

## THE SNOWY PLOVER IN SOUTHEASTERN OREGON AND WESTERN NEVADA

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Abstract.—In 1980, we searched for Snowy Plovers (*Charadrius alexandrinus*) in an area of 130,000 km<sup>2</sup> in southeastern Oregon and western Nevada. We found 2016 adult Snowy Plovers at 23 sites. Plovers were consistently associated with water and occurred on bare or sparsely vegetated alkaline substrates. We found 72 nests; nesting was documented at all but 3 sites. One hundred and fifty-four broods were found and brood size averaged 2.4 in younger broods, 1.6 in older broods. In the 1980s, rising water levels in the northern Great Basin eliminated much Snowy Plover nesting habitat.

### EL PLAYERO *CHARADRIUS ALEXANDRINUS* EN LA PARTE SURESTE DE OREGON Y EL OESTE DE NEVADA

Resumen.—Durante el 1980 examinamos un área de 130,000 km<sup>2</sup> en el sureste de Oregon y oeste de Nevada en búsqueda del playero *Charadrius alexandrinus*. Encontramos 2016 adultas en 23 localidades. Pudimos asociar consistentemente los playeros con agua y estos aparecieron en sustratos alcalinos desnudos o parcialmente cubiertos con vegetación. Encontramos 72 nidos en todas las localidades a excepción de 3 de éstas. Un total de 154 parvadas de polluelos fueron localizadas. El tamaño promedio de las parvadas varió con la edad de los polluelos. En aves con edad menor a 15 días, el tamaño promedio de la parvada resultó ser de 2.4 individuos mientras que en polluelos mayores de 15 días se redujo a 1.6. Un aumento en el nivel del agua durante el 1980 eliminó gran parte del habitación de anidamiento de estos playeros en la Gran Cuenca del norte.

Ornithologists have been remarkably slow to discover the patterns of distribution and abundance exhibited by Snowy Plovers (*Charadrius alexandrinus*) in western North America. Interior populations in Nevada and Oregon were especially slow to come to light (Linsdale 1936, Marshall 1969). In the early 1970s ornithologists suspected that the Snowy Plover had become rare over much of its range in North America, and concern about its status was expressed in several places, including the National Audubon Society's "Blue List" (see Arbib 1971). Recognizing the dearth of information on the distribution and abundance of the species, we censused Snowy Plovers in southeastern Oregon and western Nevada during the spring and summer of 1980.

## STUDY AREA AND METHODS

Between 21 Apr. and 31 Jul. 1980, we spent 73 d searching for, counting, and observing breeding populations of Snowy Plovers in an area covering nearly 130,000 km<sup>2</sup> of the northwestern Great Basin (Fig. 1); after completing the initial survey work, we gathered additional data on 12 d between 1 Aug. and 5 Sep. Working from United States Geological Survey topographic maps, our own experience and that of other observers, and the literature, we selected and checked approximately 150 sites for suitable habitat and Snowy Plovers. Sites without appropriate habitat were in some cases eliminated from further consideration after we observed them from the air. Most naturally occurring alkaline ponds and lakes, as well as artificial impoundments that constituted equivalent habitat, were surveyed on foot. At least two observers worked at each site; as many as 14 additional people assisted us in areas where the habitat was extensive. We recorded numbers and age classes of Snowy Plovers at all sites where we found them. Most sites that supported plovers were visited at least twice, as were areas with suitable habitat where we failed to find the species on our initial visit. In all places where Snowy Plovers were present, we attempted to document nesting, but we did not always make intensive searches for nests. When nests were found we recorded clutch size and described the nesting substrate. When broods were encountered we counted the number of young and estimated chick size by comparing with adults. We gathered information on physical characteristics, vegetation, and other habitat components at all sites.

## RESULTS

We found 2016 adult Snowy Plovers in the study area with 1047 of them at 11 sites in southeastern Oregon and 969 at 12 sites in western Nevada (Table 1, see Fig. 1). Candidate sites where neither Snowy Plovers nor appropriate habitat were found are listed in an unpublished report deposited in the van Tyne Library at the Museum of Zoology, University of Michigan (Ann Arbor, Michigan 48109). Sites ranged in elevation from 1180 m to 1681 m. Plovers were consistently associated with water and occurred on bare or sparsely vegetated alkaline substrates. Greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex* spp.), seablite (*Suaeda* spp.), and saltgrass (*Distichlis stricta*) dominate the vegetation that grows along the margins of the alkaline bodies of water that supported Snowy Plovers. Freshwater lakes and ponds, even those with extensive mudflats or sand beaches, did not support Snowy Plovers in the study area; dry alkali flats were similarly without plovers.

*Southeastern Oregon.*—Of the 1047 plovers we counted in southeastern Oregon, all but 6 (<1%) occurred within 4 major internal drainage basins. Harney Basin supported 42% ( $n = 436$ ) of the total, Lake Abert 33% ( $n = 345$ ), Summer Lake Basin 18% ( $n = 193$ ), and Alvord Basin 6% ( $n = 67$ ).

Harney Lake, where we found 400 Snowy Plovers, is filled primarily

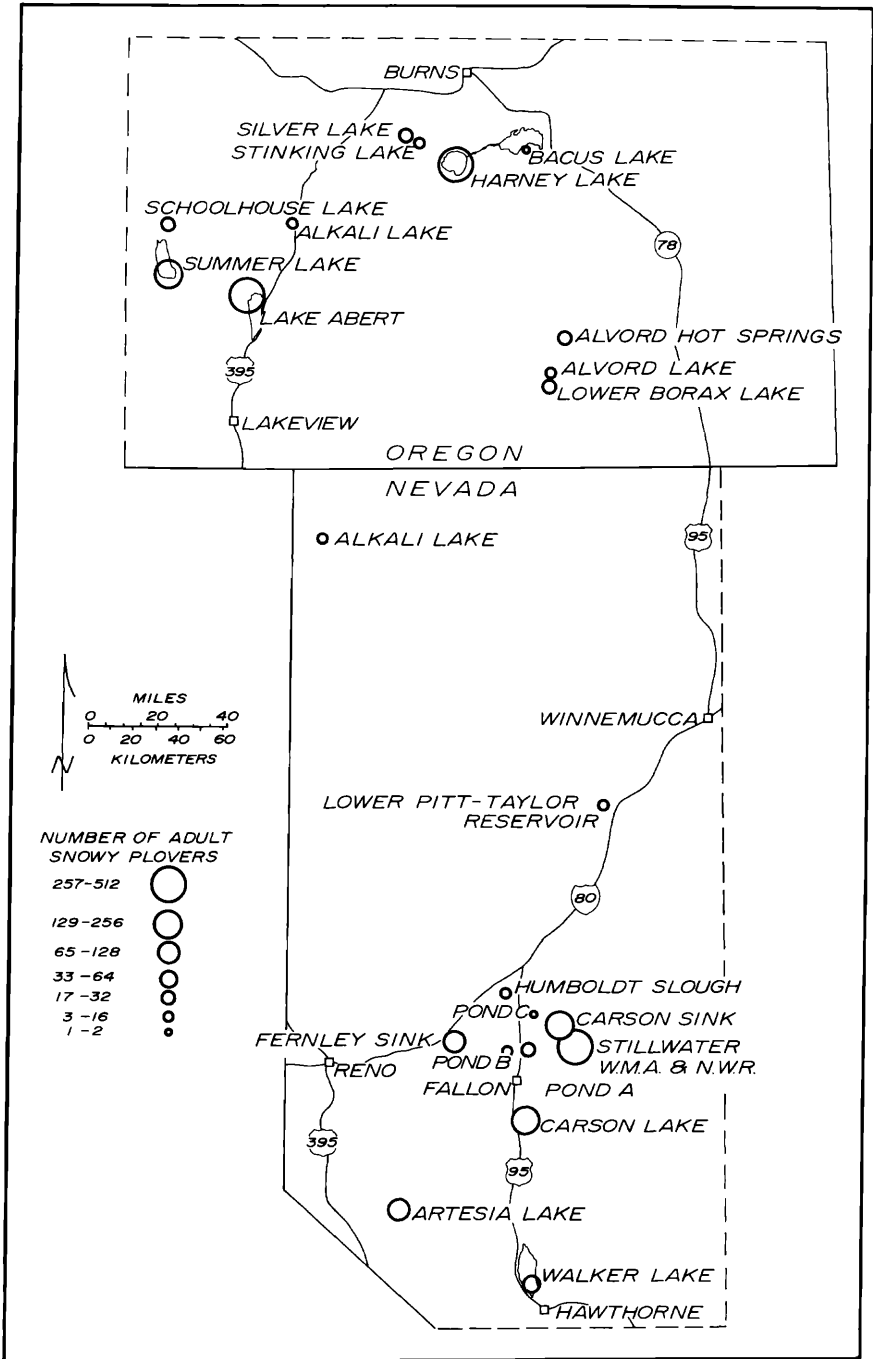


FIGURE 1. Geographic distribution of breeding sites and relative abundance of adult Snowy Plovers in southeastern Oregon and western Nevada during 1980.

TABLE 1. Distribution and abundance of adult Snowy Plovers in southeastern Oregon and western Nevada during spring and summer, 1980.

| Site                     | Number<br>of<br>adults | Date    | Elev.<br>(m) | County    | Lat.   | Long.   |
|--------------------------|------------------------|---------|--------------|-----------|--------|---------|
| Southeastern Oregon      |                        |         |              |           |        |         |
| Harney Lake              | 400                    | 5 Jun.  | 1244         | Harney    | 43°14' | 119°07' |
| Silver Lake              | 25                     | 9 Jul.  | 1257         | Harney    | 43°22' | 119°24' |
| Stinking Lake            | 9                      | 29 May  | 1254         | Harney    | 43°19' | 119°21' |
| Bacus Lake               | 2                      | 29 Jul. | 1248         | Harney    | 43°16' | 118°45' |
| Alvord Hot Spring        | 28                     | 17 Jul. | 1222         | Harney    | 42°33' | 118°31' |
| Borax Lakes              | 24                     | 16 Jul. | 1234         | Harney    | 42°20' | 118°36' |
| Alvord Lake              | 15                     | 16 Jul. | 1228         | Harney    | 42°23' | 118°36' |
| Alkali Lake              | 6                      | 4 Jun.  | 1306         | Lake      | 42°58' | 120°02' |
| Lake Abert               | 345                    | 3 Jun.  | 1297         | Lake      | 42°38' | 120°13' |
| Schoolhouse Lake         | 27                     | 15 Jun. | 1265         | Lake      | 42°58' | 120°43' |
| Summer Lake              | 166                    | 15 Jun. | 1264         | Lake      | 42°50' | 120°45' |
| Western Nevada           |                        |         |              |           |        |         |
| Alkali Lake              | 5                      | 19 May  | 1681         | Washoe    | 41°42' | 119°51' |
| Lower Pitt-Taylor Res.   | 12                     | 20 Jun. | 1260         | Pershing  | 40°38' | 118°16' |
| Stillwater NWR & WMA     | 344                    | 23 Jun. | 1185         | Churchill | 39°37' | 118°27' |
| Carson Sink <sup>1</sup> | 147                    | 27 Jun. | 1180         | Churchill | 39°43' | 118°41' |
| Carson Lake              | 144                    | 22 Jun. | 1191         | Churchill | 39°19' | 118°43' |
| Humboldt Slough          | 4                      | 27 Jun. | 1183         | Churchill | 39°50' | 118°47' |
| Pond A <sup>2</sup>      | 17                     | 26 Jun. | 1199         | Churchill | 39°33' | 118°46' |
| Pond B <sup>2</sup>      | 14                     | 26 Jun. | 1201         | Churchill | 39°33' | 118°47' |
| Pond C <sup>2</sup>      | 1                      | 27 Jun. | 1180         | Churchill | 39°46' | 118°45' |
| Fernley Sink             | 126                    | 29 Jun. | 1223         | Lyon      | 39°38' | 119°08' |
| Artesia Lake             | 112                    | 29 Jun. | 1386         | Lyon      | 38°57' | 119°17' |
| Walker Lake <sup>1</sup> | 43                     | 28 Jun. | 1212         | Mineral   | 38°43' | 118°45' |

<sup>1</sup> Incomplete survey.<sup>2</sup> Not named on U.S.G.S. maps.

by overflow from Malheur Lake, a large marsh to the east, via a channel that crosses private irrigated land. A small amount of water also is contributed by Silver and Warm Springs Creeks, which enter Harney Lake on the west side through the Warm Springs Valley. Streamwater reaches the lakebed only during years when it is available from other parts of Malheur National Wildlife Refuge (NWR), either because it is excess on those parts where it is used in waterfowl management, or because it is not needed to irrigate the private land along the channel from Malheur Lake. In many years the playa is essentially dry by early summer. In dry years the plovers aggregate around a number of upwelling thermal springs on the playa. These springs were especially important during 1976–1979. The lake was as full as we have seen it in 1980, and most of the thermal springs were submerged; Snowy Plovers were distributed around the entire playa perimeter, except for the southwest shore, where dense vegetation bordered the waterline.

The 345 Snowy Plovers we counted at Lake Abert, Lake County, on 3 Jun. constituted the second largest population in Oregon. The Che-

waucan River, which enters Lake Abert at the south end, is the primary source of water to this large lake. In years of high water, such as 1980, plover habitat is available only on the extensive alkali flat on the north and northwest sides of the lake. We found the birds principally along the waterline and at two groups of springs at the north end.

Two localities in the Summer Lake Basin, in western Lake County, accounted for 193 Snowy Plovers. Schoolhouse Lake, on the east side of Summer Lake Water Management Area (WMA), is part of an extensive alkaline marsh that has formed at the mouth of the Ana River on the north end of the Summer Lake playa. We found 27 plovers there on 15 Jun., the same day we censused all of Summer Lake. Probably birds move freely between Schoolhouse Lake and Summer Lake playa. At Schoolhouse Lake, the plovers occurred primarily on the alkali flats on the east and southwest. The species has been reported at Summer Lake WMA by Marshall (1969) and Ramsey (1978).

The Summer Lake playa was about half covered with water when we censused it in mid-June; the east half was dry. All but 16 of the 166 Snowy Plovers were at the south end.

The Alvord Basin, in southern Harney County, supported 67 Snowy Plovers at three sites. Twenty-eight of those were found on the west edge of the Alvord Desert, where water from Alvord Hot Spring forms a series of shallow pools before disappearing on the playa. We found 15 plovers along the east shore of Alvord Lake, which was nearly full as late as the end of July. The remaining 24 Snowy Plovers in the Alvord Basin were at two sites in the vicinity of the Borax Lakes; 12 at a small pond 0.8 km east of Lower Borax Lake Reservoir, and 12 at a spring 1.5 km north of Borax Lake.

*Western Nevada.*—In western Nevada, 69% of the 969 Snowy Plovers occurred in Lahontan Valley, the area that surrounds Fallon in Churchill County; Carson Lake, Stillwater Marsh, and Carson Sink were the primary sites. Fernley Sink, adjacent to the west side of Lahontan Valley, supported 13% ( $n = 126$ ) of the Nevada total, and Artesia Lake, at the north end of Smith Valley in Lyon County, accounted for 12% ( $n = 112$ ). Other sites included Walker Lake (4%;  $n = 43$ ), Lower Pitt-Taylor Reservoir (1%;  $n = 12$ ), and Alkali Lake (1%;  $n = 5$ ).

Lahontan Valley is the single most important area for Snowy Plovers in the state of Nevada. Prior to the early part of this century, the Carson River entered the valley from the west and flowed east, terminating in extensive alkaline marshes and sinks at three main outflows; Carson Lake, Stillwater Marsh, and Carson Sink. In response to increased agricultural use of the valley, the U.S. Bureau of Reclamation created the Truckee-Carson Irrigation District, an administrative body that, since 1911, has presided over the construction of dams and diversion canals that distribute available water in a design that serves irrigated farming almost exclusively. Today, water reaches Carson Lake, Stillwater Marsh, and Carson Sink only when it is not taken for irrigation. Consequently, seasonal and annual fluctuations of water levels are extreme and unpredictable. When we

surveyed these sites in late June, most storage reservoirs were at or near capacity, and water was being released from them as rapidly as possible. Water levels in the vicinity were as high or higher than they had been for many years.

More than half of the Snowy Plovers in the Lahontan Valley were found on the Stillwater WMA and Stillwater NWR. Of the 344 plovers we counted there, all but six occurred on the eastern half of the Stillwater Marsh. Several records of Snowy Plovers at Stillwater Marsh have been published: Alcorn (1946) collected specimens there on three dates in Aug. 1941. Marshall (1951) reported having seen 50 at Big Water on 20 Jul. 1950, and several hundred there on 8 Aug. 1950. He also found three nests at the northeast corner of the marsh in mid-June 1951 (Marshall and Alcorn 1952).

During the summers of 1949 and 1950, Marshall (1951) saw the species on the perimeter of Pelican Island Marsh at the south end of Carson Sink. Carson Sink was dry when we first visited Lahontan Valley in late April, but was flooded over an area of more than 200 km by late June. We surveyed 8 km of the waterline at the south end of the sink, an area that includes the mouth of the Carson River and Pelican Island Marsh, and found 147 adult Snowy Plovers.

Carson Lake, at the south end of the valley, also received large amounts of water in late May and June, limiting suitable plover habitat to the southwest portion of the lakebed, which held 144 Snowy Plovers.

Fernley Sink is in northeastern Lyon County, adjacent to the Lahontan Valley. Evenden (1952) recorded a flock of about 40 Snowy Plovers, including one downy chick, at this site on 30 Aug. 1949. We found 126 birds there (including 24 at the upper pond of Fernley WMA, 1.5 km south). At the time of our visit about 10 km of the sink was flooded, and the plovers were distributed along the south waterline where water seeps onto the flat from the Fernley WMA ponds.

We found 112 Snowy Plovers at Artesia Lake in western Lyon County. Ninety-one of those were on the broad alkali flat at the east and northeast sides of the lake, and the remaining 21 were along the west shore. The lakebed was about 60% flooded in late June.

At Walker Lake, the southern extent of our study area, we found 43 Snowy Plovers on the flats at the south end of the lake. Portions of the east shore also appeared habitable by plovers, but we did not check that area. Linsdale (1936) mentioned one record of the species near the mouth of the Walker River at the north end of the lake; high water levels at the time of our visit had eliminated potential habitat there.

Published records of Snowy Plovers exist for three additional sites in western Nevada. Alcorn (1942) found a dead Snowy Plover on 26 July 1941 at Soda Lake, 10 km west of Fallon; when we visited that site in late April and in June, it was too full of water to support any shorebirds. One bird was seen at the mouth of the Truckee River, Pyramid Lake, on 19 Apr. 1942 (Linsdale 1951). We searched that location on 30 Jun. and found no plovers. We suspect that the species may occur on the northwest side of Pyramid Lake, but efforts to obtain permission to search

that area were not successful. Evenden (1952) saw a flock of 300 Snowy Plovers at Toulon Sink, southern Pershing County, on 30 Aug. 1949. Snowy Plovers probably occur there and at neighboring Humboldt Sink in most years, but during 1980 runoff from the Humboldt River had flooded those sites, eliminating suitable nesting habitat.

*Nests, eggs, and young.*—We documented nesting (by finding eggs, or preflight juveniles) at all sites except Alkali Lake in Oregon, and Alkali Lake and unnamed pond C in Nevada. We suspect, however, that Snowy Plovers nested at both Alkali Lakes in small numbers. The corrugated topography of these two sites discouraged exhaustive searching, and our counts were made before juveniles could have been expected.

We found 72 nests; 70 of those had complete clutches. Two eggs occurred in six nests, three eggs in 63 nests, and four eggs in one nest ( $\bar{x} = 2.93$ ,  $SD = 0.31$ ). On the southeast shoreline of Harney Lake, where we found 46 nests, we measured the distances between concurrently active nests. Distances between 15 pairs of nests ranged from 12 to 63 m ( $\bar{x} = 35.7$ ,  $SD = 14.07$ ); in two of these cases, 2 nests were within 15 m of each other.

At Harney Lake we made routine searches for nests from 21 Apr. through 11 Aug. The first clutch was completed on 26 Apr.; the final two nesting attempts we discovered were initiated during the first week of July. Eggs hatched from the last week of May until the end of July. The peak of egg laying occurred from mid-May to mid-June; hatching peaked during June and early July. These findings are quite similar to those of Page et al. (1983) who, working at Mono Lake in California, southwest of the southern extent of our study area, found that Snowy Plover eggs were laid between 18 Apr. and 15 Jul. and that hatching occurred between 21 May and 16 Aug.

We observed 154 broods in the study area, and have data on age class and brood size for 141. Of those, 111 were composed of chicks judged to be less than 15 d old ( $\frac{1}{2}$  grown); brood size was three in 52% ( $n = 58$ ) of the cases, two in 34% ( $n = 38$ ), and one in 14% ( $n = 15$ ) ( $\bar{x}$  brood size = 2.39,  $SD = 0.72$ ). Among 30 broods with chicks more than half grown, 10% ( $n = 3$ ) included three chicks, 37% ( $n = 11$ ) included two, and 53% ( $n = 16$ ) were singles ( $\bar{x}$  brood size = 1.57,  $SD = 0.68$ ). The age-related difference in brood size was significant ( $t = 5.63$ ,  $P < 0.0005$ , two-sample  $t$ -test) and probably resulted from chick mortality. Although only two of 72 nests fell prey to predators we suspect that predation of chicks was more frequent. We found evidence of predation of a plover chick by a coyote (*Canis latrans*) at Walker Lake and observed predator avoidance behavior by Snowy Plovers whenever a Loggerhead Shrike (*Lanius ludovicianus*) or a low-flying California Gull (*Larus californicus*) appeared. Page et al. (1983) found that predation of both clutches and broods was substantial at Mono Lake, California.

#### DISCUSSION

We feel that we searched the study area thoroughly and that our total of 2016 adult Snowy Plovers represents a high percentage of the number

present in 1980. The only large area we did not search was in the contiguous Smoke Creek, San Emidio, and Black Rock deserts of Washoe County, Nevada; some thermal springs and the Quinn River sump may support small, isolated populations.

During spring and early summer of 1980, the western Great Basin received an unusually large amount of precipitation, and temperatures were lower than usual. As a result of direct rainfall and protracted runoff from higher elevations, most sites we examined retained water well into the nesting season. Some sites that normally are without water may have been uniquely available for nesting in 1980. Other playas, where water is normally present throughout the year, were flooded to such an extent that suitable nesting habitat was unavailable in 1980; in this latter category we suspect the following sites may have been included: Malheur Lake, portions of Summer Lake WMA, Warner Lakes, Goose Lake, and Tumtum Lake in Oregon, and northwest Washoe County Lakes, Continental Lake, Rye Patch/Pitt-Taylor Reservoirs, Humboldt and Toulon Sinks, Indian Lakes, Soda Lakes and some Lahontan Valley reservoirs in Nevada. This species appears well adapted to annual and seasonal changes in habitat availability for nesting. The population of the study area might expand or contract under different regional water level conditions, but we would not anticipate any significant change in overall abundance in any but the most severe drought or high water years (see below).

Our impression is that this population is healthy; certainly it is much larger than we had expected. Most areas that we considered suitable habitat supported nesting Snowy Plovers. The most serious threats to habitat are diversion of water for irrigation, high water conditions (Snowy Plovers have not nested in the Harney Basin during the period 1982–1986 because of unprecedented high water levels) and, potentially, lowered water tables resulting from geothermal development. Additionally, cattle may disturb nesting areas or destroy nests; cattle were present in many of the areas we visited. In our view, there is a need to look more intensively at parts of the western Great Basin Snowy Plover population, especially with respect to long-term stability of numbers and factors affecting reproductive success. The possibility of enhancing that success, especially on areas where water levels are manipulated, seems well worth investigating.

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