Synthesis: shorebirds in the arid western Great Basin of North America

Nils Warnock[1], J. Michael Reed[2], & Lewis W. Oring

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Nils Warnock, Department of Environmental and Resource Sciences, University of Nevada, 1000 Valley Rd., Reno, NV 89512 USA and Department of Biological Sciences, Simon Fraser University, Burnaby, B.C. V5A 1S6 Canada
J. Michael Reed, Biological Resources Research Center and Department of Environmental and Resource Sciences, University of Nevada, 1000 Valley Rd., Reno, NV 89512 USA
Lewis W. Oring, Ecology, Evolution, and Conservation Biology Program and Department of Environmental and Resource Sciences, University of Nevada, 1000 Valley Rd., Reno, NV 89512 USA
[1]Current address: Forest and Rangeland Ecosystem Science Center, U.S. Geological Survey, S.W. Jefferson Way, Corvallis, OR 97331 USA
[2]Current address: Department of Biology, Tufts University, Medford, MA 02155 USA

Introduction

On a warm, sunny day in mid-May with snowcapped mountains in the background, we drove to Fallon, Nevada, and stopped briefly at Carson Lake in the Lahontan Valley. We were greeted by an area of vast marshlands and shallow saline ponds teeming with birds. American Avocets (*Recurvirostra americana*) and Black-necked Stilts (*Himantopus mexicanus*) by the thousands, alarming and chasing each other, courting, and incubating eggs; White-faced Ibis (*Plegadis chihi*), terns and grebes carrying food to their chicks. As we drove around the dirt roads, small flocks of late migrating Red-necked Phalaropes (*Phalaropus lobatus*) rose up from the larger, deeper bodies of water, joined by flocks of "peeps" flushed from muddy shorelines. Solitary pairs of Long-billed Curlews (*Numenius americanus*), Willets (*Catoptrophorus semipalmatus*), Snowy Plovers (*Charadrius alexandrinus*), Killdeer (*C. vociferus*) and Spotted Sandpipers (*Actitis macularia*) were alert or alarming as we passed by probable nest sites. This is the western Great Basin. In wet springs, it explodes with breeding and migrating shorebirds, and stays active until fall when ice and snow move birds onward to warmer areas. In drought years only the deepest lakes and rivers have water. Huge wetland areas such as the Carson Lake dry up and shorebirds either fail to arrive or show up and leave.

Aside from the large numbers and diversity of shorebirds that may be present in the western Great Basin, it is the variable environment that has so much to offer ecologists, biologists, conservationists, and the casual observer. Organisms inhabiting this area must be hardy enough to withstand prolonged periods of unfavorable conditions, have the ability to disperse when conditions get bad, or have the physiological flexibility to change with conditions (Jehl 1994). Fluctuating environments and resulting fragmented habitats create unique opportunities for studying how organisms deal with and adapt to such conditions — conditions that are becoming increasingly common throughout the world.

It is apparent that we lack the data to properly assess the pros and cons of management and conservation options for shorebirds of the western Great Basin. In this volume we demonstrated the tools and methods to collect these data. As revealed by Oring & Reed (this volume), and Reed *et al.* (this volume), significant numbers of shorebirds breed and migrate through the western Great Basin, but censusing and monitoring birds in this arid and fragmented region is not a simple task. It is easy to appreciate the sites within the western Great Basin that support spectacular concentrations of shorebirds such as Abert and Mono lakes and the Carson Sink area, yet largely ignored smaller areas may also support high numbers of shorebirds. As pointed out by Robinson & Warnock (this volume), these areas may be dry in some years and receive no use by shorebirds, and then, with sufficient runoff, primarily from winter precipitation, become extremely important stopover and/or breeding areas.

With few exceptions, we lack data on the details of shorebird life within the Great Basin. Among breeding species, details are emerging on American Avocets (Alberico 1993; Robinson & Oring 1996), Snowy Plovers (Herman *et al.* 1988; Page *et al.* 1991, 1995), and Killdeer (Warnock and Oring 1996; Oring unpubl. data). Best known among migrants within the Great Basin are American Avocet, Black-necked Stilt (Alberico 1993; Robinson & Oring 1996), and Wilson's and Red-necked phalaropes (*P. tricolor*) (Jehl 1988; Rubega & Inouye 1994).

What still needs to be done?

1) We have little data on where breeding shorebirds in the western Great Basin winter, or where migrants

that pass through the western Great Basin breed or winter. Snowy Plovers breeding in this region have been found wintering on the Pacific coast from California to Mexico (Page *et al.* 1995). A few American Avocets from breeding areas around Honey Lake, California have been resighted on the western coast of Sinaloa, Mexico (Robinson & Oring 1996), and Western Sandpipers radio-marked at Honey Lake, California have been found on their breeding grounds in western Alaska (Warnock unpubl. data). Otherwise, we have no direct information on where shorebirds that breed in the Great Basin go in the winter, or where migrants passing through the western Great Basin breed.

2) We lack information on how shorebirds use habitat within the Great Basin both for breeding and migrating.

3) With the exception of staging phalaropes, we have no information on what food items are important for shorebirds within the western Great Basin.

4) Past a gross level, we are unable to predict how increased human diversions of freshwater that affect water availability and salinization impact breeding and migrating shorebirds within this region.

5) Currently, no consistent monitoring effort exists that could help determine trends in shorebird populations in the western Great Basin.

6) Estimates of turnover rates of shorebirds at major migration stopover and staging sites, vital for calculating population sizes of birds using the area, are crude.

7) Experimentally derived management of shorebirds (*e.g.*, Elphick, this volume) within the western Great Basin remains hypothetical. We do not know what water and food conditions are favorable for breeding and migrating shorebirds within the Great Basin, or how they are affected by grazing or by agriculture.

8) We have no information on the effects of predators or contaminants on shorebird populations with this region.

9) We lack a comprehensive, integrated plan for protecting wetlands that shorebirds rely on within the western Great Basin. As noted by Rubega & Robinson (this volume), salinization of freshwater supplies likely will increase in this region, causing more environmental unpredictability and fragmentation. Water diversions in the western Great Basin have resulted in the destruction of at least two large alkaline lakes, Owens Lake, California and Winnemucca Lake, Nevada, and threatened the water quality and wildlife of numerous others (Jehl 1994). Public and scientific attention has largely focused on the large alkaline lakes of the Great Basin, for instance Mono Lake, but the smaller permanent and seasonal wetlands that are found throughout the western Great Basin have been largely ignored (Robinson & Warnock, this volume).

Conclusion

Effective management and conservation of shorebirds in the western Great Basin is still in its infancy. Laubhan & Fredrickson (1993) pointed out that management and conservation of shorebirds involves a knowledge of species' life histories, wetland ecology, and engineering, as well as an understanding of local regulation and politics. Collection of these data requires commitment of personnel and resources that are largely unavailable to local managers and biologists. Collaborative efforts by state, federal and private organizations will be vital to fulfilling the daunting task of managing and conserving shorebirds in the western Great Basin while also accommodating the habitat and water demands of our burgeoning human population.

As is often the case with these types of exercises, we are left with many more questions than answers, yet it is at this stage where rapid progress can be made. We have identified areas where we have some knowledge, and we have also identified the first tier of critical questions needed before conservation and management of shorebirds in the western Great Basin is to substantively progress. It is our hope that future research will build on the information presented in this volume.

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