Spg	Adobe	SE1/4 Sec. 4, T1N, R31E
Upper Pizona Spg.	Adobe	SE1/4 Sec. 11, T1N, R31E

During these studies, Owens springsnails were limited to the spring source and 1650 ft (500 m) of spring brook supporting permanent aquatic habitat. Their abundance was correlated with the presence of aquatic vegetation, sand and gravel substrates, and water current velocities less than 0.6 ft/sec (18 cm/sec). Springsnails feed on algae gleaned from substrate and vegetation. They are oviparous and are believed to live approximately one year.

Springsnails cannot live outside of an aquatic environment and they appear sensitive to impacts from excessive livestock grazing, impoundment, decreases in discharge, and non-native mollusks (Hershler and Sada 1987, Hershler 1994). Historical distribution of Wongs springsnail in the Owens Basin is unknown; however, its current distribution and characteristics of habitat use by other Great Basin springsnail species indicate that Wongs springsnail occupied all valley-floor springs with good water quality. Ground water use and extreme modification of springs to divert discharge and dry sources have probably extirpated populations. These impacts have eliminated many springsnail populations throughout the western United States (Taylor 1980, Land 1973, Hershler and Sada 1987).

Management Recommendations. No conservation programs have been implemented for Wongs springsnail. Populations occur in Hogback, Southern Owens, Birchim Canyon, Toll House, Math., and Mule Spring Conservation Areas identified in the Owens Basin Wetland and Aquatic Species Recovery Plan (U.S. Fish and Wildlife Service 1996). For these areas, and for other areas where Wongs springsnail exists, the following guidelines which are necessary to protect Wongs springsnail from extirpation:

1--Maintain existing spring discharge in habitats occupied by Wongs springsnail.

2--Initiate spring discharge monitoring programs near Wongs springsnail habitats threatened by adverse impacts of ground water removal.

3--Maintain existing water quality and temperature regimes in Wongs springsnail habitats.

4--Protect spring sources, and at least 150 m of spring brook and 20 m of riparian vegetation on either side of the spring brook, from adverse impacts of livestock grazing and diversion. Spring water can be used without jeopardizing a population when this

length of habitat is maintained in natural condition. Downstream from this, water may be captured in a drywell for delivery to troughs or impoundments.

5--Conduct habitat and demography studies to determine characteristics of habitat availability, habitat use, and population size.

6--Initiate a long term monitoring program to determine conservation status of Wongs springsnail populations in the Owens Basin.

C. Desert tryonia (*Tryonia protea*). Status: CDFG—Special Concern; USFWS—None.

The desert tryonia is a springsnail that is believed to be widespread in western Utah, southeastern California, Baja California, and southwestern Arizona (Taylor 1966, 1981, 1985), but the taxonomic relationship of disjunct populations remains unclear (Hershler 1989). It is a relatively close relative of species in the genus *Pyrgulopsis*, but differentiated by shell and penial morphology (Hershler and Thompson 1987). Gould (1855) described *Tryonia protea* from a collection made by William P. Blake during the Pacific Railroad surveys. In a list of California mollusks, Taylor (1981) reported *Tryonia protea* only from springs near Salton Sea, Imperial County (the type locality), and Hot Creek, Long Valley, Mono County. This distribution is confirmed by morphological (Hershler 1989) and genetic (Hershler 1994a) analyses, but it is highly unusual for such close genetic and morphological similarity to be found in distantly separated springsnail populations. Recent springsnail biogeography studies indicate that the typical pattern is for differentiation and speciation to be high among isolated populations occupying endorheic drainages of the Great Basin (Hershler and Sada 1987, Hershler 1989, Hershler and Pratt 1990, Hershler 1994b).

Tryonia protea is a moderate to large springsnail with an elongate-conic to turriform shell that is between 3mm-7mm high. Shell whorls are rounded, vary in number from 4.75-6.25, and the body whorl is 55-61 percent of shell height (Hershler 1989).

Three desert tryonia populations are known in the Owens Basin, all of which occur in Long Valley thermal springs or streams (Hershler 1994a). These populations occupy a small spring tributary to Little Alkali Lake (NE1/4 Sec. 29, T4S, R29E), Whitmore Hot Springs (NE1/4 Sec. 6, T4S, R29E) and a short reach of Hot Creek (in NE1/4 Sec. 25, T3S, R27E and

NW1/4 Sec. 18, T3S, R29E). Total length of occupied habitat at each site is believed to be less than 650 ft (200 m). These habitats are also historical and current localities for Long Valley speckled dace (*Rhinichthys osculus* ssp.) (Sada 1989), which is a Federal Species of Special Concern (USFWS 1994).

No studies have examined *Tryonia* life history or ecology, however, they may be similar to species in the genus *Pyrgulopsis*. Observations made during taxonomic studies indicate that *Tryonia* and *Prygulopsis* species cannot live outside of an aquatic environment and they both require habitats with good water quality. Species in both genera probably live less than one year, and all species are oviparous. Members of both genera feed on algae and other material gleaned from substrate and vegetation. *Tryonia* and *Pyrgulopsis* species differ in the habitats each uses. *Tryonia* are restricted to thermal habitats where they live on either aquatic vegetation or within fine substrates (Hershler and Sada 1987). They are rarely found more than several hundred meters downstream from a spring source. In some habitats outside of the Owens Basin they may be found with *Pyrgulopsis* species that prefer cooler water and the surfaces of vegetation. In these habitats, *Tryonia* species occur beneath the surface of fine substrates (Hershler and Sada 1987).

Management Recommendations. Possible threats to Owens Basin desert tryonia populations include activities that may degrade water quality and physical characteristics of aquatic habitats. These may occur in areas used for recreation and livestock grazing when excessive nutrients or other compounds pollute aquatic habitats. They may also occur when activities affect habitats by diverting flows or modifying historical discharge rates or thermal characteristics. Addition of chlorine to the Whitmore Hot Springs swimming pool may be detrimental to the population in this habitat. Exploitation of ground water resources for geothermal power generation may alter thermal regimes of Owens Basin habitats occupied by desert tryonia. Ground water use, diversion, and livestock grazing have been cited for causing elimination of many springsnail populations throughout the western United States (Taylor 1980, Land 1973, Hershler and Sada 1987). No conservation programs have been implemented for the desert tryonia. It occurs in Whitmore, Little Alkali, and Hot Creek Conservation Areas described in the Owens Basin Wetland and Aquatic Species Recovery Plan (USFWS 1996). The following

management guidelines are offered to provide information necessary for aquatic habitats management that is consistent with protecting desert tryonia populations from extirpation:

1--Maintain existing discharge in desert tryonia habitats.

2--Initiate spring discharge monitoring programs near habitats threatened by adverse impacts of ground water removal.

3--Maintain existing water quality and temperature regimes.

4--Initiate studies to determine characteristics of desert tryonia ecology and life history.

5--Determine management strategies to minimize impacts of livestock grazing, recreation, and ground water utilization on desert tryonia.

6--Initiate a monitoring program to sample populations and determine the conservation status of Owens Basin desert tryonia populations.

D. Least Bell's vireo (*Vireo bellii pusillus*). Status: CDFG—Endangered; USFWS—Endangered.

This vireo is a small, insectivorous bird of the passerine Family Vireonidae that is recognized by its greenish back, black wings with white wingbars, and black eyes with prominent light eye rings. This subspecies is endemic to southern California and northern Baja California. It inhabits and nests in low riparian growth that is near water or in dry river bottoms. Feeding occurs throughout the riparian corridor but preferred nesting habitat is limited to areas with dense detritus and living vegetation. Studies conducted along the Santa Ynez River in southern California documented mean nest height of approximately 1 m from the ground in arroyo willow, red willow, and cottonwood vegetation (Olson and Gray 1989). It is listed as endangered by the U.S. Fish and Wildlife Service, and a recovery plan has been prepared outlining its recovery (USFWS 1988). Although Owens Basin birds are protected by this listing, habitats in the Owens basin are comparatively small and there is little potential for the region to support a large population of vireos. Since enhancing least Bell's vireo habitat in the Owens Basin will not result in large increases in abundance, this area is considered to be critically important to its recovery.

Its historical distribution included the central valley of California and the interior valleys of central and southern California. Breeding birds also occurred in Owens Valley, Death Valley,

and the Mojave River drainage. Although it was once a "tolerably common" summer resident in the Owens Basin (Fisher 1893), there have been only two known sightings in the Owens Basin since the turn of the century; these migrating birds were seen near Big Pine in 1976 and 1980 (CDFG NDDB 1994). The bird was not seen during an extensive survey of riparian and wetland birds of Inyo County in 1993 (Laymon and Williams 1994), however, nesting birds have been observed in other portions of the Death Valley system each of the past several years (Heindel and Heindel in litt). Laymon and Williams (1994) concluded that, "...this species has without doubt been extirpated from the Owens Valley because of brown-headed cowbird (Molothrus ater) parasitism over the past 70 years". Occasional sightings of least Bell's vireo in the Owens Valley during the past 20 years shows that the species may recolonize the area if management strategies are implemented to enhance its habitat and decrease cowbird impacts.

Management Recommendations. Least Bell's vireo breeding in the Owens Valley (this vireo was not a historical resident of higher Owens basin elevations) is likely to occur if structural diversity of riparian habitats are increased and nest-parasitism by brown-headed cowbirds is reduced. These actions would also aid the southwestern willow flycatcher and the yellow warbler (Laymon and Williams 1994), as well as other to riparian bird species nesting in the basin (Gaines 1974, Laymon 1987, Harris 1991). These improvements can be accomplished by implementing an integrated land use program to maintain dense under story riparian vegetation from adverse impacts of livestock grazing, wood cutting, and stream bank clearing. Although these actions should improve under story vegetation that is essential for vireo feeding and nesting, they may not be successful unless cowbird populations are also controlled. Management guidelines recommended to allow reestablishment of least Bell's vireo in the Owens basin are:

1—Manage riparian vegetation communities in accordance with potential identified by U.S. National Resource Conservation Service (NRCS) Ecological Site Descriptions for the Owens basin (NCRS 1995) and U.S. Bureau of Land Management (BLM) desired plant communities for springs and wet meadows and riparian zone proper functioning condition (U.S. Bureau of Land Management 1991 and 1995).

2—Manage riparian vegetation in the Owens Valley to achieve structural diversity that is similar to conditions that are upstream from Tinemaha Reservoir, lower Baker Creek, and the Owens River through Pleasant Valley.

3—Initiate cowbird control programs in selected areas and monitor the response of riparian bird populations to determine effects of brown-headed cowbirds on riparian bird nesting success.

4—Identify characteristics of habitats where negative impacts of cowbirds on native riparian bird nesting success is minimal.

5—Change land use strategies following recommendations made using information accumulated during monitoring.

E. Southwestern willow flycatcher (*Empidonax traillii extimus*). Status: CDFG—Endangered; USFWS—Endangered.

This is a small, gray-brown flycatcher (Passeriformes: Tyrannidae) with prominent wing bars and eye rings, and one of five, very similar Empidonax species. It inhabits dense riparian thickets in low-lying areas and mountain canyons throughout much of the southwestern U.S. and Mexico. It is a spring-summer resident of the Owens Valley. Nests are built at a height of approximately 1 m above the ground, with about 1 m of cover above the nest. Foliage density ranges from 50 - 70 percent (Sanders and Flett 1989). It is a comparatively late breeder, with egg incubation continuing into late June. Fledgling occurs in mid-August (Sanders and Flett ibid). Its abundance and distribution have declined as riparian vegetation has been diminished (from excessive livestock grazing, meadow erosion, and stream diversions) and of brown-headed cowbirds have increased and parasitized its nests (Serena 1982). Littlefield (1986) found significantly more willow flycatchers in areas ungrazed by livestock than in areas that had been grazed.

It was first noted in the Owens Valley by Fisher (1893), and it was observed as far north as Independence by Grinnell and Miller (1944). The NDDB (NDDB 1994) cites recent observations near June Lake (Mono Co. 1986), Laws (Inyo Co. 1986), and between Big Pine and Baker Creeks (Inyo Co. 1992), but none of these sightings were believed to be breeding birds. The Laws sighting was within the Laws Significant Natural Area (SNA), INY-027 (CDFG

1993). Laymon and Williams (1994) found southwestern willow flycatchers in Inyo County on Baker Creek (August 1993), the Owens River between Steward Lane and Tinemaha Reservoir (August 1993), and the Owens River between Pleasant Valley and northeast Bishop (July 1993). The latter was a breeding population.

Management Recommendations. As mentioned above for least Bell's vireo, enhancing the southwestern willow flycatcher also requires controlling nest-parasitism by brown-headed cowbirds and maintaining high quality, dense riparian vegetation. Management guidelines recommended to provide for southwestern willow flycatchers in the Owens basin are:

1—Manage riparian vegetation communities in accordance with potential identified by U.S. National Resource Conservation Service (NRCS) Ecological Site Descriptions for the Owens basin (NCRS 1995) and U.S. Bureau of Land Management (BLM) desired plant communities for springs and wet meadows and riparian zone proper functioning condition (U.S. Bureau of Land Management 1991 and 1995).

2—Manage riparian vegetation in the Owens Valley to achieve structural diversity that is similar to conditions that are upstream from Tinemaha Reservoir, lower Baker Creek, and the Owens River through Pleasant Valley.

3—Initiate cowbird control programs in selected areas and monitor the response of riparian bird populations to determine effects of brown-headed cowbirds on riparian bird nesting success.

4—Identify characteristics of habitats where negative impacts of cowbirds on native riparian bird nesting success is minimal.

5—Change land use strategies following recommendations made using information accumulated during monitoring.

F. Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*). Status: CDFG—Endangered; USFWS—None.

This is a California Endangered (listed 1988) species (Cuculiformes: Cuculidae) that winters in South America and breeds during summers in extensive riparian thickets or forests. It requires habitats with structural diversity that includes dense under story vegetation (usually

willow) and a nearly complete canopy cover in expansive woodlands. Layman and Halterman (1989) willow/cottonwood woodlands greater than 80 ha in areas and 600 m wide as optimum habitat, areas 41 ha - 80 ha and greater than 200 m wide as suitable habitat, and areas 20 ha - 40 ha and 100 m - 200 m wide as marginal habitat. Habitats must also support large insects (such as caterpillars, grasshoppers, and cicadas) which are its preferred food (Gaines 1977).

It disappeared from much of its range in the western U.S. following reductions in riparian habitat that accompanied intensive livestock grazing and woody-vegetation control programs. Riparian habitats were once extensive throughout much of California, but they have been drastically reduced as river systems have been channelized, diverted, and impounded, and because of excessive livestock grazing. As a consequence of habitat degradation, the species is at risk of extinction in California.

There is little historical information about the occurrence of yellow-billed cuckoos in the Owens Basin. Fisher (1893) recorded one observation, two specimens were collected during 1917 near Independence (specimens reside in the U. C. Berkeley Museum of Vertebrate Zoology [MVZ]), and Dawson (1923) sited cuckoos near Bishop. The NDDB (1994) reports more recent sightings of up to 8 individuals in willow groves and herbaceous meadows fed by seeps and springs on the Owens Valley Ranch (CDFG SNA INY-037) near Big Pine in 1968, 1977, 1991, and 1992, at Hogback Creek/Alabama Springs, Alabama Hills Recreation Area, 7 mi (10 km) north west of Lone Pine (CDFG SNA INY-061), and a single individual was observed in willows at the north end of Tinemaha Reservoir in 1992 (CDFG SNA INY-106). Laymon and Williams (1994) reported yellow-billed cuckoos occupying 150 ac (60 ha) of habitat at three sites in the Owens Valley. These included nonbreeding birds at Baker Creek in mixed riparian woodland and along the Owens River near Aberdeen Station Road in open mature willows. They also observed two breeding pairs and an unmated male in riparian vegetation dominated by young willows that occurred along the Owens River within the first 1.5 mi (3 km) upstream from Tinemaha Reservoir.

Laymon and Williams (1994) believed that cuckoos occupy nearly all of habitat that is presently suitable for them in the Owens Basin (which supports a breeding population estimated

at between 2 and 6 pairs). They also speculated that additional suitable habitat could be created through restoration planting, and management of spring and summer grazing.

Management Recommendations. Management of this rare migrant will involve protecting and enhancing riparian woodlands where breeding aggregations have been observed, such as on the Owens Valley Ranch, the Alabama Hills Recreation Area, and along the Owens River above Tinemaha Reservoir. Also, their abundance may increase with improved riparian habitat management. Management of cuckoos should be facilitated with the establishment of the proposed Baker Creek, Hogback, and Southern Owens Conservation Areas (USFWS 1996), where recent sightings of yellow-billed cuckoos have occurred. Suitable habitat can be enhanced and expanded by thinning and control of exotic black locust (particularly at Baker Creek), and by planting black willow and cottonwood to supplement existing native vegetation. In addition to the Conservation Areas (ibid.), special attention and enhancement should be directed to the riparian area immediately upriver from Tinemaha Reservoir, as this was most recently observed (1993) to support the only two breeding pairs of cuckoos in the Owens Valley (Laymon and Williams, 1994). This area supports good riparian understory, essential cuckoo feeding habitat, and every effort should be made to maintain and enhance this element. The Owens River through Pleasant Valley was judged to have suitable habitat but no cuckoos were observed there in 1993 (ibid.), and multispecies recovery efforts there should also include habitat enhancement for cuckoos. While restoration of woodlands should increase cuckoo breeding sites, such efforts will also necessarily need to provide broad habitat corridors within restoration and Conservation Areas to promote gene flow within these areas. In addition to enhancing woodland over story for breeding, it will be essential to enhance the riparian under story for feeding, best accomplished by managing grazing in cuckoo habitat. All of these management activities in concert should result in more and better cuckoo breeding and feeding habitat, thereby increasing population size. Management guidelines recommended to provide for yellow-billed cuckoos in the Owens basin are:

> 1—Manage riparian vegetation communities in accordance with potential identified by U.S. National Resource Conservation Service (NRCS) Ecological Site Descriptions for the Owens basin (NCRS 1995) and U.S. Bureau of Land Management (BLM) desired

plant communities for springs and wet meadows and riparian zone proper functioning condition (U.S. Bureau of Land Management 1991 and 1995).

2—Manage riparian vegetation in the Owens Valley to achieve structural diversity that is similar to conditions that are upstream from Tinemaha Reservoir and lower Baker Creek.

3—Initiate monitoring programs to determine changes in abundance and habitat used by yellow-billed cuckoos in the Owens Valley.

4—Change land use strategies following recommendations made using information accumulated during monitoring.

G. Least bittern (*Ixobrychus exilis*) - rookery sites only. Status: CDFG—Special Concern; USFWS—None.

The least bittern (Ciconiiformes: Ardeidae) winters in Mexico and it is an uncommon summer resident of central and southern California. Least bitterns prefer marshland habitats where they occupy dense emergent vegetation for nesting. Feeding occurs along the vegetation margin where it captures fish, crayfish, insects, and amphibians in open water by quietly stalking through vegetation. They seem to prefer marshes with nearly equal proportions of open water and emergent vegetation, and they avoid marshes with either extensive open water or extensive, dense vegetation (A. Kirk pers. comm.). Nesting least bitterns are very sensitive to fluctuations of water levels, which should be avoided during the nesting season (May through September) to ensure incubation and fledging success. Thus, subjecting marshes to water-level manipulation should improve bittern habitat.

It is uncommon in the Owens Basin, with only two entries in NDDB (1994), both in Inyo County. Both of these were apparent rookery sites because they included both adult and juvenile birds. These sites were Billy Lake, 3 mi (4 km) east-northeast of Independence, where nesting activity was observed in 1991 (July-August) and 1992 (May-August), and Cottonwood Marsh, along the west edge of Owens Lake, 12 mi (19 km) south of Lone Pine, during May-August 1992. Both habitats are freshwater marshes with emergent vegetation. A. Kirk (pers. comm.) also reported successful least bittern breeding at these sites during the 1991-1994 breeding seasons. He also reported adult bitterns at Billy Lake between 7 April and 2 October, with

nestlings and juveniles present between 27 May and 2 September (Kirk's observations are not yet included in the NDDB). No bitterns were observed during the 1993 surveys of riparian and wetland breeding birds in the lower Owens Valley (Laymon and Williams 1994).

Management Recommendations. Least bittern management requires maintaining marshes with approximately amounts of open water and emergent vegetation. Cottonwood Marsh lies within the proposed Southern Owens Conservation Area (USFWS 1996), and its management should be consistent with least bittern husbandry. Also, Billy Lake, the most consistent and successful breeding locality of least bitterns in the Owens Valley, is near the southern end of the proposed Blackrock Conservation Area (ibid.). Every effort should be made to include Billy Lake within this Conservation Area. Ongoing or proposed activities that could affect bittern habitat at Cottonwood Marsh are the Lower Owens River Rewatering Project, the Owens Lake Flood Irrigation Project, and mining for Trona. Least bittern habitat in the Owens Basin can be enhanced with the following management:

1—Controlling vegetation growth at Billy Lake and Cottonwood Marsh to provide an equal mix of emergent vegetation and open water. This can usually be accomplished in conjunction with accepted management practices that enhance marshlands for waterfowl. Vegetation reduction should occur during the non-breeding season by water draw-down, drying, and then burning such that a patchwork of habitat is maintained with the appropriate vegetation-water ratio that is in the most suitable successional stage for least bitterns.

2—Monitor populations to determine trends and affects of land uses on nesting success.

H. Osprey (*Pandeon haliaetus*) - breeding sites only. Status: CDFG—Special Concern; USFWS—None.

The osprey (Falconiformes: Accipitridae) is widely distributed but uncommon throughout much of North America, where it inhabits freshwater and marine shorelines and preys upon fish. It requires large trees and snags in open forest habitats for nesting. Large adjacent trees are also necessary for perching before approaching a nest. Food includes fish, amphibians, birds, reptiles, and large invertebrates that it takes from open clear water.

In the Owens Valley the only record of breeding ospreys consist of a single pair observed from April-August 1992 on a nest at Tinemaha Reservoir, Inyo County (CDFG SNA INY-106) NDDB (1994). This pair was nesting in an existing nest with 3 hatchlings by 12 June. The hatchlings were flapping in the nest on 14 July, but had disappeared by 16 July, probably from predation (T. and J. Heindel pers. comm.). No other records of breeding Ospreys in the Owens Valley are available, and none were noted by Laymon and Williams (1994) in their intensive 1993 survey of breeding birds. The most likely places are where osprey may establish nesting sites in large trees adjacent to existing reservoirs and where fish may be readily obtained, such as Tinemaha, and Upper and Lower Haiwee Reservoir.

Management Recommendations. An intensive effort to locate nesting sites near existing reservoirs in the Owens Basin should be undertaken during the summer nesting season. Where nests or adult ospreys are found, every effort should be made to inform the fishing and boating public of their presence, and to discourage encroachment while nests are occupied. It is also imperative to maintain stands of suitable mature nesting trees, especially cottonwoods, adjacent to these reservoirs.

I. Yellow rail (*Coturnicops noveboracensis*). Status: CDFG— Special Concern; USFWS—None.

Yellow rail (Gruiformes: Rallidae) occur mainly in Canada and the northern United States. It occasionally winters in coastal California where it prefers freshwater marshes and marshy meadows. It formerly nested east of the Sierra Nevada in Mono County, but now it is regarded as an accidental sighting in California (Small 1974). There are no records of yellow rail in the Owens Basin in the NDDB (1994), nor in the wetlands breeding bird survey of the Owens Valley by Laymon and Williams (1994). For the purpose of these Guidelines, this species must be considered insignificant until positive information on its occurrence in the Owens Basin becomes available.

Management Recommendations. Land managers should be alerted to the possible occurrence of this marsh inhabitant, and, if seen, every effort should be made to encourage its continuing presence. It is likely that the proposed Conservation Areas (USFWS 1996) will

provide habitat enhancement that will attract these birds. Management for least bittern should also benefit yellow rail.

J. Western snowy plover (*Charadrius alexandrinus nivosus*) - interior population, breeding sites only. Status: CDFG—Special Concern; USFWS—None.

In California, the western snowy plover (Charadriiformes: Charadriidae) is a summer resident and migrant that occupies coastal habitats and shorelines of Great Basin lakes where it feeds on insects (Riser 1985). It suffered a decline in California that is correlated with recreation-related disturbances affecting nesting sites along coastal beaches. Even though less subject to recreational disturbance, inland populations have also declined during at least the last two decades.

Significant, but declining, snowy plover populations are resident along the shorelines of the now dewatered Owens Lake. Prior to dewatering of the lake, Fisher (1893) noted that many colonies, feeding on the seemingly inexhaustible supply of brine flies, occurred at close intervals in suitable localities all around the shoreline. More recently, population declines have been documented, with 499 adults around the lake in 1978, 194 birds in 1988, 141 individuals in 1990, and 100 in 1993 (Laymon and Williams 1994). Reasons for this decline are poorly understood, but it is believed to be attributed to disturbance by grazing livestock and diminishing habitat. The 499 birds observed in 1978 represented the single largest inland population in California, comprising 23 percent of all inland snowy plovers in the state (Page and Stenzel 1979). In 1978, the second-largest inland population occurred at Mono Lake; present status of this population is not available. A small breeding population of snowy plovers at Tinemaha Reservoir (NDDB, 1994; CDFG SNA INY-106) has only been observed intermittently (e.g., 1978 and 1992) on an exposed flat during drought years.

At Owens Lake, breeding populations currently occupy three sites along the original western lake shoreline, where permanent or semi-permanent seeps of water create small ponds or pools that support brine flies. These sites are described in detail by Laymon and Williams (1994), and are designated, from north to south, as North Seeps, Cottonwood Springs, and Ash

Creek Springs. Each of these sites is supported by groundwater seepage that provides habitat for snowy plover food.

Snowy plover habitat at Owens Lake appears to be improved by on-going projects. The Great Basin Unified Air Pollution Control District (GBUAPCD) is conducting experimental flood-irrigation projects (FIP) as a means to control emission of airborne particulate pollutants from the lake bed. Two projects, denoted as the Keeler FIP and the South FIP (T. Schade pers. comm.), spread water over portions of Owens Lake and create pools that attracts brine flies, other insects, marsh vegetation, and birds. In the spring of 1996, sufficient water occurred at South FIP to attract brine flies and up to 60 snowy plovers, some of which attempted to nest (Schade ibid.). It is likely that the GBUAPCD will expand flood irrigation on the bed of Owens Lake still further, creating the potential to create additional snowy plover habitat (Schade ibid.). Rewatering portions of the lower Owens River may also create additional snowy plover habitat.

Management Recommendations. Snow plover conservation in the Owens Valley should focus on populations around Owens Lake. A number of management recommendations are made by Laymon and Williams (1994) snowy plover enhancement and protection. These guidelines state that ". . . it is vital to maintain the present levels of seepage and to try to restore some habitat by allowing more freshwater to seep onto the lake bed in certain areas". In addition, we recommend:

1—Increasing and enhance snowy plovers by integrating their habitat needs into flood irrigation projects that are currently being undertaken by GBUAPCD and the proposed Lower Owens River Rewatering Project.

2—Managing livestock grazing so that snowy plover breeding success is not adversely affected (primarily during the nesting period (April through July; peak nesting May - June).

3—Maintain existing discharge from springs surrounding Owens Lake.

4—Initiate spring discharge monitoring programs near snowy plover habitats to avoid adverse impacts of nearby ground water removal.

5—Monitor the Owens Lake population to determine population trends and to accumulate habitat information that can be used to change land use so that plover abundance does not decline.

K. Yellow warbler (*Dendroica petechia brewsteri*) - breeding sites only. Status: CDFG—Special Concern; USFWS—None.

The yellow warbler (Passeriformes: Parulidae) is a summer breeding visitor throughout many of California's lowlands. It migrates south to spend winters in Mexico and Central and South America. It breeds in mostly deciduous riparian woodlands with dense undergrowth, but it is also known to nest in montane shrubbery within conifer forests (Ryser 1985). It feeds on insects and spiders (Small 1974).

This bird was once a common breeder in the Owens Valley (Fisher 1893), and Grinnell and Miller (1944) also listed it as common in 1944. More recently, it has declined from adverse impacts by reductions in riparian habitat and brown-headed cowbird nest parasitism. Its population in the Owens Basin is now very small and in danger of extirpation (Laymon and Williams 1994). Breeding populations have been observed recently on Baker Creek near Big Pine, along the Owens River from Pleasant Valley to Bishop (Laymon and Williams 1994), and in Birchim Canyon in Round Valley (J. & D. Parker, pers. comm.). At this latter locality, 15 - 20 birds were seen during May-June 1992, 1993 and 1994, and successful breeding was confirmed in June 1993. This area is in the Round Valley Conservation Area (USFWS 1996).

Management Recommendations. Willow thickets that are the preferred habitat of the yellow warbler requires require management that is consistent with recommendations made above for southwestern willow flycatchers and least Bell's vireo. These management practices will be aided by the incorporation of the known populations of the yellow warbler into the proposed Round Valley and Baker Creek Conservation Areas (USFWS 1996). In addition, steps should be taken to improve riparian habitat throughout the basin and reduce brown-headed cowbird nest parasitism. Management guidelines recommended to provide for yellow warblers in the Owens basin are:

1—Manage riparian vegetation communities in accordance with potential identified by U.S. National Resource Conservation Service (NRCS) Ecological Site Descriptions for the Owens basin (NCRS 1995) and U.S. Bureau of Land Management (BLM) desired plant communities for springs and wet meadows and riparian zone proper functioning condition (U.S. Bureau of Land Management 1991 and 1995).

2—Manage riparian vegetation in the Owens Valley to achieve structural diversity that is similar to conditions that are upstream from Tinemaha Reservoir, lower Baker Creek, and the Owens River through Pleasant Valley.

3—Initiate cowbird control programs in selected areas and monitor the response of riparian bird populations to determine effects of brown-headed cowbirds on riparian bird nesting success.

4—Identify characteristics of habitats where negative impacts of cowbirds on native riparian bird nesting success is minimal.

5—Change land use strategies following recommendations made using information accumulated during monitoring.

L. Yellow-breasted chat (*Icteria virens*) - breeding sites only. Status: CDFG— Special Concern; USFWS—None.

The yellow-breasted chat breeds is an uncommon summer resident of riparian thickets throughout much of California, and it migrates south to spend winters in Mexico and Central America. Its preferred habitat is dense thickets of willow and other brushy riparian vegetation (Ryser 1985), which is similar to other riparian birds discussed in these Guidelines. The chat feeds on insects, spiders that are gleaned from vegetation, and it will also forage on small fruits and berries. Its abundance has declined throughout California because of deteriorated riparian habitat conditions and nest parasitism by brown-headed cowbirds. It remains common in the eastern Great Basin (Ryser 1985).

Around the turn of the century this species was moderately common in the Owens Valley (Fisher 1893), but it has declined with increased nest parasitism by the brown-headed cowbird (Laymon and Williams 1994) and degraded riparian habitat conditions. Yellow-breasted chats

have been observed in recent years at several sites in the Owens Valley. Since the bird migrates here for breeding, all of these sites must be considered as potential breeding sites, and should be managed appropriately. Breeding chats were observed during the summer of 1993 by Laymon and Williams (1994) at Hogback Creek (CDFG SNA INY-061) near Lone Pine, Baker Creek (CDF&G SNA INY-037) near Big Pine, and along the Owens River north of Lone Pine, from Steward Lane to Tinemaha Reservoir and between Pleasant Valley and Bishop. For three successive years (1992 - 1994) small numbers of chats have been consistently observed in Birchim Canyon, Round Valley, during May and June (J. and D. Parker, pers. comm.). The NDDB reports the occurrence of four adult males and a juvenile between April and June 1992 at Hogback Creek in the Alabama Hills Recreation Area, and 1-2 chats from May-July 1992 at Baker Meadows, near Big Pine.

Management Recommendations. Management for this species also requires habitat management that is consistent with that is necessary for other riparian birds that breed in riparian zones, and that are discussed above. Chat habitat, nesting potential, and population size can be enhanced by moderating livestock grazing in riparian zones and by controlling brown-headed cowbirds. Incorporation of these activities into management of several proposed Conservation Areas (e.g., Round Valley, Baker Creek, and Hogback) (USFWS 1996) will improve its status in the Owens Basin. Habitat along the Owens River through Pleasant Valley is also important for the chat. Management guidelines recommended to provide for yellow-breasted chat in the Owens basin are:

1—Manage riparian vegetation communities in accordance with potential identified by U.S. National Resource Conservation Service (NRCS) Ecological Site Descriptions for the Owens basin (NCRS 1995) and U.S. Bureau of Land Management (BLM) desired plant communities for springs and wet meadows and riparian zone proper functioning condition (U.S. Bureau of Land Management 1991 and 1995).

2—Manage riparian vegetation in the Owens Valley to achieve structural diversity that is similar to conditions that are upstream from Tinemaha Reservoir, lower Baker Creek, and the Owens River through Pleasant Valley.

3—Initiate cowbird control programs in selected areas and monitor the response of riparian bird populations to determine effects of brown-headed cowbirds on riparian bird nesting success.

4—Identify characteristics of habitats where negative impacts of cowbirds on native riparian bird nesting success is minimal.

5—Change land use strategies following recommendations made using information accumulated during monitoring.

M. Bank Swallow (*Riparia riparia*). Status: CDFG— Threatened; USFWS—None.

The bank swallow breeds in California (in areas generally west of desert regions) during summer and winters in South America. Its preferred breeding habitat is vertical, soft banks or sandy mounds near water where it can easily dig holes for nests. It feeds on insects that it collects while flying over riparian areas or open brushland, grassland, or croplands. Its abundance has declined in California due to river and stream channelization and impoundment, and bank stabilization material that has been placed over vertical, friable substrate that is required for nesting.

Only three colony sites of bank swallows have recently been found in the Owens Basin. A large colony along the North Fork of Bishop Creek near the Bishop Airport was located in June 1992, and subsequently impacted by disturbance from activities at a nearby gravel mining operation later that month. Observations in May 1996 (T. Heindel pers. comm.) found 60 bank swallows were exhibiting nesting behavior at this site, and active nest holes were being used along a road-cut leading to the gravel pit. The second colony was observed in 1993. It consisted of an unknown number of birds that were attempting to nest in the sides of sand piles at a gravel company near the intersection of Five Bridges and Fish Slough Roads, north of Bishop (J. and D. Parker, pers. comm.). Disturbance was high at this site, and it is unlikely that there was much successful breeding (T. Heindel pers. comm.)

The third, and probably largest and most permanent, nesting colony in the Owens Basin occurs at Green Banks, along the northwest shore of Crowley Lake, Mono County (T. Heindel, B. Tillemans pers. comm.) On 25 May 1988 over 300 bank swallows occupied this site

(Metropoulus 1989). Later this year on 23 August about 500 swallows were observed at the site; the additional 200 birds presumably representing successful recruitment (Metropoulus 1990) This colony remains active and healthy today (Heindel, Tillemans ibid.)

Management Recommendations. The management goal for bank swallows in the Owens basin is to maintain nesting colonies and increase their abundance if possible. This can be accomplished by:

1— Conducting surveys to identify existing and potential nest sites.

2—Protecting nest sites from disturbance and habitat modification that causes nesting failure. Protection of existing nest sites includes: a) the Five Bridges Road - Fish Slough Road site which near within the proposed Fish Slough Conservation Area (USFWS 1996), where it may be possible to encourage the assistance of sand and gravel companies to create and protect breeding habitat. Protection of exposed riverbanks in this area, together with the development of artificial sand heaps might promote nesting colonies; b) the colony presently occupying a road cut leading to the gravel quarry located north of the Bishop airport. Although no threats are known to effect this site (T. Heindel pers. comm.), contact with operators of the quarry should be made to encourage their assistance in minimizing disturbance of the area when bank swallows are present; c) the large bank swallow nesting colony at Crowley Lake appears, at present, to be secure (T. Heindel, B. Tillemans pers. comm.).

N. Silverleaf milkvetch (*Astragalus argophyllus* var. *argophyllus*). Status: CDFG—California Native Plant Society (CNPS) List 2; USFWS—None.

Silverleaf milkvetch is an herbaceous perennial with a prostrate growth form that inhabits poorly drained alkaline soils on the periphery of meadows and playas in Inyo, Mono, and Lassen Counties in California. It is also found in Arizona, Idaho, Nevada, Utah, Montana, and Wyoming (Cronquist *et al.* 1989; Skinner and Pavlik 1994). In Inyo and Mono Counties it occurs in three sites: the Fish Slough Area of Critical Environmental Concern; south of Laws and east of the Owens River; and in Chalfant Valley, east of Hwy 6 (NDDB 1998; Manning

1993; LADWP 1990). Other than a single disjunct location in Lassen County, these are the only reported locations in California (NDDB 1998).

The species may be recognized by its nearly stemless habit and its densely woolly leaves that cover a thick, woody stem. Flowers are bright pink-purple, blooming and setting fruit from May to July. The mature seedpods are leathery, short-hairy, and one-chambered. At Fish Slough, silverleaf milkvetch occurs in sites classified as Leymus-Poa, Juncus-Distichlis, and Sporobolus-Allenrolfea plant associations (Ferren 1991). It usually occurs with other species restricted to alkaline soils classified as Aquic Torriorthents, and has been observed with other sensitive species, including Fish Slough milk-vetch (*Astragalus lentiginosus* var. *piscinensis*), Inyo mariposa lily (*Calachortus excavatus*) and alkali ivesia (*Ivesia kingii* var. *kingii*). It is also abundant in the mound and basin areas that occur most frequently southwest of Northeast Springs. In Fish Slough, there are four sites occupied by this taxon, varying from 1 ac to 70 ac (0.25 ha -28 ha) in size. In 1992, these sites supported from 6 to greater than 1,000 individuals, with a combined total of almost 2000 plants (Halford and Novak 1992). All populations at Fish Slough occur on lands administered by LADWP, and a portion of one population occurs on Federal lands at BLM Spring. One LADWP population, consisting of 877 individuals in 1992, is within a 32 ha (80 acre) exclosure.

Management Recommendations. The location where this taxon occurs at Fish Slough is within the proposed Fish Slough Conservation Area (USFWS 1996), and will be provided some protection as a result of that designation . The chief threat to the plants at Fish Slough is possible grazing and trampling by cattle during its growth phase from May through August. This coincides not only with the plant's flowering and fruit-set, but also with the subsequent period of photosynthetic production and allocation of energy to underground rhizomes, important for over-winter survival, energy storage, and initial spring growth. Seedling establishment could also be affected by livestock grazing or trampling during this period. Livestock management will be necessary to provide conditions suitable for reproduction and to ensure population viability. Many of the habitat and management requirements of the silverleaf milk-vetch are shared by the Fish Slough milk-vetch (*Astragalus lentiginosus* var. *piscinensis*), with which it co-occurs in Fish Slough (USFWS 1996). Therefore recovery efforts for the latter species should benefit the

silverleaf milk-vetch. Permanent population trend plots established by LADWP in 1991 and by BLM in 1987 should be monitored annually, or at a minimum of three-year intervals to determine if existing management strategies are appropriate. Populations where grazing is excluded can be used as controls to compare trends in population structure and community dynamics.

O. Hot Springs fimbristylis (*Fimbristylis thermalis*). Status: CDFG— CNPS List 2; USFWS—None.

In taxonomic treatments, Hot Springs fimbristylis has sometimes been included with the more widespread *Fimbristylis spadicea* (Cronquist *et al.* 1977), but recent California treatments (Munz and Keck 1959, Hickman 1993) identify it more appropriately as *F. thermalis*. This plant inhabits wet, alkaline soils, often near hot springs. In addition to California, it is found in northwestern Arizona and Nevada. It is rare in California but occurs in San Bernardino, Kern, Inyo, and Mono Counties (Skinner and Pavlik 1994). In the Owens Basin, the primary distribution is in Fish Slough, where scattered individuals or small colonies lie along margins of seasonally flooded habitats at Northeast and BLM Springs. It exists only within enclosures on lands administered by the LADWP and BLM. Hot Springs Fimbristylis is a grass-like perennial sedge that grows in clumps on alkaline soils that are saturated with water. Culms of the plant are 8 in to 32 in. (20 cm to 80 cm) tall, and its leaves are slender and elongate. Blooming occurs in mid-July and its umbelliform cyme inflorescence often produces many apparently viable achenes (Ferren 1991). It occurs only within Eleocharis-Muhlenbergia and Leymus-Poa plant associations (Odion *et al.* 1991).

Management Recommendations. With its primary occurrence in Fish Slough, the Hot Springs fimbristylis will benefit from recovery efforts associated with designating this Conservation Area (USFWS 1996). Although probably not directly affected by grazing due to its restriction to saturated habitats not preferred by cattle, grazing activities may indirectly affect populations through enhanced nitrification of the habitat resulting from livestock defecation and urination in adjacent areas. This nitrification is thought to encourage growth of the common reed (Phragmites australis) which, in turn, could crowd out the fimbristylis (Marks *et al.* 1994; A.

Halford, pers. comm.1998). Every effort should be made to manage livestock grazing so that nitrogen enrichment does not occur. Water quality monitoring during the growing season (for instance, in May, July, and September) should be conducted and livestock access to this taxon's habitat modified accordingly. Periodic monitoring of water quality, water availability, and fluctuations in structure and composition within existing populations of Hot Springs fimbristylis populations will be necessary to determine trends in abundance of this species.

P. Alkali ivesia (*Ivesia kingii* var. *kingii*). Status: CDFG—CNPS List 1B; USFWS—None.

Alkali ivesia is an herbaceous perennial plant that has been grouped with Ash Meadows ivesia (*Ivesia kingii* var. *eremica*) in some past taxonomic treatments (cite). This perennial occurs in seasonally moist, alkaline, clay soils on playas and on the edges of more densely herbaceous alkali meadows. Its distribution includes Utah, Nevada, and California, where it is rare, with fewer than ten known California occurrences (NDDB 1998). It occurs in almost monospecific stands in Inyo County at Fish Slough and in Adobe and Long Valleys, Mono County. At Fish Slough it is fairly abundant from the vicinity of the Northwest Spring to south of the junction of the Fish Slough Channel and McNally Canal in plant associations typed as: Scirpus-Typha , Scirpus-Eleocharis , Leymus-Poa, Juncus-Distichlis , Spartina-Sporobulus, Sporobulus-Allenrolfea, Distichlis-Chrysothamnus, and Chrysothamnus-Sporobulus (Ferren 1991). In Adobe and Long Valleys it is locally abundant but restricted to the low-lying alkali basins of Aquic Torriorthent type soils (National Resource Soil Conservation Service, In Press - chk). Alkali ivesia is characterized by its slender, 6 to 14 in. (15 cm to 350 cm) long stems rising from a basal cluster of leaf stocks and thick tap root. The white flowers bloom profusely in July, and seed set usually occurs through late July and August.

Management Recommendations. The chief threat to the alkali ivesia is off-road vehicle use that causes formation of deep trenches and denuded areas. This impact is most significant when vehicles are driven on the saturated Aquic soils in winter and early spring. Grazing, especially during flowering, may also negatively affect this taxon by reducing pollinator activity (A. Halford in litt. 1993.). In Long Valley, BLM has constructed protective barriers to block vehicle access from its alkali meadow habitat and has initiated small-scale revegetation efforts

(BLM in litt. 1997). Signs discouraging vehicular use in these sensitive areas have also been erected on lands administered by the LADWP and BLM. Vehicular impacts also occur in Fish Slough, especially in the vicinity of Fish Slough lake and BLM Spring. In Long Valley, wherever possible, populations of alkali ivesia should be incorporated into proposed recovery Conservation Areas (e.g., Little Hot Creek, Whitmore, Little Alkali, Hot Creek) (USFWS 1996), and off-road vehicle use should be prohibited in those Areas. In Fish Slough, a proposed Conservation Area (USFWS 1996), alkali ivesia will be afforded some protection due to its co-occurrence with the Inyo County mariposa lily and the Fish Slough milkvetch. Annual monitoring of major alkali ivesia populations should be implemented in both Long Valley and Fish Slough to determine status trends and effectiveness of existing management.

Q. Inyo phacelia (*Phacelia inyoensis*). Status: CDFG—CNPS List 4; USFWS—None.

Inyo phacelia is a diminutive annual that occurs in scattered stands in alkaline scrub communities often peripheral to alkali meadows. Its known distribution is confined to Inyo and Mono counties, California, where it occurs near the southwestern extremity of Fish Slough, and in scattered, sparse populations in the Alabama Hills. Surveys conducted in 1995, by the BLM and California Native Plant Society volunteers, located an additional four populations of this species (BLM in litt. 1997). In 1998, several additional populations were located at the north end of Fish Slough, in the Warren Bench area, and in the Alabama Hills. Inyo phacelia is a delicate plant, 12 in to 40 in. (30 cm to 110 cm) high, with short, spreading, hairy, glandular foliage and pale yellow flowers. Vegetative growth begins in April, and blooming is May to August. Recently documented populations in Fish Slough indicate that plants occur on thermic, ashy, and slightly alkaline soils (Blind Springs Gravelly Loam; National Resource Soil Conservation Service (In Press)) of sandy to pebbly surface texture. Many sites also occur in small canyons within the western volcanic escarpment of Fish Slough in association with scattered stands of alkali sacaton (*Sporobulus airoides*) and greasewood (*Sarcobatus vermiculatus*). It also occurs in distinct, 45 ft -75 ft (15 m -25 m) wide bands that are transitional zone between alkali scrub and alkali meadow community types (A. Halford personal communication 1994).

Management Recommendations. Major threats to Inyo phacelia are ephemeral grazing and trailing activities by sheep and habitat modification by off-road vehicles. As of 1995, the BLM no longer permits sheep grazing in Zone 1 of the Fish Slough ACEC due to the presence of this species and due to archeological concerns (BLM in litt. 1998). Off-road vehicle use should not occur within its habitat and sheep grazing should be precluded in its habitat between May and August to insure successful reproduction. In Fish Slough, it is essential that Inyo phacelia populations be incorporated into the proposed Fish Slough Conservation Area (USFWS 1996), to provide it with appropriate management. Protection will also be provided by establishment of the proposed Hogback and Southern Owens Conservation Areas (USFWS 1996), which include sparse populations of Inyo phacelia in the Alabama hills. An annual or semi-annual monitoring program should be implemented during the peak blooming period, during favorable precipitation years, to more accurately delineate population size and distribution, and to identify previously unknown populations.

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APPENDIX D

Peer Review and Summary of Comments
Draft Recovery Plan for the Owens Basin Wetland and Aquatic Species

The U.S. Fish and Wildlife Service (Service) initiated the process of writing a recovery plan for the Owen Basin Wetland and Aquatic Species in 1994. From its inception, the Owens Valley Multi-Species Recovery Task Force (representing the principle stakeholders and experts on these species) was actively involved in review and comment during the plan's development. They also reviewed the draft plan. In addition to this group, the Service also solicited and received peer reviews on the plan from scientific experts familiar with these species.

In the August 26, 1996, *Federal Register* Notice of Availability, the Service solicited written comments on the draft recovery plan; the comment period was 60 days. Because some people did not receive early notification of the availability of the draft plan and because the management guidelines were not available during the initial announcement, the Service reopened the comment period on January 13, 1997, for an extended 90-day comment period. During the initial comment period, the Service received 25 letters of response, and 18 letters of response were received during the second comment period. The following summarizes the comments received and the Service's response, as needed.

All of the comments submitted that were editorial in nature, that presented new information or identified misinformation, or requested clarification have been incorporated into the final version of the recovery plan. The comments listed below represent those that could not be incorporated with explanation.

1. One commenter suggested that the design and management of the Conservation Areas isolates species (lack of corridors), minimizes gene flow between Conservation Areas and surrounding ecosystems, inhibits natural selection, promotes genetic drift and mutation, and ignores the role of biodiversity in ecosystem resiliency.

Service Response – The Service acknowledges that addressing all these conservation principles is essential for any recovery plan and, as such, has appropriated them in the concept and design of this plan. Each Conservation Area was selected based on a variety of factors, including species richness, ability of the site to be recovered, compatibility with existing land use practices, and large enough that the genetic integrity of the target species will be secured. The importance of corridors between populations is important, and although the Service does not believe that they are needed in this situation, additional conservation efforts to restore native habitat conditions that connect Conservation Areas would be an added benefit and supported by the Service.

2. Several commenters stated that the least Bell's vireo should not be included in this recovery plan simply because it once inhabited the Owens Valley.

Service Response – The Service disagrees. The federal listing of endangered, threatened and candidate species of the Owens Basin documents that the aquatic and riparian ecosystems are endangered; recovery of these species is focused on the restoration of these ecosystems which

implies that the native assemblage should be identified and their life history requirements addressed in recovery efforts. If the habitat is restored, (i.e., the threats removed), native species should return. Recovery of the least Bell's vireo is addressed in its own recovery plan, although the Owens Basin is not considered important for preventing the extinction of the species, it is important to the long term conservation of the species and the ecosystems of which they are a part. Furthermore, the holistic management of our resources should ensure against additional species declining to such levels that they will need the protection of the federal Endangered Species Act.

3. One commentor suggested that the Inyo County Mosquito Abatement personnel be encouraged to use the native pupfish in place of the exotic mosquito fish (*Gambusia*).

Service Response - The Service agrees with this suggestion. Whenever possible, native species should be used a biotic controls; pupfish have demonstrated equal or better ability than mosquito fish at controlling mosquitos.

4. One commentor stated that the Service and California Department of Fish and Game should allow landowners operational flexibility and offer concessions in allowance of take for Code 1601 activities for the reintroduction of native fish.

Service Response - The Service cannot address issues specific to the Department of Fish and Game. For take issues under the jurisdiction of the Fish and Wildlife Service, there are specific procedures for allowing take under section 7 and 10 of the Endangered Species Act. Regarding implementation of this recovery plan, the principle recovery tasks will involve the development of conservation plans that will address likely take, measures to minimize and mitigate take, and assurances that additional requirements will not be imposed for future projects once the conditions of the conservation plan are met. This process will maximize flexibility and provide for the concerns regarding take.

5. One commentor suggested that the plan should accomplish recovery for the listed species and potentially arrest, by default, the decline of candidate and other species of concern.

Service Response - The Service disagrees. The Service, by policy, is developing multispecies recovery plans aimed at protecting ecosystems. To do this the plan must include actions that actually arrest, not just potentially arrest, the decline of candidate and other species of concern. Furthermore, by managing on the ecosystem level, all native species should benefit and the conservation of candidates will be direct, not coincidental to recovery for listed species. By this approach we should be assured that future listing will be avoided.

6. One commentor requested that the high-voltage transmission line right-of-way corridors be given species status relative to operational flexibility with the Conservation Area.

Service Response - The plan is designed to be flexible to consider existing land use needs. In developing the conservation plan, the needs regarding the transmission line corridor will be addressed; there should be no conflicts regarding operational flexibility.

7. One commentor enquired whether the final recovery plan would include the participation plans, management plan and specific boundaries of each Conservation Area; and if not, will the plan be amended to include such information when it is available.

Service Response – No. The specifics for each Conservation Area will be developed as a draft Conservation Plan. Much work will be required to develop the site specific Conservation Plan, the necessary management actions, and delineation of the area. The conservation plans will be free standing documents requiring individual review, approval and permitting. These plans, as described in the recovery plan, will be the actual implementation mechanism for recovery of these species.

8. Numerous commentors inquired how and when will the California Environmental Policy Act (CEQA) and/or the National Environmental Policy Act (NEPA) be addressed in the plan.

Service Response – Neither CEQA nor NEPA will be addressed in the recovery plan. Recovery planning is specifically exempt from NEPA because it is strictly a planning exercise; it is a road map to recovery of listed species, other means may be available. However, if, as specific recovery tasks are implemented, a task does meet the definition of an action that triggers NEPA, then the Service (or another federal agency) will pursue the appropriate NEPA course of action. The same is true for CEQA.

9. One commentor enquired as to whether the public will have an opportunity to review the plan before it goes final.

Service Response – No. There is typically one public review period after which the Service reviews the comments and incorporates those that are pertinent into a final recovery plan. If, based on the comments received, the Service believes it should significantly change the recovery strategy and criteria, then the Service would release the plan for additional public review. This did not occur with this recovery plan. Recovery plans are dynamic documents that incorporate adaptive management into the recovery strategy. If at any time there is new information that alters the recovery needs, the plan will be revised and again released for public review and comment.

10. One commentor enquired as to who bears the cost of recovery actions.

Service Response – Part III of the recovery plan, the implementation schedule, identifies who are the lead entities for each recovery task. On federal land, the agency responsible for the administration of that land often bears the cost of recovery. The Fish and Wildlife Service receives from Congress some funding to implement recovery actions as well as funding for grants to the state for recovery of endangered species through section 6 of the Endangered Species Act. For some species there are private entities that contribute substantial funding for specific recovery efforts.

11. One commentor enquired as to what affect of the plan may have on existing and future uses of lands located within and outside of designated Conservation Areas.

Service Response – The Service has intentionally identified Conservation Areas in which there would be minimal conflict with existing land use practices. The specifics for each Conservation Area will be identified in the Conservation Agreements which will be developed only with the cooperation and support of the landowners. Implementation of the conservation plan will be to the benefit of both the landowners and the recovery needs of the natural resources. Prior to delisting of endangered and threatened species, the full protective measures of the Endangered Species Act apply to the species and their habitats. The goal for the recovery plan is

to restore the native habitats to conditions where the protective and regulatory requirements of the Endangered Species Act are no longer need; and then, the protective measures of the Endangered Species Act will no longer be imposed.

12. One commentor inquired as to how the plan might affect the County's discretion for management decisions on non-state or federal-owned property.

Service Response – The recovery plan does not obligate the implementation or funding of any of the recovery tasks. However, the plan is believed to be the best approach to recovery of listed species and ensuring that species of concern do not need to be listed in the future. Until recovery is achieved, the restrictions and prohibitions of the Endangered Species Act will remain in full force. Land management flexibility and discretion will increase (within the context of the conservation plan) as listed species are recovered.

13. One commentor enquired how the recovery plan and the Lower Owens River Project were related.

Service Response – The Lower Owens River Project was developed at the same time as was the draft Owens Basin recovery plan. The Lower Owens River Project is designed to meet certain court ordered conditions and appears it will also benefit local rare and endangered species. The Owens Basin recovery plan is designed to conserve specific areas high in biodiversity and is representative of the different aquatic and riparian habitat types unique to the Owens Basin. It is unclear at this time how these two effort will relate. As both plans develop, we will consider the contributions the Lower Owens River Project offers toward the recovery goals identified in the recovery plan.

14. One commentor stated that implementation of the plan may affect recreational, agricultural and other uses in Inyo County.

Service Response – The recovery plan is designed to minimize conflicts with existing land use practices. The Fish and Wildlife Service does recognize that in some cases conservation plans may identify modification to some activities, but it is not believed that ultimately modifications would be significant. If there are potential economic impacts, these would be addressed through the NEPA process.

15. One commentor enquired as to how land ownership will affect the boundary configuration of the Conservation Areas.

Service Response – The Fish and Wildlife Service will work with the affected landowner regarding the configuration of the Conservation Areas. Conservation plans are developed only with the support and cooperation of the affected landowner. Prior to approval of any conservation plan, all appropriate approvals and permits will be required and secured.

16. One commentor was concerned that the recovery plan would add additional and unnecessary regulation to the already strictly controlled land uses in Inyo and Mono counties.

Service Response – Recovery plans are strictly guidance documents; they impose no obligation on any agency, entity, or persons to implement the various tasks listed in the plan. However, with successful implementation of recovery efforts, listed species will be removed from the federal list of endangered and threatened species, thereby removing a layer of federal

regulation and prohibitions.

17. Several commentors noted that the recovery plan was not developed in accordance with the National Environmental Policy Act (NEPA).

Service Response - Recovery plans developed for species listed pursuant to the federal Endangered Species Act generally are categorically excluded from analysis under NEPA. Recovery plans are broad planning documents that list all tasks the Service believes may contribute to the recovery of a species. These tasks involve action by the Service, by other Federal agencies, by State and local governments, by the private sector, or by a combination of these. Recovery plans typically do not propose specific actions, but instead set forth general policies and guidelines for management and treatment of the species. For these reasons, meaningful analysis of the environmental impacts of a recovery plan is usually difficult, if not impossible. In addition, recovery plans impose no obligations on any agency, entity, or persons to implement the various tasks listed in the plan. In fact, some recommendations in recovery plans are never implemented because of limitations in funding, knowledge about the species, or changes in the species' needs. Finally, any specific recovery actions set forth in a recovery plan that are to be carried out by Federal agencies will be subjected to NEPA analysis at the time they actually are "proposed" within the meaning of NEPA.

18. One commentor noted that the recovery plan should mention the warm water fish hatchery at Fish Slough.

Service Response - The Service is not aware that a warm water fish hatchery ever existed at Fish Slough.

19. One commentor stated that it was unreasonable that current users have to pay for the past policies of the agencies.

Service Response - Resource management is the practice of applying the best available knowledge with public interest. Past policies were likely established with the best of intentions. However, changes occur with time. Changes in the knowledge of species and ecosystems. Local and global changes that affect these systems. Changes in public interest. And, changes in our understanding of how past land uses and policies affect the resources and the ability for future management. Ideally, past policies would stand as correct and persist long into the future. But as new information suggests that change is needed, e.g., the listing of endangered and threatened species which indicates that the local ecosystems are at risk and current management practices are problematic, agencies must adapt their management to meet those needs and make changes as appropriate. It would be a violation of the public trust for land management agencies to manage only to continue current practices, ignoring new information and managing the resources for future generations. When change is necessary, the Service strongly believes that stakeholders should be involved in identifying and implementing viable solutions.

20. One commentor noted that implementation of the plan would eliminate 60% of game fishing in Owens Valley.

Service Response - The Service disagrees and believes this interpretation may be due to a mis-reading of the plan. The plan indicates that the proposed system of Conservation Areas includes at least 60 percent of the habitats where the richness of listed species and other species

of concern is high. The Conservation Areas actually total but a small fraction of the valley floor wetlands.

21. One commentor questioned why implement a plan that includes a disclaimer that says it may be impossible to implement.

Service Response – The Service was unable to identify the specific disclaimer referenced; the Service fully supports this plan and believes that this plan can and will be implemented. The Service does state within the document that this plan will apply an adaptive management strategy. Adaptive management means that as management actions are implemented, there will be a continual information flow documenting the success of those actions. And, based on the new information, management actions may change to ensure that the goal of the plan is met.

22. One commentor raised concerns about manipulating and managing in favor of one species, to the detriment of other species at a site.

Service Response – The Service has long recognized that single species management often is not the best approach for recovery of endangered and threatened species. The Owens Basin Wetland and Aquatic Species Recovery Plan is designed to achieve recovery by management at the community (multi-species and habitats) level. This approach should ensure against management actions that would work to the detriment of other listed species or other species of concern. Further assurances are provided through the management guidelines for other listed and rare species of the Owens Basin that are included as an appendix.

23. Two commentors recommended that the Service consider a long-term monitoring strategy for species recovery.

Service Response – The Service agrees. Monitoring is essential to assess the current status of the species and their habitat as well as the effectiveness of recovery efforts, both site specific and within the larger geographic area. The recovery plan does identify the importance of, and include monitoring. Furthermore, the Service will be engaged in monitoring the status of the species for at least 5 years after they are delisted to ensure that the species do not decline after Federal protection is removed. These monitoring programs and management plans should be integrated for consistency purposes and to ensure that actions are compatible with survival and continued evolution of the rare species.

24. Several commentors requested that the boundaries be more specifically delineated.

Service Response – The recovery plan purposely illustrated the Conservation Areas in a non-specific way; the illustrations are intended to provide stakeholders with the general size, shape, and location of each area. The plan clearly states that the exact delineation of the Conservation Areas will result from monitoring and survey efforts at each site to ensure the necessary vegetative community types and listed species/species of concern are included for coverage in the management plans. Until this effort in undertaken, it is not possible to specifically delineate each Conservation Area.

25. Two commentors identified that the Pleasant Valley Conservation Area would not likely achieve the desired goals.

Service Response – The Service agrees. Birchim Canyon and Pleasant Valley

Conservation Areas were replaced by the Round Valley Conservation Area following comments from LADWP and CDFG stating that much of the Pleasant Valley Conservation Area could not be managed for native fishes. LADWP commented that there was insufficient water available in the Owens River to create permanent aquatic habitat in Pleasant Valley oxbows. This limitation would prevent establishing native fishes in the area. CDFG commented that management requirements for the wild trout fishery in Pleasant Valley would preclude management necessary to conserve native fishes.

The Round Valley Conservation Area was created by adding the lower Horton Creek (previously in the Pleasant Valley Conservation Area) to the Birchim Canyon Conservation Area. Combining these two areas provides connectivity between Owens Valley checkerbloom populations in Round Valley. It is believed that this change will decrease the amount of land within northern Owens Valley conservation areas.

26. One commentor suggested that the recovery plan should include a discussion of current biological conditions of each Conservation Area.

Service Response - Surveys have not been conducted to quantify the biological condition of conservation areas. These surveys will be conducted as management plans and goals are prepared for each area. The Service believes that the importance of existing conditions is comparatively minor because recovery and enhancement will occur following implementation of actions necessary to achieve goals that are identified for each conservation area in this recovery plan.