

FINAL REPORT

RIPARIAN AND WETLAND BREEDING BIRD SURVEYS,
INYO COUNTY, CALIFORNIA,
WITH EMPHASIS ON THE YELLOW-BILLED CUCKOO AND THE SNOWY PLOVER.

Prepared By:
Stephen A. Laymon, Research Director
and
Pamela L. Williams, Senior Scientist
Kern River Research Center
P.O. Box 990
Weldon, CA 93283

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PART I. DISTRIBUTION OF BREEDING RIPARIAN BIRDS IN OWENS VALLEY, INYO COUNTY, CALIFORNIA

INTRODUCTION

Many riparian bird species have declined in abundance throughout the west due to habitat loss and degradation. Riparian species have also been adversely affected by Brown-headed Cowbird parasitism. One of the most endangered riparian species in California is the Yellow-billed Cuckoo (*Coccyzus americanus*). Other riparian species of concern in the state include: the state endangered Willow Flycatcher (*Empidonax traillii*) and Bell's Vireo (*Vireo bellii*) and several state species of special concern: Brown-crested Flycatcher (*Myiarchus tyrannulus*), Yellow Warbler (*Dendroica petechia*), Yellow-breasted Chat (*Icteria virens*) Blue Grosbeak (*Guiraca caerulea*), and Summer Tanager (*Piranga rubra*).

Yellow-billed Cuckoos nesting in western North America have declined dramatically during the past eighty years (Roberson 1980; Gaines and Laymon 1984; Laymon and Halterman 1987a, 1987b). This species was once wide-spread, inhabiting the formerly extensive riparian habitats that once lined the rivers and streams throughout the region. The Yellow-billed Cuckoo, however, no longer nests over much of its previous range, including southern British Columbia, Washington, Oregon, Idaho, and Nevada. Once a common breeding bird in California (Grinnell 1915), by 1940 the species was "...wanting in extensive areas where once found" (Grinnell and Miller 1944). The Yellow-Billed Cuckoo is now listed as: (1) endangered by the California Department of Fish and Game; (2) a sensitive species by the U.S. Forest Service; and (3) a candidate species for listing as endangered by the U.S. Fish and Wildlife Service.

A chronology of this decline indicates that the initial cause of decline was linked to the extensive loss of riparian habitat in the nesting areas of the cuckoo, which breeds in North American, but winters in South American (Gaines and Laymon 1984; Laymon and Halterman 1987a, 1987b, 1989). During the late 1800's and early 1900's, large areas of virtually continuous riparian habitat were disrupted by human activities, including conversion to agriculture, submersion under reservoirs, and channelization for flood control. The remaining riparian habitat in the region exists as discrete patches of varying size, shape, and isolation (Halterman 1991). Recent local and regional declines in the number of Yellow-billed Cuckoos nesting in California, however, do not appear to be as well correlated with these broad-scale nesting habitat losses, and some secondary factor, or combination of factors, is likely causing the recent declines in the number of nesting pairs in California. One possible factor may be linked to the use of persistent pesticides leading to significant eggshell thinning (Laymon and Halterman 1987a, 1990). Additionally, the number of individuals in most sub-populations has reached such low levels that these sub-populations are in danger of stochastic extinction (Laymon and Halterman 1989).

Other riparian obligate species have been equally impacted. The Least Bell's Vireo is

now both state and federally endangered. As recently as 80 years ago it was one of the most common breeding species throughout lowland California including the Owens Valley and is now found in less than 10% of its original range and in less than 1% of its original numbers. The Willow Flycatcher is state endangered and the southwestern subspecies has been proposed for federal listing by the U.S. Fish and Wildlife Service. This subspecies also historically occupied a much larger range and is presently found at only three or four locations in the state. The Yellow Warbler was the most common species at riparian sites in lowland California as recently as 80 years ago. It has been extirpated from much of its original range in California and has become an uncommon species where it is still found. Healthy populations of Yellow Warblers are found only at higher elevations in California today. The common thread that binds these three species is susceptibility to Brown-headed Cowbird parasitism.

Gaines (1973) was the first to point out the connection between cowbirds and the decline of southwestern riparian birds. Other studies have described the mechanism behind the affect of parasitism (Laymon 1987). Habitat loss and cowbird parasitism have a synergistic effect on host populations. Habitat loss reduces the total population of the host species and at the same time renders the remaining hosts more susceptible to parasitism because the habitat patches are smaller and more fragmented.

The purpose of this study was to survey riparian habitats to determine population levels of riparian obligate birds. Special sampling was to be conducted for Yellow-billed Cuckoos and all other riparian species were to be tallied.

STUDY AREA

The study area included riparian habitats along the Owens River and its tributaries in Inyo County. The Owens River flows out of the Sierra Nevada in the vicinity of Mammoth Lakes and flows south through the Owens Valley and ends in Owens Lake. Numerous streams flow into the river from the Sierra Nevada immediately to the west. The area in which we conducted surveys ranged from 1400 m at Pleasant Valley to 1100 m at Owens Lake. The riparian habitat is along the banks of the river and farther from the banks the habitat becomes either grassland or desert scrub.

The dominant trees in the study area are the introduced black locust (*Robinia pseudoacacia*), and the native Goodding's black willow (*Salix gooddingii*) and Fremont cottonwood (*Populus fremontii*). Black cottonwood (*Populus balsamifera*) is found at a few locations at the edge of the valley. The dominant vegetation along much of the Owens River upstream from Big Pine is a shrubby willow growing in thickets up to 3 m in height. This is apparently arroyo willow (*Salix lasiolepis*). The invasive shrub and small-tree form salt cedar (*Tamarix parviflora*) is common in some locations especially in the Islands area and along the lower Owens River.

METHODS

Survey sites were chosen, from all available riparian habitats, on the basis of which habitats had the highest probability of supporting Yellow-billed Cuckoos. This was based on habitat parameters outlined in other studies such as habitat width, and total habitat area. Sites with closed canopy riparian habitat less than 100 m in width and 10 ha in extent are considered unsuitable (Gaines and Laymon 1984; Laymon and Halterman 1989; and Halterman 1991). We surveyed breeding pairs of cuckoos by repeated survey transects. We conducted surveys using a "kowlp" call tape recording played on a Sanyo "The Outsider" 2 speaker portable tape recorder. We made survey stops every 150 to 200 m. We used ten "kowlp" calls, each spaced 1 minute apart, to elicit responses at each stop. The recording could be heard 200 m or more under all field conditions. We plotted the cuckoo's locations on 1:24000 scale maps. We planned the surveys to begin after mid-June because Yellow-billed Cuckoos arrive late on the breeding grounds. Surveys were terminated before mid-August when cuckoos leave for South America. In addition, we listed the number of individuals of each bird species encountered during the surveys at each location. Surveys for Willow Flycatchers were conducted from canoe along the Owens River using recordings of the flycatchers songs and calls. Plant names are after The Jepson Manual (Hickman 1993).

RESULTS

Based on our initial habitat surveys we selected seven sites as having potential for breeding Yellow-billed Cuckoos. They were: Baker Creek, Hogback Creek, the Owens River at the Islands near the Alabama Gates, the Owens River from Pleasant Valley to Bishop, the Owens River from Steward Lane to Tinemaha Reservoir, the Owens River from Keeler Bridge to Owens Lake, and the Owens River south of Aberdeen Station Road (Figure 1). These were the only sites that appeared to have even marginal characteristics for Yellow-billed Cuckoos. Other sites that we checked on both the Owens River and on tributary streams either had insufficient width, area, or the vegetation was too scattered, providing insufficient canopy cover.

Sites were surveyed one to three times depending on habitat quality for Yellow-billed Cuckoos (Tables 1-7). The Islands area along the Owens River was only surveyed twice because water releases from Alabama Gates precluded the third visit. The Owens River from Pleasant Valley to Bishop was surveyed twice because the habitat was not suitable for Yellow-billed Cuckoos. The Owens River from Keeler Bridge to Owens Lake was surveyed only once because the habitat was not suitable for Yellow-billed Cuckoos. A total of 100 hours of surveys were conducted.

Each of the seven study sites was unique. Hogback Creek (Area A) potentially has some of the best habitat for Yellow-billed Cuckoos. The creek flows east from the Sierra Nevada alternating above and below surface flow. This area has been subject to several fires

Figure 1

in recent years and many of the older trees were killed. These trees were resprouting from the base and younger trees had germinated, but the habitat has not yet matured enough to be used by cuckoos. This area was grazed but not so intensively as to preclude establishment of willows. The vegetation was primarily Fremont cottonwood, and Goodding's black willow and sandbar willow. At this site we found seven riparian associated species, of which the Song Sparrow was the most common (Tables 1, 8 & 9). Warbling Vireos were found on only the last survey and were believed to be migrants.

Baker Creek (Area B) also flows east from the Sierra Nevada and is forced to the surface about one mile west of Big Pine. The riparian habitat in this area is extensive but the northern half has black locust as the primary tree. The southern half has more native vegetation primarily Fremont and black cottonwood and Goodding's black willow interspersed with pasture. Much of this area is heavily grazed at various times of the year, possibly precluding the establishment of additional riparian vegetation. Eleven riparian associated species were found at this site. One unmated male Yellow-billed Cuckoo was present throughout the season as was an unmated male Summer Tanager (Tables 2, 8 & 9). Blue-gray Gnatcatcher was the most common species followed by Song Sparrow. This was one of only two locations in the Owens Valley where Yellow Warblers are known to breed (Tom and Jo Heindel, pers. comm.). This was the only location where a Red-shouldered Hawk was found.

The Owens River at the Islands (Area C) spreads across a broad floodplain with many sloughs and channels. This area has the largest extent of riparian vegetation, but much of it shows past stress from lack of water. Most trees have some dead limbs and many trees were dead. The area was also grazed, which removed much of the understory vegetation in some areas. The lack of canopy density and habitat vigor precludes Yellow-billed Cuckoos from using the area as a breeding site. Nine species of riparian associated birds were found at this site (Tables 3, 8 & 9). Common Yellowthroat was the most common species at this location, followed by Song Sparrow and Blue-gray Gnatcatcher. This was the only site where Warbling Vireos apparently bred, and also the only site where a probable Brown-crested Flycatcher was heard.

The Owens River from Steward Lane to Lake Tinemaha (Area D) had the best habitat for Yellow-billed Cuckoos. The upper portion was primarily a strip of Goodding's black willows one to three trees wide and was not suitable. One and a half miles north of Tinemaha Reservoir the flood plain broadened and reached up to 400 m in width and was highly suitable for cuckoos. The trees and shrubs at this site were very healthy and vigorous and showed no water stress. We estimated that up to three pairs of cuckoos could nest at this site and two pairs and an unmated male were detected during the surveys (Tables 4, 8 & 9). This was the only location where Yellow-billed Cuckoos nested in the Owens Valley during the summer of 1993. In addition to the cuckoos, nine other riparian associated species were found (Table 9). Song Sparrow, Tree Swallow and Common Yellowthroat were the most abundant riparian species. This was the only site where Wood Ducks were found and they may breed here.

The Owens River from Pleasant Valley to Bishop (Area E) had primarily low dense stands of sandbar willow along its banks giving it the look and feel of a mountain meadow. Ten riparian associated species were found in this area. This was the only place where Willow Flycatchers were observed breeding and was one of only two locations where Yellow Warblers bred (Tables 5, 8 & 9). Song Sparrows were exceedingly common in this region and Black Phoebes were the second most common riparian species.

The Owens River south of Aberdeen Station Road (Area F) on the west side has extensive riparian habitat. This area was heavily grazed and there was little understory. The predominant vegetation was mature Goodding's black willows. There were no young trees except for a few in two low-lying areas. Seven species of riparian associated species were detected at this site including an unmated male Yellow-billed Cuckoo (Tables 6, 8 & 9). Song Sparrow and Blue-gray Gnatcatcher were the two most common species.

The Owens River from Keeler Bridge to Owens Lake (Area G) had riparian habitat that was relatively narrow, open, and dry. It was not suitable habitat for Yellow-billed Cuckoos. Only five riparian associated species were found at this site which we surveyed only once (Table 7,8&9). Blue-gray Gnatcatcher was the most common species.

SPECIES ACCOUNTS

Wood Duck

Wood Ducks (*Aix sponsa*) were found at only one site, Tinemaha Reservoir where they may have bred (Tables 4, 8 & 9). They are uncommon in Owens Valley where there are few breeding records (T. & J. Heindel pers. comm.) They were not known from the east side of the Sierra in the early 1900s (Grinnell and Miller 1944), but are now regular in small numbers, at scattered locations on the east side, and probably breed (pers. obs.).

Red-shouldered Hawk

Red-shouldered Hawks (*Buteo lineatus*) were found at only one site, Baker Creek (Tables 8, 9). This is a rare species in the Owens Valley which they have colonized in recent years. They were unknown on the east side of the Sierra during the first half of the century (Grinnell and Miller 1944). Their numbers and range have increased in California over the past 20 years (pers. obs.).

Swainson's Hawk (California Threatened, Federal Candidate)

Swainson's Hawks (*Buteo swainsoni*) were found at only one site, Tinemaha Reservoir, where a pair was apparently breeding (Tables 4, 8 & 9). They are an uncommon breeding species in the Owens Valley. This area was within the regular breeding range of this species in

the early 1900s before they were extirpated from the southern half of the state (Grinnell and Miller 1944). Fisher (1893), however did not record the species in the Owens Valley.

Spotted Sandpiper

Spotted Sandpipers (*Actitis macularia*) were found only along the Owens River from Pleasant Valley to Bishop during the surveys (Tables 8, 9). This species was found along the Owens River only near its headwaters by Fisher (1893) and this region is not listed within the species breeding range by Grinnell and Miller (1944)

Yellow-billed Cuckoos (California Endangered, Federal Candidate)

Yellow-billed Cuckoos (*Coccyzus americanus*) were found at three of the seven locations (Tables 8 & 9); an unmated male at Baker Creek throughout the summer, an unmated male along the Owens River south of Aberdeen Station Road only on 21 July, and two pairs and an unmated male in the first 1.5 miles up stream from Tinemaha Reservoir throughout the summer. These three sites were all very different from each other. The Baker Creek site was older, closed canopy, mixed riparian forest with Fremont and black cottonwood and several species of willows. In places there was a dominant component of black locust. The entire Baker Creek site was grazed, with some portions grazed moderately and some heavily. The Aberdeen Station Road site was a more open, heavily grazed site, with mature willows and no regeneration. The Lake Tinemaha site was primarily young willows, less than 10 years old, with a few scattered older willows. Canopy cover was over 70%, and there was little evidence of grazing. Fisher (1893) found only one cuckoo in the Owens Valley.

Black-chinned Hummingbird

Black-chinned Hummingbirds (*Archilochus alexandri*) were found at four of seven study sites (Tables 8, 9). This species is the most common hummingbird breeding in the Owens Valley. Fisher (1893) found the species to be a common nesting species in the Owens Valley.

Downy Woodpecker

Downy Woodpeckers (*Picoides pubescens*) were found at five of the seven study sites (Tables 8, 9). At most sites they were the second most common woodpecker after Nuttall's. There were no records for this species in the Owens Valley prior to 1944 (Grinnell and Miller 1944, Fisher 1893). This species has apparently colonized this area in recent years.

Willow Flycatcher (California Endangered, Federal Candidate)

Willow Flycatchers (*Empidonax traillii*) were found at three locations, but were found breeding only along the Owens River between Pleasant Valley and Bishop. Special surveys were conducted by canoe, using tape recordings of Willow Flycatcher songs, to determine

population levels. A total of 10 singing Willow Flycatchers were located. This was a previously unknown population. This species is listed as endangered in California. It is not certain whether or not this is a population of the soon to be Federally listed Southwestern Willow Flycatcher (*E.t. extimus*). The subspecies of Willow Flycatchers are not distinguishable by voice or plumage in the field. Populations can be separated by morphological characteristics using birds in the hand. The habitat, where they were found, consisted of low shrubby willows, rather than tree-form willows. This is more consistent with the habitat used by the montane subspecies, but the historic range of the Southwestern Willow Flycatcher came as far north as Independence, Inyo County (Grinnell and Miller 1944). Fisher (1893) also found them in the Owens Valley during the breeding season.

Black Phoebe

Black Phoebes (*Sayornis nigricans*) were found at all study sites and were the fourth most common riparian obligate species in the valley (Tables 8, 9). This species was historically a very uncommon resident in the Owens Valley, as Fisher (1893) found them only twice in that region, once at Bishop Creek and once at Little Owens Lake. In 1944 they were considered a sparse resident in the Owens Valley (Grinnell and Miller 1944).

Brown-crested Flycatcher (California Species of Special Concern)

A probable Brown-crested Flycatcher (*Myiarchus tyrannulus*) was detected only once by voice at the Islands. This species has expanded to the northwest from Arizona in the last 20 years and small populations have become established in the South Fork Kern Valley and the Amargosa River near Tecopa. There are several other recent records for the Owens Valley. This species was not detected historically in the region and was only a "marginal pioneer" in California up to the 1940s (Grinnell and Miller 1944).

Tree Swallow

Tree Swallow (*Tachycineta bicolor*) was found at two of the seven survey locations (Tables 8, 9). This species breeds early in the season and nesting was completed prior to our surveys. The species was found in flocks near Lake Tinemaha and below the Keeler Bridge. Tree Swallows were not found in Owens Valley during the Death Valley Expedition (Fisher 1893). The species was mentioned as breeding east of the Sierra Nevada by Grinnell and Miller (1944) but Owens Valley was not mentioned specifically.

Blue-gray Gnatcatcher

Blue-gray Gnatcatcher (*Polioptila caerulea*) was the third most common species nesting in the riparian zone. It was found at all seven survey sites and was most common at Baker Creek and the Islands. It was found to be uncommon in lower Independence Canyon 100 years ago (Fisher 1893) and was not found on the floor of the Owens Valley. Gnatcatchers have

apparently expanded their range and increased their population during this time period. Grinnell and Miller (1944) listed the species as breeding in desert mountain ranges, but do not list them as breeding in riparian habitat in the Owens Valley.

Warbling Vireo

Warbling Vireos (*Vireo gilvus*) were found at only three locations; The Islands where they apparently bred, and at Baker Creek and Hogback Creek where they were likely post-breeding dispersers or transients. They were found commonly by Fisher (1893) at several locations in the Owens Valley. Grinnell and Miller (1944) listed the species as breeding in the Owens Valley region, but do not specifically mention them in riparian habitats in Owens Valley. They list the subspecies of Warbling Vireo breeding in this region as the Great Basin subspecies (*V. g. leucopolius*), not the Western Warbling Vireo (*V. g. swainsonii*). Warbling Vireos have become rarer probably due to Brown-headed Cowbird parasitism.

Bell's Vireo (California Endangered, Federal Endangered)

Bell's Vireo (*Vireo bellii*) was not found on any of our surveys and probably no longer breeds in the Owens Valley. Fisher (1893) found them to be a "tolerably common" summer resident in the Owens Valley. Grinnell and Miller (1944) listed this species as locally common in suitable habitats within its range which included the Owens Valley. The subspecies that occurred in this region was the Least Bell's Vireo (*V. b. pusillus*). Grinnell and Miller (1944) also noted that "In the last fifteen years a noticeable decline in numbers has occurred in parts of southern California and in the Sacramento Valley, apparently coincident with increase of cowbirds which heavily parasitize this vireo." This species has without doubt been extirpated from the Owens Valley because of Brown-headed Cowbird parasitism over the past 70 years.

Yellow Warbler (California Species of Special Concern)

Yellow Warblers (*Dendroica petechia*) were found at only two locations; Baker Creek and along the Owens River from Pleasant Valley to Bishop. The population of this warbler in the Owens Valley apparently does not exceed 10 pairs. This species has declined greatly over the past 100 years. Fisher (1893) found Yellow Warblers to be a common breeder in shade trees and orchards in Lone Pine and Independence. Grinnell and Miller (1944) listed this species as common in the Owens Valley. This species has been adversely impacted by Brown-headed Cowbird parasitism over the past 100 years. The total population of this species in the Owens Valley is very low and is in danger of extirpation.

Common Yellowthroat

Common Yellowthroats (*Geothlypis trichas*) were the second most common riparian species in the Owens Valley (Table 9). They were found breeding at four of the seven study sites and were most common in the marshy areas along the Owens River from Pleasant Valley to

Lake Tinemaha. Their status has apparently not changed because Fisher (1893) found them to be a "tolerably common summer resident" throughout the Owens Valley.

Yellow-breasted Chat (California Species of Special Concern)

Yellow-breasted Chats (*Icteria virens*) were found in small numbers at five of the seven locations (Tables 8, 9). They were most numerous along the Owens River from Pleasant Valley to Bishop. It is unlikely that the population of chats in the Owens Valley exceeds 30 pairs. The species was found to be moderately common in the Owens Valley by Fisher (1893). The population of the species has apparently declined during the past 100 years, possibly due to Brown-headed Cowbird parasitism.

Summer Tanager (California Species of Special Concern)

A Summer Tanager (*Piranga rubra*) was found at only one site, Baker Creek, where an adult, unmated male was found (Tables 8, 9). It had been present since late spring but apparently did not find a mate (Tom and Jo Heindel pers. comm.). This species has expanded into southwestern California over the past 50 years. Grinnell and Miller (1944) reported the species as only occurring along the Colorado River. It has since expanded to the Amargosa River, South Fork Kern River, Morongo Valley, and Owens Valley. This survey and past field work by Tom and Jo Heindel show that the population of this species in the Owens Valley is very small and apparently breeding pairs do not occur every year.

Blue Grosbeak

Blue Grosbeaks (*Guiraca caerulea*) were a relatively common species found at six of the seven survey sites (Tables 8,9). The total population of the Owens Valley is probably less than 100 pairs. Fisher (1893) found the species to be very common in the Owens Valley. It is likely that the population has decreased greatly in the past 100 years probably due to increased cowbird parasitism.

Song Sparrow

Song Sparrows (*Melospiza melodia*) were the most common riparian species in the study area. They were found at all seven sites and in most areas they were the most common riparian bird (Table 9). It was a "tolerably common" species in the Owens Valley 100 years ago (Fisher 1893). Its population status has apparently not been affected by cowbird parasitism, although Song Sparrows are commonly parasitized.

Brown-headed Cowbird

Brown-headed Cowbirds (*Molothrus ater*) were an abundant species, topped only in numbers by Song Sparrows (Table 9). The cowbird is a nest parasite which lays its eggs in the

nests of open-cup nesting birds. For larger birds like the Song Sparrow, the addition of a cowbird egg does not significantly reduce reproductive success. For smaller birds like flycatchers, warblers, and vireos the addition of a cowbird egg precludes the successful fledging of any of their own young. The Brown-headed Cowbird has been implicated in the decline of many passerine species including Willow Flycatcher, Bell's Vireo, Warbling Vireo, Yellow Warbler, Blue-gray Gnatcatcher, and Chipping Sparrow (*Spizella passerina*), especially in riparian habitats (Gaines 1973, Harris 1991). The high populations of cowbirds in this region probably limit the populations of many other bird species. The Brown-headed Cowbird is a recent arrival in the Owens Valley as Fisher (1893) did not find it there. Grinnell and Miller (1944) listed both subspecies, the Nevada Brown-headed Cowbird (*M. a. artemisiae*) and the Dwarf Brown-headed Cowbird (*M. a. obscurus*), as breeding in the Owens Valley. The first published record of cowbirds for the Owens Valley was a parasitized nest near Bishop in 1922 (Grinnell and Miller 1944). There are two specimens in the Museum of Vertebrate Zoology collection at University of California, Berkeley which predate this published record (T.& J. Heindel pers. comm.).

DISCUSSION

Riparian habitats have changed in the Owens Valley since the first settlement in the 1850s. Settlers cleared riparian vegetation to plant crops and for fuel. The major changes in the valley came from control of the Owens River with the building of Crowley Lake and out of basin water diversions. Ground water pumping has also lowered the water table out of reach of riparian trees in some areas. In many areas the nonnative black locust has taken the place of the native willows and cottonwoods.

Over the past 100 years, changes have occurred in the riparian avifauna of the Owens Valley. Several species have colonized the region or increased their numbers, while other species have declined or become extirpated. The key species in this survey was the Yellow-billed Cuckoo.

Historical accounts of Yellow-billed Cuckoos in the Owens Valley are few. This state probably reflects more a scarcity of ornithologists rather than a scarcity of cuckoos. Besides the cuckoo found in Bishop on 11 August 1891 by Fisher (1893), a specimen was taken there in August 1956 (California State University, Los Angeles). Other records prior to 1977 were two specimens taken 3 km north of Independence on 29 June 1917 (Museum of Vertebrate Zoology, University of California, Berkeley), one taken between Bishop and Lone Pine 22 Sep. 1928 (Museum of Vertebrate Zoology, University of California, Berkeley) and one seen 3 km southwest of Big Pine in July 1968 (Steven Cardiff pers. comm.).

In 1977, during the first statewide survey for Yellow-billed Cuckoos a small and apparently breeding population was found in the Owens Valley (Gaines and Laymon 1984). During that survey, Gaines found three cuckoos at Baker Creek and a single cuckoo at Hogback

Creek. A pair at Baker Creek were carrying twigs and insects and were either courting or nesting.

In 1986, during the second statewide survey for Yellow-billed Cuckoos, the species was again found in the Owens Valley (Laymon and Halterman (1987b). This time only one individual was detected, an unmated female at Hogback Creek.

During 1991, Tom and Jo Heindel surveyed the Baker Creek site weekly and found up to eight cuckoos, an all-time high for that location. From their description, most of these birds were unmated males; however, one to two pairs may have bred. In 1992 they found only two cuckoos at that site. In 1993 we found only one unmated male at Baker Creek.

Yellow-billed Cuckoos were not found on this survey at Hogback Creek where they were found on surveys in 1977 and 1986 (Gaines and Laymon 1984; Laymon and Halterman 1987b). One was found at this site in 1991 (A. Kirk fide D. Racine). Hogback Creek has not been surveyed as regularly as the Baker Creek site.

Cuckoos were found at two new location during this survey, both on the Owens River: (1) south of Aberdeen Station Road and (2) north of Lake Tinemaha. The area near Aberdeen Station is marginal for breeding cuckoos and the sighting probably represented a migrant or an unmated male. The Lake Tinemaha site was surveyed by Gaines in 1977 but no cuckoos were found. This site was not checked by Laymon and Halterman in 1986 and has not been surveyed again until this year. The two pairs found at this site were apparently nesting and represent the only nesting cuckoos in the Owens Valley during 1993.

At present, a viable population of cuckoos does not exist in the Owens Valley. The birds that occur here are apparently individuals that overflow from other areas in years of low food supply elsewhere or high reproductive success in the previous year. Laymon and Halterman (1989) in their proposed habitat management plan for Yellow-billed Cuckoos in California recommended that the Owens Valley be designated as one of the areas where a viable population of cuckoos be established. To achieve a minimum viable population of cuckoos in the Owens Valley would require a population of at least 25 pairs. At present there is approximately 60 ha of riparian habitat in the Owens Valley that is suitable for cuckoos. Each pair of cuckoos occupies an average of 20 ha of habitat. An additional 440 ha of suitable habitat would need to be created in the Owens Valley to create a minimum viable population of cuckoos. This habitat could be created through a variety of means including restoration planting and removal of spring and summer grazing. At many locations the restoration process could be advanced by planting on sites with existing scattered trees.

The species that have increased in the Owens Valley include the Wood Duck, Red-shouldered Hawk, Downy Woodpecker, Black Phoebe, Brown-crested Flycatcher, Blue-gray Gnatcatcher, Summer Tanager, and the Brown-headed Cowbird. Wood Ducks were at a very low population level at the turn of the century and their populations have increased over the past

80 years with increased conservation measures. Red-shouldered Hawks have been expanding their populations since 1970 and have occupied portions of the state where they did not formerly occur. Brown-crested Flycatchers and Summer Tanagers have expanded from the southwest over the past 30 years, as have Inca Doves (*Columbina inca*), Common Ground-Doves (*Columbina passerina*), Great-tailed Grackles (*Quiscalus mexicanus*), Verdins (*Auriparus flaviceps*), and Vermilion Flycatchers (*Pyrocephalus rubinus*). This expansion may be related to a long-term climate change causing southern California to become more arid. The expansion of Brown-headed Cowbirds also fits this pattern, but their expansion started earlier and may have been more related to the expansion of livestock grazing and irrigated agriculture (Laymon 1987). Heavily grazed fields with average grass length shorter than 15 cm is ideal for foraging Brown-headed Cowbirds. Feed lots and horse and cattle corrals also provide cowbirds with ample opportunity for foraging. The increase of Downy Woodpeckers, Black Phoebes, and Blue-gray Gnatcatchers are harder to explain. Black Phoebes generally are a resident species and only are found where they can find sufficient food. Winters in California since the late 1960s have not had as heavy snowfalls as they had in the 1950s and 1960s and this may have allowed Black Phoebes to expand their range. Blue-gray Gnatcatchers are a small migratory species which for some reason has been able to expand its range in the Owens Valley in spite of heavy cowbird parasitism in this region. In areas including the Sacramento Valley and the South Fork Kern River Valley they have disappeared as a breeding species in riparian habitats. They may have increased in numbers, in the Owens Valley by filling the niches of the species such as Yellow Warblers and Bell's Vireos extirpated by cowbird parasitism. How they have been able to withstand cowbird parasitism in this region, but not others, is a topic for further research. The Downy Woodpecker was a nesting species in the South Fork Kern River 100 km to the south in 1911 (Fisher 1893). They may have simply expanded into the Owens Valley from the Kern Valley.

The species that have declined or become extirpated are Swainson's Hawk, Willow Flycatcher, Warbling Vireo, Bell's Vireo, Yellow Warbler, Yellow-breasted Chat, and Blue Grosbeak. The Swainson's Hawk has declined throughout southern California where it was once common. It has been speculated that this decline was related to use of persistent pesticides in California from the 1940s to the 1970s. The other species that have declined are all highly susceptible to Brown-headed Cowbird parasitism. Cowbirds, being non-selective parasites, are able to drive other species to extinction if they have a suitable host which can maintain the cowbird populations. In the east, this role is often played by the Northern Cardinal (*Cardinalis cardinalis*). In the west, the California Towhee (*Pipilo crissalis*) and the Song Sparrow often fill this role.

Song Sparrows apparently are able to produce enough young to sustain their populations even when they are heavily parasitized by cowbirds. This is possible because Song Sparrows are able to fledge their own young in addition to a cowbird young and because in many years the first Song Sparrow clutch is laid prior to the initiation of laying by cowbirds. It is not entirely understood how Blue-gray Gnatcatchers and Common Yellowthroats have been able to maintain or expand their populations in the face of heavy cowbird parasitism. Gnatcatchers in this region

may nest prior to cowbirds and yellowthroat nests may be difficult for cowbirds to find because suitable search perches are often not available in the marshy setting preferred by the yellowthroats.

The overall effect of cowbird parasitism is a simplification of the insect gleaning portion of the avifauna. The open-cup nesters are replaced by cavity nesters such as House Wren and possibly several woodpecker species. A few species such as the Song Sparrow and Common Yellowthroat become very common and the overall species richness and species diversity drops.

In riparian habitats there are two groups of species, those whose populations are limited by existing habitat and those that are limited by Brown-headed Cowbird parasitism. In the first category are species with large home ranges, and species that require forest interiors for nesting. Red-shouldered Hawks, Yellow-billed Cuckoos, and Summer Tanagers are examples of habitat limited species. The other species that have declined in the Owens Valley are cowbird limited species. Warbling Vireos, Bell's Vireos, Willow Flycatchers, and Yellow Warblers are examples of cowbird limited species. Certainly riparian habitat is in short supply and to manage for viable populations of Yellow-billed Cuckoos will require significant habitat restoration. However, other riparian obligate species do not fully occupy existing habitats because of cowbird parasitism. A two-pronged management plan using both habitat restoration and cowbird population management would begin to restore the riparian avifauna of the Owens Valley.

MANAGEMENT RECOMMENDATIONS

1. There is every indication that Yellow-billed Cuckoos are occupying most of the suitable habitat in the Owens Valley. To increase the population to a minimum viable level of 25 pairs would require significant habitat restoration efforts combined with a reduction of grazing. Areas managed for cuckoos should include multi-layered forest patches greater than 50 acres in extent and greater than 100 m in width. These sites must have adequate ground or surface water to maintain vigorous foliage throughout the growing season. A mixture of Goodding's black willow and Fremont cottonwood should be planted. If possible, it would be advisable to expand existing riparian sites. A study of soils and ground water should be undertaken to determine the feasibility of restoration at selected sites. Specific recommendations for the seven sites shown on Figure 1 are as follows:

- A. Hogback Creek would benefit from additional planting of tree-form willows and cottonwoods to supplement the existing riparian vegetation. Spring and summer grazing should be reduced or eliminated at this site.
- B. Baker Creek would benefit from additional planting of willows and cottonwoods to supplement the existing riparian vegetation. Replacement of the exotic black locust with native vegetation would also benefit riparian species. Spring and summer grazing should be eliminated at this site.
- C. The Islands would benefit from additional planting and reduction of grazing. Most trees at this site show water stress and the most important factor for restoration at this site

is maintaining adequate ground water levels to support riparian vegetation.

D. The vegetation between Steward Lane and Lake Tinemaha, especially in the area immediately upstream from Lake Tinemaha, is in excellent condition. It is possible that the riparian zone could be broadened here with additional planting. Monitoring of grazing is necessary so damage to the riparian vegetation does not occur.

E. The Owens River from Pleasant Valley to Bishop has excellent understory riparian habitat. This area would benefit from additional planting of tree-form willows and cottonwoods. Grazing pressure should be controlled so it does not damage riparian habitat.

F. A reduction in grazing pressure in the area downstream from Aberdeen Station Road would benefit the riparian habitat. This area is a candidate for additional planting between the existing trees.

G. At present the hydrology along the Owens River between Keeler Bridge and Owens Lake probably precludes any additional planting to widen the existing riparian habitat. Sustained flows in the Owens River in this region would be needed before restoration is undertaken.

2. Brown-headed Cowbird populations are very high in the study area. Management activities including reduction of grazing, riparian habitat restoration, and Brown-headed Cowbird removal would have a positive impact on the populations of many riparian species including Willow Flycatcher, Yellow Warbler, Warbling Vireo, Common Yellowthroat, Yellow-breasted Chat, and Blue Grosbeak. A cowbird removal program should be conducted during the breeding season in riparian habitat. It should be initiated in the vicinity of sites where small populations of cowbird limited species such as Willow Flycatchers and Yellow Warblers breed. A winter trapping program in the Owens Valley may be feasible because the birds are concentrated at bird feeders at that time. It is not known how effective wintering trapping would be for protecting the local host populations, because the wintering cowbirds may not breed in the Owens Valley.

PART II. DISTRIBUTION AND ABUNDANCE OF WETLAND ASSOCIATED BIRD SPECIES AT OWENS LAKE, INYO COUNTY, CALIFORNIA

INTRODUCTION

The coastal breeding population of Snowy Plovers (*Charadrius alexandrinus*) in the western United States has been severely impacted by human disturbance, mainly from recreational activities on coastal beaches, and has been listed as a threatened species by the U.S. Fish and Wildlife Service. The interior population of Snowy Plovers far outnumbers the coastal population, but while numbers in some areas (especially the San Joaquin valley in California) are apparently increasing, numbers at other sites have been decreasing. Owens Lake, Inyo County, California is one of the interior sites at which the abundance of Snowy Plovers has declined dramatically (Page et al. 1991).

In 1978 Owens Lake was the interior site with the largest number of Snowy Plovers (499 adults composing 23% of the interior breeding population) (Page and Stenzel 1979, 1981). However, a subsequent survey in 1988 counted only 194 adults on the lake (Page and Stenzel unpubl. data) There was a further reduction in numbers in 1990 with a total of only 141 adults located (Page and Stenzel unpublished data).

The purpose of this study was to survey birds in wetland habitats at Owens Lake. The surveys were organized to cover suitable Snowy Plover habitat at the lake and to record all species of wetland birds present at these sites. An appendix outlining the survey procedure for each area has been included to aid anyone wishing to survey the same areas in the future (see also Page and Stenzel 1979).

METHODS

Snowy Plover surveys were conducted on Owens Lake, Inyo County, California from 18 through 24 May, 1993. Surveys were conducted mainly in mornings (until noon) and evenings (1700-2100) when Snowy Plovers tend to congregate around freshwater seeps on the alkali flats. The emphasis was on counting adult Snowy Plovers, with breeding information collected only tangentially. Areas surveyed included those with surface water covered by Page and Stenzel (1979) with the exception of South Keeler Seep, and, in addition, a walk out into the Owens River delta. Names of areas checked follow those in Page and Stenzel (1979), including places names they chose to designate locations not named on maps. Suitable habitat was traversed on foot by one or two observers, using binoculars and a Kowa zoom (20-60x) spotting scope. All adults and chicks were counted on each visit, and certain sites were visited more than once. For sites that were visited two or more times, the measure of abundance for the site is indicated by the maximum number observed at any one time. Chick size was recorded as a proportion of adult size.

RESULTS AND DISCUSSION

Locations and Numbers of Snowy Plovers at Owens Lake

A total of 100 adult Snowy Plovers were located on the lake (Table 10), and only a small percentage of these were identified to sex, so no sex ratio is given here. Adults were located at only four of the 14 areas surveyed. The four areas where Snowy Plovers were detected were North Seeps, Cottonwood Springs Seeps (outflow onto Owens Lake), Ash Creek Springs Seeps (outflow onto Owens Lake east of Permanente ruins and east of Ash Creek Pond), and Southeast Seep (Figure 2). Nine broods including 13 chicks were located, all at the outflow from Cottonwood Springs (Table 11). At North Seeps at least one pair appeared to be incubating. Although the contents of the nest were not checked (to avoid disturbance to the birds), the location of the nest was indicated by the behavior of the attending female (I had been watching two adults through my spotting scope for 30 minutes when the female wiggled her rump and sat down in the sand at a site behind a small mound with a sprig of salt grass [*Distichlis spicata*] about 100 m from me). The small sample of breeding activity recorded is a reflection of focusing on locating adults, rather than nests.

Habitat--An early reference to Snowy Plovers at Owens Lake indicates that they were present there before the turn of the century, when the lake was filled with water.

"This handsome little plover was observed by the writer [A.K. Fisher] on the shores on Owens Lake, near Keeler, May 30 to June 4, where it was common in small flocks of five or ten on the alkaline flats which border the lake. Like most other birds in the vicinity, it fed extensively, if not exclusively, on a species of small fly (*Ephydra hians* Say), which was found in immense masses near the edge of the lake. Many of these swarms of flies were four or five layers deep and covered an area of 15 or 20 square feet. Some idea can be formed of the inexhaustible supply of food which this insect furnishes for birds when it is known that colonies of equal size occurred at close intervals in suitable localities all around the lake, which has a shore line of between 40 and 50 miles." (Fisher 1893)

Thus the habitat currently available to Snowy Plovers is only a small fraction of the original lake shoreline.

Of the five creeks (Carroll, Cottonwood, Ash, Braley, and Cartago) and the Owens River that have historically flowed into Owens Lake, only Cartago Creek was flowing during this survey. Water also seeped onto the lake bed at North Seeps, Bartlett Soda Works, Cottonwood Springs, Ash Creek seeps (both east of the Permanente ruins and of Ash Creek pond), Dirty Socks, Southwest and Southeast Seeps, Keeler East and West Evaporators, and Keeler North seeps.

Of the 14 areas surveyed, 10 had enough shallow surface water with surrounding alkali flat to provide good foraging habitat for the Snowy Plover. Only small patches of water were

available at two areas (Bartlett Soda Works, North Keeler Seeps) and no suitable surface water was available at two areas (Carroll Creek and Owens River delta).

Figure 2

Food resources, primarily brine flies in this alkaline habitat, were noticeably sparse. Areas such as Cartago Creek and Dirty Socks had abundant water but very few brine flies, with long stretches of water without any flies at all. The four areas where plovers were detected all had noticeable, and at some spots abundant, brine flies. However, brine flies were also abundant at Keeler East and West Evaporators where no plovers were found. It is possible that Snowy Plovers were not detected at Keeler because the survey was conducted at midday, rather than during the preferred morning and evening hours. The Permanente seeps at Ash Creek Springs attracted many Snowy Plovers, but had strikingly less water and fewer brine flies than I had observed there on a Snowy Plover survey in May, 1990 (pers. obs.).

North Seeps--A total of 15 adult Snowy Plovers were observed at North Seeps and one nest was located during a morning survey on 19 May and an evening survey on 20 May (Table 10). Brine flies were abundant around the shallow ponded water on the alkali flat. In 1978, 33 adults were observed at North Seeps, but in 1988 and 1990 only two and five adults, respectively, were observed (Page and Stenzel unpubl. data).

Cottonwood Seeps--The maximum number of Snowy Plovers observed at Cottonwood Seeps in this study was 51 (51% of the total observed on May, 1993 surveys) on the morning of 24 May, 1993 (Table 10). Only the seeps on the lake bed flowing from Cottonwood Springs were monitored in 1993, not the area north to Cottonwood Point (called Cottonwood North in earlier studies). Three surveys at dusk in the immediate vicinity of the outflow on 18, 21 and 23 May recorded 16, 20 and 37 adults respectively (Table 10). Only one young, 35% grown, was identified on these dusk surveys. The morning survey on 24 May covered an area 2 km in length from the outflow to the north towards Bartlett Soda Works. I walked slowly along the lake edge from north to south and stopped to scan with a spotting scope out into the lake, along the course of a flowing channel of water about 10 meters wide. The survey took 3.25 hours and I counted 51 adults and nine broods of Snowy Plovers (Tables 10, 11). The amount of water flowing onto the lake greatly exceeded the flow I observed in May 1990 in this area (pers. obs.).

Results from previous surveys covered somewhat different areas around Cottonwood Seeps (Page and Stenzel 1979, Wetlands Research Associates 1991, Page and Stenzel unpubl. data) and are therefore not directly comparable. However, there appeared to be many more plovers at the Cottonwood Springs outflow in 1993 than there were in 1978 when 33 adults were counted along the shoreline from Bartlett Soda Works to Cottonwood Creek (Page and Stenzel 1979) or in 1988 when eight Snowy Plovers were counted in the Bartlett to Cottonwood Creek area (Page and Stenzel unpubl. data). In 1990 only six adult plovers were counted at the Cottonwood Springs Seeps, while another 17 were counted along the shore south of the seeps to Cottonwood Point (Wetland Research Associates 1991, pers. obs.).

Another survey conducted in 1993 at Cottonwood Seeps recorded a total of 86 Snowy Plovers between Cottonwood Point and a spot about a mile south of Bartlett Soda Works (Lake Minerals unpubl. data). Age was determined for only about one half of these birds, of which eight (or 19%) were definitely juveniles. If these proportions hold true for the other half of the

population, about 16 birds were juveniles and 70 were adults. Thus, my high count of 51 adults from this study may have been an underestimate. Alternatively, the population may have shifted its distribution during the weeks between the two surveys. If this survey does underestimate the numbers of Snowy Plovers at Cottonwood Springs, this may be due to my lack of coverage of the area north of the seeps to Cottonwood Point. In that case, the total of 100 adult Snowy Plovers for the entire lake would also be an underestimate.

Ash Creek Seeps--A total of 32 adult Snowy Plovers (32% of the total observed during May, 1993 surveys) were observed at the Ash Creek Springs seeps in the lake east of the Permanente ruins (26) and east of Ash Creek Pond (6; [Table 10]). This area has consistently attracted a significant proportion of the Snowy Plovers at Owens Lake in all years it has been surveyed. In 1978, 61 (12%) of a total of 499 adult Snowy Plovers were observed at the Permanente seeps (Page and Stenzel 1979). In 1988, 37 (19%) of 194 adults were observed at Permanente Seeps (Page and Stenzel unpubl. data), while in 1990, 31 (22%) of 141 adults were counted at this site (Wetlands Research Associates 1991, pers. obs.).

Southeast Seep--Two adult Snowy Plovers were observed at Southeast Seep on 24 May 1993 (Table 10). It is possible that this was an underestimate of numbers at this site, because this survey was done on a windy day between 1300 and 1430. Early morning and late evening are better times to get maximum counts. In the wind the plovers tend to lie low, making it difficult to detect them, and the wind also makes using a spotting scope difficult. When this site was surveyed in 1978, 1988, and 1990 a total of 11, 10 and 7 adults, respectively, were observed (Page and Stenzel 1979, Page and Stenzel unpubl. data).

Disturbance--Potential predators at Owens Lake of Snowy Plovers and their nests include Northern Harrier (*Circus cyaneus*), gulls, Common Raven (*Corvus corax*), and Coyotes (*Canis latrans*). Northern Harriers were noted at three sites: a pair over the marsh at Carroll Creek, one at Cottonwood Springs, and one at the Owens River delta (Table 12). Gulls, mainly Ring-billed (*Larus delawarensis*) and California (*Larus californicus*), were found at North Seeps, Cottonwood Springs Seeps, and Olancha Pond (and one at Southeast Seep). Ravens, well-known for eating eggs and young of nesting birds, were seen at seven of the 14 sites surveyed (Table 12). A pair of ravens were observed at four sites: North Seeps (walking and standing far out on the alkali flats), Ash Creek Springs (sitting on a salt grass island in the lake bed near Permanente Seeps), Cartago Creek, and North Keeler pond and seep. Two pairs of ravens were observed at Bartlett Soda Works. A single raven at Southwest Seeps was chased by three American Avocets, as was a raven at North Seeps. Coyotes were seen at North Seeps and Cartago Creek. At North Seeps I saw a coyote on both visits and on 19 May watched a coyote cross the marsh and seeps from south to north carrying a full-grown jack rabbit. Additional evidence of coyotes (footprints, scat, and howling) was noted at five other sites: Owens River delta, Bartlett Soda Works, Cottonwood Springs, Ash Creek, and Olancha Pond. There were coyote footprints across the entire area I surveyed at Ash Creek. Cattle can destroy nests by inadvertently walking on them, and eighteen head of cattle were observed at North Seeps.

Location and abundance of other wetland breeding species

Eared Grebe

Three Eared Grebes (*Podiceps nigricollis*) in breeding plumage were observed in the full evaporator at Cartago Creek (Table 12). A dead Eared Grebe was observed at the Dirty Socks Pond. Eared Grebes have nested in the Owens Valley, and whether they nest in a particular year depends on yearly fluctuations in water level and other conditions (Garrett and Dunn 1981).

Black-crowned Night-Heron

An immature Black-crowned Night-Heron (*Nycticorax nycticorax*) was seen at Cottonwood Springs (Table 12) on 18 May. An early record for the Owens Valley was an individual seen at a small freshwater pond not far from Owens Lake on June 26, 1891 (Fisher 1893). There are no recent publications that discuss current breeding status in the Owens Valley.

Great Egret and Snowy Egret

Great Egrets (*Casmerodius albus*) and Snowy Egrets (*Egretta thula*) were observed at the outflow from Cartago Creek where they were foraging in the same general area. A solitary Snowy Egret was also observed at Cottonwood Springs (Table 12). Neither species of egret was observed in Owens Valley in the spring of 1891 by members of the Death Valley Expedition (Fisher 1893). There are no recent publications that discuss current breeding status in the Owens Valley.

White-faced Ibis (California Species of Special Concern)

The 12 adult White-faced Ibis (*Plegadis chihi*) observed foraging at Olancha Pond (Table 12) were probably transients. Currently they are considered an uncommon transient throughout most of California (Garrett and Dunn 1981). They were formerly common breeders on the west side of the Sierras, especially in the San Joaquin Valley, but by the 1940's they were already rapidly declining in California (Grinnell and Miller 1944). The earliest record near the Owens Valley comes from Little Lake in the Rose Valley where members of the Death Valley Expedition observed White-faced Ibis between May 6 and 11 (Fisher 1893).

Canada Goose

At dusk on 19 May I was looking through my scope south from Ash Creek and saw eight Canada Geese (*Branta canadensis*). Two adults and six young Canada Geese (Table 12) were walking single file out on the lake bed, probably following the water out from the Cartago evaporators. On the morning of 23 May on the levee around the full evaporator at Cartago there

were abundant goose droppings and large pieces of egg shell that may have been left from the hatching of goose eggs. I do not know if these were domestic or wild geese, but I am not aware of any records of wild Canada Geese breeding at Owens Lake.

Ducks

Seven species of ducks were observed at Owens Lake (Table 12). Of these seven species, three were recorded in the Owens Valley as early as 1891: Mallard (*Anas platyrhynchos*), Cinnamon Teal (*Anas cyanoptera*), and Redhead (*Aythya americana*). The most dramatic change in duck distribution and abundance at Owens Lake in the last hundred years, is the disappearance of Fulvous Whistling-Ducks (*Dendrocygna bicolor*) from most of California. In 1891, Fulvous Whistling-Ducks were common at Little Lake and a flock of a dozen or more were seen on June 1 at Ash Creek on Owens Lake (Fisher 1893).

Northern Harrier (California Species of Special Concern)

Northern Harriers (*Circus cyaneus*) were observed at three sites: two birds at Carroll Creek, one at Cottonwood Springs, and one at the Owens River delta (Table 12). Northern Harriers were found throughout the Owens Valley in 1891 "doubtless attracted by the vast number of meadow mice (*Arvicola*) which swarm through the wet meadows and marshes" (Fisher 1893). They still breed in the Owens Valley (Garrett and Dunn 1981).

Virginia Rail

One Virginia Rail (*Rallus limicola*) was heard from the marsh south of Carroll Creek (Table 12). In 1891, "the species was not uncommon at Lone Pine in Owens Valley" (Fisher 1893). They are resident breeders in the Owens Valley (Garrett and Dunn 1981).

Sora

A total of four Soras (*Porzana carolina*) was located (Table 12). Two Soras were heard in the marsh at Cartago Creek, one was calling in the marsh north of Dirty Socks Pond, and one was heard near the North Keeler pond. During the breeding season Soras are found throughout California wherever there is suitable freshwater marsh or wet meadow habitat (Grinnell and Miller 1944). However, Soras were not recorded in the Owens Valley in 1891 (Fisher 1893). There is a breeding record from the Owens Valley near Olancho (Garrett and Dunn 1981).

American Coot

American Coots (*Fulica americana*) are resident breeders in the Owens Valley and were observed at Cottonwood Springs and Cartago Creek (Table 12) where there are large freshwater ponds. The American Coot was common at Ash Creek on the southwestern side of Owens Lake on June 1, 1891 (Fisher 1893).

Killdeer

Killdeer (*Charadrius vociferus*) are a regularly occurring breeding species at Owens Lake. On this survey they were observed at three sites: Bartlett Soda Works, Cottonwood Springs, and Cartago Creek (Table 12). C. Hart Merriam found them to be abundant at Owens Lake on June 19, 1891 and Nelson also observed them at Keeler and at Lone Pine in June, 1891 (Fisher 1893).

American Avocet

American Avocet (*Recurvirostra americana*) is the most common shorebird breeding at Owens Lake. They occurred at nine of 12 sites surveyed and they ranged in abundance from 4 to 81 (West Keeler Evaporator) at these nine sites (Table 12). They were in breeding plumage and many were obviously paired. Two nests were found; one with four eggs was found on 18 May at Cottonwood Springs Seeps; another with two eggs (probably not yet complete) was found on 24 May at Southeast Seeps. These nests were found despite my efforts to avoid likely nesting habitat and to move away from obviously agitated adults. On 15 June 1993, a total of 150 avocets were counted in the Cottonwood Springs area (Lake Minerals unpubl. data). American Avocets were noted at Owens Lake as early as 1891, when C. Hart Merriam saw a dozen or more at the northwestern end of Owens Lake on June 19 (Fisher 1893).

Black-necked Stilt

Black-necked Stilts (*Himantopus mexicanus*) are likely breeders at Owens Lake where they occur in small numbers at a few sites. On this survey they were observed at North Seeps, Cartago Creek, Southeast Seep and West Keeler Evaporator (Table 12). Black-necked Stilts were not seen in the Owens Valley on the Death Valley Expedition (Fisher 1893).

Long-billed Curlew (California Species of Special Concern)

Two Long-billed Curlews (*Numenius americanus*) were seen, one on 20 May at North Seeps and one on 18 May at Cottonwood Springs Seeps (Table 12). There is a published nesting record for the Owens Valley (near Big Pine in July 1978) and the small amount of wet meadow habitat around Owens Lake is similar to breeding habitat in northeastern California (Garrett and Dunn 1981). Long-billed Curlews have been recorded at Owens Lake since May 1891 when they were seen at Ash Creek on the lake shore (Fisher 1893).

Snowy Plover Population Declines (California Species of Special Concern, Federal Candidate)

As the human population of California expands, coastal beaches have become more and more heavily used for recreation. The disturbance caused by the growing use of beaches has coincided with a decline in the coastal Snowy Plover population, as plovers are no longer able to breed successfully on many coastal beaches (Page and Stenzel 1979). The interior population of plovers has been little disturbed by human recreation, and is therefore of critical importance to the survival of this species. Following is a review of habitat needs of interior breeding plovers and recommendations to protect and enhance plover habitat at Owens Lake.

In the interior (with the exception of San Francisco Bay) the Snowy Plover's main breeding habitats are shallow, usually brackish or alkaline lakes bordered by unvegetated flats (Page and Stenzel 1979). (In San Francisco Bay, the plovers utilize salt evaporators, a man-made habitat.) At these shallow, alkaline lakes, the adult plovers and broods are most concentrated near the water's edge, but nests are scattered over non- to lightly-vegetated flats up to 3 km from the water (Page and Stenzel 1979). At Owens Lake, the lake itself has almost completely disappeared and the plovers concentrate around freshwater outflows and seeps in the lake bed. These areas cover only a small fraction of the original shoreline.

In 1978, 499 (23%) of the total of 2194 adult Snowy Plovers at inland locations in California were found at Owens Lake, the largest population at an individual location (Page and Stenzel 1979). The next largest interior population occurred at Mono Lake (Page and Stenzel 1979).

Unfortunately, Snowy Plovers at Owens Lake have been declining in the past decades, as evidenced by comparisons of numbers between this survey and earlier surveys in 1978, 1988, and 1990 conducted by the Point Reyes Bird Observatory. In 1978 a total of 499 adult Snowy Plovers were observed at Owens Lake (Page and Stenzel 1979). When this survey was repeated in 1988, a total of 194 adult Snowy Plovers (only 39% of the 1978 count) were found (Page and Stenzel unpubl. data). Two years later in 1990 numbers of adult Snowy Plovers showed yet another decrease to a total of 141 individuals (Page and Stenzel unpubl. data). Finally, in this study only 100 adults were located (Table 10).

The decrease in numbers has been particularly marked at some locations on the lake, while at others (such as North Seeps) numbers have been more stable. In 1978, Cartago Creek was the area with the largest number of adult plovers (115), but none have been recorded there since then (Page and Stenzel unpubl. data and this study). The water flow in the Cartago Creek area has been significantly smaller in all subsequent survey years. In 1978, 88 Snowy Plovers were observed at Dirty Socks pond and seeps. By 1988 numbers at Dirty Socks had declined to 41; by 1990 only 27 adults were seen, and in 1993 no adults were counted at Dirty Socks (although several were seen there in June [Lake Minerals unpubl. data]).

The six main streams that flow into Owens Lake are presently used mainly to fill the Los Angeles aqueduct and therefore little water enters the lakes from these streams. In 1993, a year of well above average rainfall, only Cartago Creek had water flowing down towards the lake. Therefore, the critical habitat to support the plovers depends on the availability of sufficient ground water to support springs and seeps in the area.

MANAGEMENT RECOMMENDATIONS

Because Snowy Plovers tend to concentrate around freshwater seeps and springs around the lake shore, 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. For example, the East Keeler Seep used to have considerably more water and support more birds before the well there was capped. Although there is still some water present at East Keeler Evaporators, a greater area should be flooded to allow some use by Snowy Plovers. In 1993 the flow of water at Dirty Socks seemed reduced from previous levels in 1978, 1988, and 1990 (G. Page, pers. comm.), and there was less water flowing onto the lake at Ash Creek Springs, both at the Permanente Seeps to the south and the Ash Creek Pond seeps to the north (pers. obs.). Both of these areas should be investigated to determine what might be slowing the flow of water onto the lake. The reduction in flow is not due to weather conditions because 1993 was an above average rain fall year. Allowing some outflow of water through the Owens River onto the lake bed would likely attract Snowy Plovers to forage and nest there. The dry channel observed at the end of the vegetation on the Owens River looked like suitable foraging habitat and the flats and scattered mounds sparsely vegetated with salt grass looked like good nesting habitat. There was less water flowing onto the lake at Ash Creek Springs, both at the Permanente Seeps to the south and the Ash Creek Pond seeps to the north, and the flow here should be investigated.

Snowy Plovers nest most commonly on unvegetated or sparsely vegetated flats, and therefore it is important to make sure that surface water is available near such habitat. Dense marsh vegetation is not suitable for nesting Snowy Plovers or American Avocets, the most abundant shorebird species breeding at Owens Lake.

In order to protect current outflow areas, measurement of the amount of water flowing onto the lake, as is possible at Cottonwood Springs, should be carried out at other sites, especially Dirty Socks, Ash Creek seeps, East Keeler Seeps and West Keeler Seeps. The Keeler area may be particularly important to Snowy Plovers, as this is where they were observed in 1891 between 30 May and 4 June by members of the Death Valley Expedition (Fisher 1893).

As the population of Snowy Plovers at Owens Lake may be in a continuing decline, monitoring of the population is essential. Yearly surveys should be conducted that include observations at all the sites covered in this study within as short a time frame as possible. Since numbers vary with time of day at some sites (e.g. adults from a wide area may gather to feed only at certain seeps at dusk), it is important to sample each site both in the morning and the

evening. The entire lake can be surveyed in a week by two people, and with additional participants some sites could be surveyed concurrently. Surveying sites concurrently would have the advantage of controlling for any movement of adults between sites.

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Table 1. Birds Surveyed in Riparian Habitats along Hogback Creek, Inyo County, Summer 1993.

Species	30 June 93	22 July 93
Northern Harrier	4	1
Red-tailed Hawk	2	1
American Kestrel	8	2
California Quail	9	4
Virginia Rail	2	-
Mourning Dove	33	10
Greater Roadrunner	-	1
Common Barn-Owl	2	-
Black-chinned Hummingbird	-	1
Anna's Hummingbird	-	1
Costa's Hummingbird	1	1
Nuttall's Woodpecker	1	1
Downy Woodpecker	-	1
Northern Flicker	17	6
Western Wood-Pewee	1	-
Black Phoebe	6	-
Say's Phoebe	-	3
Ash-throated Flycatcher	4	2
Western Kingbird	2	1
Scrub Jay	5	7
Common Raven	3	1
Plain Titmouse	1	-
Bewick's Wren	23	13
House Wren	5	-
Blue-gray Gnatcatcher	6	5
American Robin	4	5
Loggerhead Shrike	1	-
Warbling Vireo	-	1

Yellow-breasted Chat 5 1

Table 1. Cont.

Species	30 June 93	22 July 93
Western Tanager	-	1
Blue Grosbeak	3	5
Lazuli Bunting	2	-
Rufous-sided Towhee	12	13
Black-throated Sparrow	4	25
Song Sparrow	26	7
Brown-headed Cowbird	6	1
Northern Oriole	5	-
House Finch	3	-
Lesser Goldfinch	5	-

Table 2. Birds Surveyed Along Baker Creek, Inyo County, Summer 1993.

Species	2 July 93	21 July 93	6 August 93
Northern Harrier	2	-	1
Cooper's Hawk	-	1	-
Red-shouldered Hawk	-	-	1
Red-tailed Hawk	1	-	-
American Kestrel	6	3	2
California Quail	3	1	8
Mourning Dove	27	8	9
Yellow-billed Cuckoo	1	1	1
Great Horned Owl	-	2	-
Common Nighthawk	28	2	-
Black-chinned Hummingbird	3	-	2
Belted Kingfisher	1	-	1
Nuttall's Woodpecker	5	1	1
Downy Woodpecker	5	2	3
Hairy Woodpecker	2	1	2
Northern Flicker	15	1	3
Willow Flycatcher	-	-	1
Gray Flycatcher	-	-	1
Black Phoebe	1	-	1
Ash-throated Flycatcher	2	1	1
Western Kingbird	-	1	2
American Crow	2	1	2
Common Raven	2	6	-
Mountain Chickadee	-	-	1
Bushtit	27	15	35
Bewick's Wren	27	1	16
House Wren	20	5	6
Blue-gray Gnatcatcher	23	4	7

American Robin 5 3 2

Table 2. Cont.

Species	2 July 93	21 July 93	6 August 93
European Starling	25	-	-
Orange-crowned Warbler	-	-	1
Yellow Warbler	7	-	1
Yellow-breasted Chat	5	-	1
Summer Tanager	1	-	1
Western Tanager	4	-	-
Black-headed Grosbeak	1	1	-
Blue Grosbeak	2	1	-
Lazuli Bunting	18	7	1
Rufous-sided Towhee	24	11	5
Chipping Sparrow	-	-	3
Black-throated Sparrow	2	-	-
Song Sparrow	18	4	5
Western Meadowlark	3	1	11
Brown-headed Cowbird	15	13	-
Northern Oriole	4	3	2
House Finch	-	1	4
Lesser Goldfinch	9	13	1

Table 3. Birds Surveyed in The Islands area, along the Owens River, Summer 1993.

Species	1 July 93	22 July 93
Great Blue Heron	1	2
Mallard	2	-
Cinnamon Teal	2	-
Turkey Vulture	-	1
Northern Harrier	3	2
Red-tailed Hawk	1	-
American Kestrel	8	3
California Quail	2	7
Virginia Rail	3	1
American Coot	1	-
Mourning Dove	31	6
Great Horned Owl	1	-
Common Nighthawk	11	1
Black-chinned Hummingbird	-	1
Nuttall's Woodpecker	4	-
Northern Flicker	29	3
Black Phoebe	3	-
Ash-throated Flycatcher	15	-
Brown-crested Flycatcher	1	-
Western Kingbird	9	6
Cliff Swallow	1	1
Barn Swallow	2	-
Black-billed Magpie	3	-
Common Raven	4	-
Bushtit	20	-
Bewick's Wren	46	2
House Wren	8	-
Marsh Wren	4	2

Blue-gray Gnatcatcher 16 4

Table 3. Cont.

Species	1 July 93	22 July 93
Northern Mockingbird	10	-
Loggerhead Shrike	7	-
European Starling	3	-
Warbling Vireo	4	-
Common Yellowthroat	36	11
Yellow-breasted Chat	1	3
Blue Grosbeak	5	-
Lazuli Bunting	-	1
Rufous-sided Towhee	1	-
Song Sparrow	25	2
Red-winged Blackbird	27	3
Western Meadowlark	10	1
Great-tailed Grackle	1	2
Brown-headed Cowbird	24	7
Northern Oriole	5	-
House Finch	1	-

Table 4. Birds Surveyed along the Owens River from Steward Lane to Tinemaha Reservoir, Summer 1993.

Species	2 July 93	21 July 93	5 August 93
Pied-billed Grebe	1	-	-
American Bittern	-	-	1
Great Blue Heron	-	10	3
Black-crowned Night-Heron	-	1	6
Wood Duck	-	2	1
Mallard	8	11	1
Cinnamon Teal	-	1	-
Turkey Vulture	1	2	-
Northern Harrier	-	1	1
Swainson's Hawk	-	3	4
Red-tailed Hawk	-	3	-
American Kestrel	2	9	2
Mourning Dove	2	20	23
Yellow-billed Cuckoo	2	3	3
Common Barn-Owl	-	2	-
Common Nighthawk	1	7	-
White-throated Swift	-	-	4
Nuttall's Woodpecker	1	4	2
Downy Woodpecker	1	2	4
Northern Flicker	3	7	7
Willow Flycatcher	-	-	1
Black Phoebe	-	6	4
Say's Phoebe	-	2	-
Ash-throated Flycatcher	2	7	-
Western Kingbird	-	4	2
Tree Swallow	-	30	4
N. Rough-winged Swallow	-	1	2

Cliff Swallow 20 1 -

Table 4. Cont.

Species	2 July 93	21 July 93	5 August 93
Black-billed Magpie	-	2	-
Common Raven	-	1	1
Bushtit	-	27	3
Bewick's Wren	6	1	5
House Wren	-	1	-
Marsh Wren	5	5	4
Blue-gray Gnatcatcher	-	2	3
Mountain Bluebird	-	3	-
Yellow Warbler	-	-	4
Common Yellowthroat	8	23	25
Yellow-breasted Chat	-	1	-
Blue Grosbeak	-	6	4
Lazuli Bunting	-	-	1
Rufous-sided Towhee	-	2	2
Black-throated Sparrow	-	2	-
Song Sparrow	6	33	10
Red-winged Blackbird	-	9	6
Western Meadowlark	2	-	1
Yellow-headed Blackbird	2	-	-
Brown-headed Cowbird	-	26	1
Northern Oriole	-	1	4
Lesser Goldfinch	-	-	2

Table 5. Birds Surveyed Along the Owens River From Pleasant Valley to NE Bishop, Summer 1993.

Species	1 July 93	12 July 93
Pied-billed Grebe	-	1
Great Blue Heron	-	5
Mallard	-	6
Cinnamon Teal	-	4
Northern Harrier	-	1
Spotted Sandpiper	-	2
Mourning Dove	-	3
Greater Roadrunner	1	-
Downy Woodpecker	-	2
Northern Flicker	-	9
Western Wood-Pewee	-	1
Willow Flycatcher	-	5
Black Phoebe	-	28
Ash-throated Flycatcher	-	1
Western Kingbird	-	4
Cliff Swallow	-	6
Black-billed Magpie	1	7
Common Raven	-	2
Bushtit	-	6
Bewick's Wren	-	7
House Wren	1	-
Blue-gray Gnatcatcher	-	3
Yellow Warbler	-	3
Common Yellowthroat	1	14
Yellow-breasted Chat	4	10
Blue Grosbeak	2	6
Lazuli Bunting	1	3
Rufous-sided Towhee	4	4

Savannah Sparrow - 5

Table 5. Cont.

Species	1 July 93	12 July 93
Song Sparrow	11	87
Red-winged Blackbird	-	26
Brown-headed Cowbird	-	73
Northern Oriole	1	1

Table 6. Birds Surveyed Along the Owens River South of Aberdeen Station Rd., Summer 1993.

Species	21 July 93	5 August 93
Pied-billed Grebe	1	-
Great Blue Heron	1	-
Cooper's Hawk	1	-
Red-tailed Hawk	2	-
American Kestrel	2	-
American Coot	2	-
Mourning Dove	11	-
Yellow-billed Cuckoo	1	-
Common Barn-Owl	5	1
Lesser Nighthawk	3	-
Black-chinned Hummingbird	-	2
Anna's Hummingbird	-	1
Costa's Hummingbird	1	-
Belted Kingfisher	2	-
Nuttall's Woodpecker	4	1
Downy Woodpecker	1	-
Northern Flicker	8	1
Black Phoebe	2	-
Ash-throated Flycatcher	6	-
Cliff Swallow	30	-
Black-billed Magpie	5	1
Common Raven	1	1
Plain Titmouse	-	1
Bushtit	12	-
Bewick's Wren	10	9
Blue-gray Gnatcatcher	4	2
Blue Grosbeak	2	1

Rufous-sided Towhee	8	-
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Table 6. Cont.

Species	21 July 93	5 August 93
Brewer's Sparrow	-	1
Song Sparrow	6	1
Brewer's Blackbird	20	-
Brown-headed Cowbird	11	-
House Finch	1	-

Table 7. Birds Surveyed Along the Owens River South of Keeler Bridge, Summer 1993.

Species	22 July 93
Great Blue Heron	5
Mourning Dove	13
White-throated Swift	3
Ladder-backed Woodpecker	1
Nuttall's Woodpecker	4
Hairy Woodpecker	1
Black Phoebe	3
Say's Phoebe	3
Ash-throated Flycatcher	8
Tree Swallow	6
Barn Swallow	1
Black-billed Magpie	3
Common Raven	4
Bewick's Wren	8
House Wren	2
Marsh Wren	11
Blue-gray Gnatcatcher	16
Loggerhead Shrike	2
Common Yellowthroat	6
Song Sparrow	7
Red-winged Blackbird	15
Yellow-headed Blackbird	1
Brown-headed Cowbird	3
Northern Oriole	6

Table 8. Distribution and Breeding Status of Riparian Associated Species in the Owens Valley, Summer 1993.

Species	Site A	Site B	Site C	Site D	Site E	Site F	Site G
Wood Duck				B?			
Red-shouldered Hawk		B?					
Swainson's Hawk				B			
Spotted Sandpiper					B?		
Yellow-billed Cuckoo		NB		B		NB	
Black-chinned Hummingbird	B	B	B			B	
Downy Woodpecker	B	B		B	B	B	
Willow Flycatcher		M		M	B		
Black Phoebe	B	B	B	B	B	B	B
Brown-crested Flycatcher			?				
Tree Swallow				B?			B?
Blue-gray Gnatcatcher	B	B	B	B	B	B	B
Warbling Vireo	M		B?				
Yellow Warbler		B		M	B		
Common Yellowthroat			B	B	B		B
Yellow Breasted Chat	B	B	B	B	B		
Summer Tanager		NB					
Blue Grosbeak	B	B	B	B	B	B	
Song Sparrow	B	B	B	B	B	B	B
*Brown-headed Cowbird	B	B	B	B	B	B	B

Site A = Hogback Creek

Site B = Baker Creek

Site C = Owens River, The Islands

Site D = Owens River, Steward Lane to Tinemaha Reservoir

Site E = Owens River, Pleasant Valley to Bishop

Site F = Owens River, south of Aberdeen Station Road

Site G = Owens River, Keeler Bridge to Owens Lake

M = Migrant

NB = Not breeding, singing males present, but not paired

B = Breeding

B? = Possible breeding

? = Occurrence not certain

* = Nest Parasite in Riparian Zone

Table 9. Abundance of riparian associated species in the Owens Valley, Summer 1993, derived from the maximum number detected on surveys at each site. Birds known to be migrants were not included.

Species	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Total
Wood Duck				1				1
Red-shouldered Hawk		1						1
Spotted Sandpiper					2			2
Yellow-billed Cuckoo		1		5		1		7
Black-chinned Hummingbird	1	3	1			2		7
Downy Woodpecker	1	5		4	2	1		13
Willow Flycatcher					5			5
Black Phoebe	6	1	3	6	28	2	3	49
Brown-crested Flycatcher			1					1
Tree Swallow				30			6	36
Blue-gray Gnatcatcher	6	23	16	1	3	4	16	69
Warbling Vireo	1		4					4
Yellow Warbler		7			3			10
Common Yellowthroat			36	25	14		6	81
Yellow-breasted Chat	5	5	3	1	10			24
Summer Tanager		1						1
Blue Grosbeak	5	2	5	6	6	2		26
Song Sparrow	26	18	25	33	87	6	7	202
* Brown-headed Cowbird	6	15	24	26	73	11	3	158

* = Nest Parasite in Riparian Zone

Site A = Hogback Creek; Site B = Baker Creek; Site C = Owens River, The Islands;

Site D = Owens River, Steward Lane to Tinemaha Reservoir;

Site E = Owens River, Pleasant Valley to Bishop; Site F = Owens River, S. of Aberdeen Station Road;

Site G = Owens R., Keeler Bridge to Owens L.

Table 10. Numbers of Snowy Plovers at locations surveyed on Owens Lake from 18 to 24 May, 1993. Numbers in parentheses (-) are not included in the totals. Location names follow Page and Stenzel (1979).

Locations	Date	Time	Adults	Broods/Nests
North Seeps - North side South side	19 May	0645-0915	5	0/1
	20 May	1700-1930	10	0/0
Carroll Creek	22 May	0745-0900	0	0/0
Bartlett Soda Works	21 May	1730-1930	0	0/0
Cottonwood Springs Seeps	18 May	1800-2000	(16)	(1/0)
	21 May	2000-2015	(20)	(0/0)
	23 May	1830-2015	(37)	(0/0)
	24 May	0715-1030	51	(9/0)
Ash Creek Seeps - Pond - Permanente	19 May	1820-1920	6	0/0
	19 May	1945-2015	26	0/0
Cartago Creek	22 May	0930-1015	0	0/0
	23 May	0800-1100	0	0/0
Olancha Pond	22 May	1100-1300	0	0/0
	23 May	1800-1815	0	0/0
Dirty Socks Pond & Seeps	20 May	0545-0730	0	0/0
Southwest Seep	20 May	0810-0910	0	0/0
Southeast Seep	24 May	1300-1430	2	0/0
Keeler: East Evaporators	23 May	1210-1240	0	0/0
Keeler: West Evaporators	23 May	1245-1315	0	0/0
Keeler: North Seeps	23 May	1345-1415	0	0/0
Owens River Delta	21 May	0810-1110	0	0/0
TOTAL			100	9/1

Table 11. Description and size of 9 Snowy Plover broods with 13 chicks detected at Cottonwood Springs Seeps, Owens Lake, Inyo County, California on 24 May, 1993.

Number of adults	Number of chicks	Chick Size
1	2	40%
0	2	35%
1	1	70%
0	1	60%
1	2	50%
0	1	40%
0	1	60%
0	1	50%
1	2	50%

Table 12. Distribution and abundance of wetland associated species at Owens Lake, Inyo County, California derived from the maximum number detected on surveys at each site from 18 to 24 May, 1993. Sites designated by letters are: Site A = North (Elk) Seeps; Site B = Carroll Creek; Site C = Bartlett Soda Works; Site D = Cottonwood Springs; Site E = Ash Creek seeps, from the Pond to Permanente; Site F = Cartago Creek evaporators and seeps; G = Olancha Pond; Site H = Dirty Socks pond and seeps; Site I = Southwest and Southeast Seeps (West/East); Site J = Keeler Evaporators, East and West (East/West); Site K = Keeler, North pond and seep; Site L = Owens River delta. Plus (+) indicates the species was noted, but not counted.

Species	A	B	C	D	E	F	G	H	I (W/E)	J (E/W)	K	L	Total
Eared Grebe						3							3
Black-crowned Night-Heron				1									1
Great Egret						6							6
Snowy Egret				1		6							7
White-faced Ibis							12						12
Canada Goose							8*						8*
Green-winged Teal						2	1	7		-/1	10		21
Mallard	4		2	+		2							8
Northern Pintail						2							4
Cinnamon Teal	1				+			4					5
Gadwall						3	3						6
Redhead						2	10						12

Species	A	B	C	D	E	F	G	H	I (W/E)	J (E/W)	K	L	Total
Ruddy Duck						3							3
Northern Harrier		2		1								1	4
Virginia Rail		1											1
Sora						2		1			1		4
American Coot				+		18							18
Snowy Plover adults (chicks)	15(-)			51(13)	32				-/2				100(13)
Killdeer			1	2		1							4
American Avocet	25		4	58	17	13	48	44	6/57	32/81			385
Black-necked Stilt	4					5			-/2	-/3			14
Spotted Sandpiper	1									-/1			2
Long-billed Curlew	1			1									2
Dowitcher spp.	2												2
Wilson's Phalarope	1												1
Red-necked Phalarope	1			2						-/1			4

Ring-billed Gull	36			44			34			-/1			115
Species	A	B	C	D	E	F	G	H	I (W/E)	J (E/W)	K	L	Total
California Gull	2			11									13
Gull spp.				20									20
Caspian Tern							1						1
Common Raven	2		4		2	3		1	1/-		2		15
Red-winged Blackbird	+	+	+					+				+	+
Yellow-headed Blackbird	20			+	50					+		+	70+
Great-tailed Grackle						5							5

* = 2 adults and 6 young.

Appendix A. Areas surveyed for Snowy Plovers in May 1993 at Owens Lake, Inyo County, California.

North Seep--Labeled "A" on the map. The name "North Seep" was coined by Page and Stenzel (1979) and is sometimes called "Elk Seep" by birdwatchers in the area (Tom Heindel, pers. comm.). It is a seep from the shore out into the lake bed at the northwestern end of the lake. Two seeps flow through a marsh with an oblong pond and then out onto the lake bed in two areas. The northern lake seep creates a patch of salt grass in the shape of a long peninsula with a terminal bulge; it looks like an island connected by a causeway to the marsh. The southern lake seep first forms a large oblong pond in the marsh and then a slightly smaller pond on the lake bed. The pond and northern lake seep were surveyed on 19 May from 0645 to 0915, while the pond and southern seep were surveyed on 20 May from 1730-1930. The surveys consisted of walking around the outer extent of the seeps in each area and scanning the flats in all directions. The borders of the seeps were bare in some areas and surrounded by vegetation (mainly salt grass) in other areas.

North Seep can be reached from Lone Pine by Highway 395 south to the AARP road sign; 100 meters beyond the sign make a left turn (with caution) to cross the north bound highway and continue across a cattle guard onto a dirt road. Park your car at the top of the ridge and walk down and east to the marsh and seep. Although the road continues, it is so sandy that driving is not advisable.

Carroll Creek--Labeled "B" on the map. Carroll Creek was not flowing during the survey week and there were no seeps in the area on the lake bed with the exception of two ponds (one about 200 m² and the other about 50 m²) about 1.2 km out on the alkali flat. The water in the ponds was a deep rusty orange-brown. The edges of the ponds were almost vertical and there were no brine flies present. The only water on the shore in the vicinity of Carroll Creek was a spring and marsh south along the shore. The spring was fenced and water was briskly overflowing. There was marsh to the south and east of the spring and a line of tamarisk trees (with a few willows next to the spring) went east out into the lake bed. At this site the wet area was all thickly vegetated (mainly salt grass and bull rushes (*Scirpus* spp.) and not suitable nesting or foraging habitat for Snowy Plovers. I explored this area from 10:20 to 10:50 on 18 May (walking south towards Bartlett Soda Works) and from 0745-0900 on 22 May (circling the watered area and walking about 0.5 km out onto the lake bed).

The Carroll Creek area can be reached from the north or the south by taking the Bartlett Road off Highway 395, about 11 km (7 miles) south of Lone Pine.

Bartlett Soda Works--Labeled "C" on the map. The abandoned soda works consists of a number of old evaporators, most with breaks in the levees. At the time of my visit the small amount of surface water was confined to a pond and channel (about 250 m long) surrounded by vegetation (salt grass and bull rushes) from which shallow water spread onto the alkali flats for about 30 meters. The pond was deep enough to cover an avocet's belly (there were several foraging there). The only other water occurred in puddles holding about 2 gallons of water which were sporadically spaced along the levee nearest the shore. Brine flies were noted, but not abundant at any of the channels or puddles. A larger area of channels and flat areas south of the buildings were damp, suggesting that there had been surface water here earlier in the season. I visited this area on 18 May and surveyed it on 21 May from 1730-1930.

Bartlett Soda Works can be reached from Lone Pine by taking Highway 395 to the Cottonwood Power Plant Road, making a U-turn across the divided highway, and then backtracking 0.6 km (0.4 miles) to the north in order to turn onto an unmarked road. This dirt road goes north to a railroad underpass; after the underpass continue on the branch to the northwest until you reach the lake shore. You can walk along the lake shore from here all the way to Carroll Creek.

Cottonwood Springs--Labeled "D" on the map. There was a large pond and a fenced wet meadow/pasture on the west side of the road that paralleled the lake shore. From there water runs out onto the lake through several channels and seeps appear in an area of about 0.25 km. An abundance of water was flowing out from Cottonwood Springs creating a flowing stream at least 10 m wide on the lake bed. The water continued flowing to the north-northeast as far as I could follow it. There was no water in Cottonwood Creek where it was crossed by Highway 395, and therefore it is likely that no water was flowing out into the lake at Cottonwood Point, but that area was not checked. On dusk counts on 18 and 23 May I walked about 1 km, 0.5 km from the south to 0.5 km to the north of the Cottonwood Springs outflow. On the evening of 21 May I arrived in time only to count plovers at the outflow onto the lake from 2000-2015. On the morning of 24 May, I parked about 2 km north of the springs and walked south to the springs outflow from 0715 to 1030.

Cottonwood Springs can be reached from the same dirt road that goes to Bartlett Springs. After passing under the railroad follow the fork to the south and continue you until you reach the spring fed pond and marsh in a fenced pasture. From here you can walk both north and south to cover the extent of the seeps into the lake bed.

Ash Creek Seeps--Labeled "E" on the map. There was no water in Ash Creek, but there were extensive seeps on the lake bed east of Permanente ruins (south of Ash Creek) and a small seep east of the pond to the north. I visited the area on 18 May and surveyed the area from the pond to Permanente seeps on the lake bed between 1800 and 2015 on 19 May. Snowy Plovers were found only at the seeps.

The road out to the Permanente ruins leaves Highway 395 about 0.8 km (0.5 miles) south of the highway crossing of Ash Creek; it is paved where it leaves the highway.

Cartago Creek--Labeled "F" on the map. Cartago Creek was the one creek on the west side of Owens Lake that was flowing, and it was filled with water rushing towards the lake. I used a spotting scope to survey the evaporators from the pasture at the end of Whitney Street on one other occasion, on 22 May between 0930 and 1000. On 23 May we (Denyse Racine [DR] and I [PW]) explored the evaporators at the end of Whitney Street and then followed the flow of water north-northeast out onto the lake bed between 0800 and 1100. Although there was an abundance of flowing water there were very few brine flies and also few birds on the lake bed.

The Cartago survey area can be reached by taking Whitney Street off Highway 395 and parking where the road ends near the old evaporators.

Olancha Pond--Labeled "G" on the map. The pond was about 1/3 filled with water. There was a small island surrounded by water on all sides and a larger island with water only on the west and north sides. The pond area that wasn't flooded was bare alkali flat. On 22 May between 1100 and 1300, we (PW and DR) walked from the south, out across the dry part of the pond, crossing to the northeast corner and then walking west towards the water's edge before circling back to the south. On the west and southwest shores the pond is surrounded by salt grass marsh and on the north by a partially vegetated gravel ridge. I also scanned the pond from one spot near the south shore on 23 May between 1800 and 1815.

Olancha Pond can be reached from a dirt road off Highway 190 about 1.0 km (0.6) miles from the junction with Highway 395. The road follows the high voltage transmission line.

Dirty Socks--Labeled "H" on the map. Water from a warm spring at the lake's edge fills a pond, then spreads out into a marsh, and finally flows out onto the lake bed. On 20 May between 0545 and 0730 we (PW and DR) surveyed Dirty Socks pond and seep. We counted birds at the pond and marsh and then followed the seep to its end on the lake bed about 1 km to the north. There was much less water than at

Cottonwood Springs or Cartago Evaporators. There were very few brine flies on the lake bed and none were apparent farther than 150 meters from the pond. Even within the first 150 meters there were long stretches of water with no flies at all. All the birds observed were within the first 150 meters of the seep. As at Cartago, there were few brine flies and few birds. I scanned the area from shore from 1015 to 1045 on 22 May and again saw no Snowy Plovers.

Because of the warm spring, Dirty Socks is an area of high visitor use with a broad entrance road off Highway 190 about 5 km (3 miles) east from Highway 395.

Southwest and Southeast Seeps-- Labeled "I" on the map. I reached "Southwest Seeps" by driving 3.2 km (2 miles) east of Dirty Socks on Highway 190 and walking north to the lake bed. There were several salt grass covered islands in the lake bed, one area of very shallow ponded water, and a tangle of narrow channels from 5 cm to 1 m wide. Almost all of the watered area was covered with vegetation. The soil was too damp and unstable to walk on, so I walked west along the shore (with the sun at my back) scanning to the north and west. I surveyed Southwest Seep on 20 May from 0810 to 0910.

I reached "Southeast Seeps" by driving 6.4 km (4 miles) east of Dirty Socks on Highway 190 and walking north to the lake bed. Southeast Seeps consist of a tangle of channels, some damp and some with flowing water, around scattered islands of salt grass. The channels look like race tracks, flat and smooth, with scattered brine flies near the water (similar in appearance to the seeps at Permanente ruins near Ash Creek). I surveyed Southeast Seep on 24 May from 1300-1430.

Keeler Evaporators, East and West--Labeled "J" on the map. Keeler Evaporators were reached by following Highway 190 about 29 km (18 miles) east from Highway 190 and then turning onto a road going west (past a mound of white salt about 13 x 18 meters [40 x 60 feet]) out into the lake bed.

At the old evaporators near the lake shore ("East Keeler Evaporators") there was a capped well that allowed a small trickle of water out onto the lake bed filling about 1/2 of the area of a former pond. The brine flies were dense around the periphery of the pond. I scanned the water and alkali flats here from 12:10 to 12:40 on 23 May.

The next surface water occurred about three miles farther out at "West Keeler Evaporators." Here there was much more water than at East Keeler Evaporators. A pond and lush marsh were located north of the road. The water flowed south from the marsh into an old evaporator where it formed a large expanse of shallow water on the alkali flats. The water further spread out in additional broad ponds, connected by channels. Brine flies were patchily distributed, but not abundant, throughout the area of shallow water. I walked the perimeter of this ponded area to the south and the west about 1 km from the pond and then retraced my steps because of unstable soil on the west side of these ponds. Denyse Racine surveyed the pond and marsh. We counted birds here on 23 May between 1245 and 1315.

North Keeler Seeps--Labeled "K" on the map. About 3.2 km (2 miles) north of Keeler there is a pond and small seep on the lake shore. The pond is thickly surrounded by bull rushes and offered no shallow or bare areas suitable for Snowy Plovers. West of the pond there was water seeping from a spring mound that created an area of shallow water on the alkali flats, but there were no shorebirds in evidence. We (DR and PW) surveyed birds from the eastern edge of the pond from 1345 to 1415. The wind and dust came up, putting an end to our explorations of the area, but no shorebirds had been seen.

Owens River Delta--Labeled "L" on the map. To reach the southern end of the forested area along the Owens River, we drove west from Highway 395 on a dirt road opposite Lubkin Canyon Road. The road follows a transmission line to the east and is not shown on the 1982 USGS 1:24,000 topographic sheet. From the highway to the river was about 4 km. We turned to the south about 400 meters west of the river

to parallel the river, but the sand stopped us in approximately 1.5 km. We parked well beyond the end of the trees along the river. The vegetation from here out to the bare alkali flats of the lake bed was a mixture of marsh, alkali flats, and scattered tamarisk trees. We (PW and DR) walked about 3.5 km out to the end of the vegetation, searching the marsh, sparsely vegetated patches, and alkali flats in the vicinity of the two forks of the river. We started our walk at 0800 and returned to the car about 1100. No water was observed on the extensive alkali flats. The river was dry throughout much of our route, but the channel was damp and showed many bird footprints. There were no brine flies or other obvious insects on the surface of the river channel. At the southern terminus of the vegetation there was a channel about 6 meters wide. The soil was damp suggesting that water had stood here recently. There was one puddle of rusty orange-brown water no more than 5 m in length and 1 m wide with a few handfuls of brine flies around it. In the lake bed beyond there were scattered mounds with salt grass growing on them, but no surface water. We returned to the truck along a "road" in the sand paralleling the west side of the river.