

DROUGHT AND PREDATION CAUSE AVOCET AND STILT BREEDING FAILURE IN NEVADA

JULIE A. R. ALBERICO, University of Nevada, Ecology, Evolution and Conservation Biology Program, 1000 Valley Rd., Reno, NV 89512

The Lahontan Valley wetlands of Nevada are critical breeding, wintering, and migratory stopover sites for shorebirds and waterfowl and have been classified as a Hemispheric Reserve within the Western Hemisphere Shorebird Reserve Network (Myers et al. 1987, Harrington et al. 1989). From 1905 through 1987, wetlands in the Lahontan Valley declined from 34,800 to 6150 ha (Hoffman et al. 1990:5). In 1991, these wetlands were reduced further as Nevada experienced its fifth consecutive year of drought (Schaefer 1991). During 1991, I monitored breeding by American Avocets (*Recurvirostra americana*) and Black-necked Stilts (*Himantopus mexicanus*) in the extremely limited suitable habitat available to them in the Lahontan Valley. Here I report numbers of breeding recurvirostrids and discuss possible reasons for their success or failure in 1991.

Avocets and stilts feed in shallow wetlands and nest together in loose colonies (Hamilton 1975). Neighboring pairs work together in voicing alarm, mobbing potential predators, and performing distraction displays (Sordahl 1986, 1990). Like the well-studied Pied Avocet (*R. avocetta*) in Europe and Black Stilt (*H. novaeseelandiae*) in New Zealand, they probably first breed at an age of 2 or 3 years and are relatively long-lived (Cadbury and Olney 1978, Christine Reed pers. comm.). Sordahl (1984) marked individual American Avocets and Black-necked Stilts and observed 20–30% return in the following breeding season; 60–90% of these birds had previously bred successfully.

METHODS

I compiled count data for American Avocets and Black-necked Stilts from a variety of sources: Alcorn (1988), nesting season reports in *Audubon Field Notes* and *American Birds*, and unpublished data provided by Larry Neel of the Nevada Department of Wildlife and Bill Henry of Stillwater National Wildlife Refuge. I used only count data that distinguished breeding birds from nonbreeders or migrants because there is extreme variability in migration dates for these birds (Bill Henry unpubl. data; dates in *American Birds* regional reports), and I observed large numbers of resident nonbreeders during the 1991 breeding season. However, breeding birds can be undercounted if adults use alternate foraging sites (Yésou and Girard 1988), and incubating birds can be difficult to see at some sites (Gibson 1971, his Figure 3). They can also be overcounted because birds sounding an alarm attract others (pers. obs.).

In 1991, I monitored avocets and stilts at all Lahontan Valley wetlands with conditions potentially appropriate for breeding (Figure 1). I categorized birds as *prenesting* (defending feeding territories and copulating but without a nest), *nesting* (with nests and defending feeding territories), or *nonbreeding* (showing no defensive or copulatory behavior) (Gibson 1971,

Hamilton 1975). I found most nests during the laying period. For nests found after the clutch was complete, I estimated initiation dates by floating the eggs (Westerkov 1950). When possible, I identified nest predators from evidence left in the nest, tracks, and direct observation. Nests at Mahala Slough were checked every 2 days as part of behavioral monitoring, and nests at S-Line seep were monitored every 5 days. For nests at Mahala Slough, I took data on several variables I expected to influence the likelihood of nest predation: distance to land, number of avocets in the colony, number of stilts in the colony, and distance to nearest neighbor.

RESULTS AND DISCUSSION

Prior Breeding Numbers and Reproductive Success

During 18 of the years from 1949 to 1975, numbers of breeding recurvirostrids at Stillwater Wildlife Management Area (SWMA) were estimated and reported in SWMA Annual or Quarterly Narrative Reports (Figure 2). Kingery (1974) reported counts at SWMA of 2400, 2100,

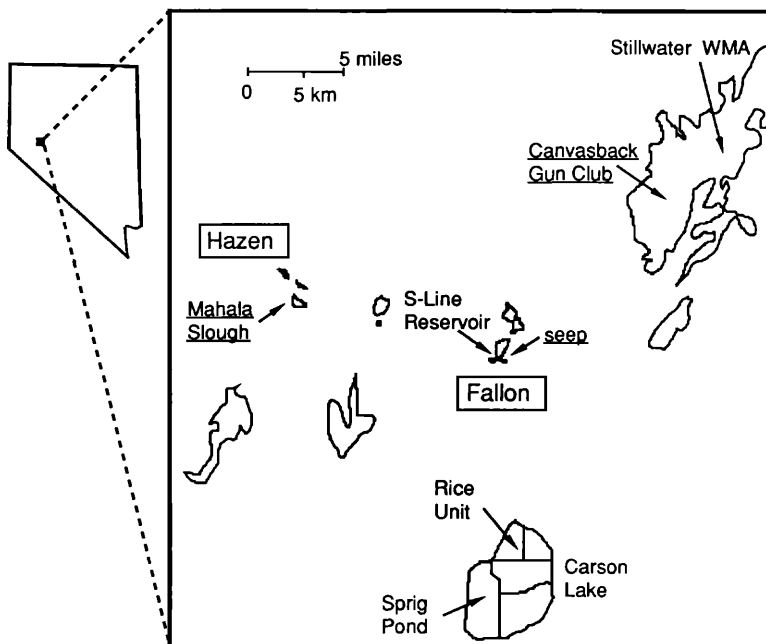


Figure 1. Map of Lahontan Valley wetlands near Fallon, Nevada, adapted from Hoffman et al. (1990) and U.S. Geological Survey maps. Labeled wetlands held water during all or part of the 1991 breeding season; underlined labels indicate wetlands with known recurvirostrid breeding attempts in 1991.

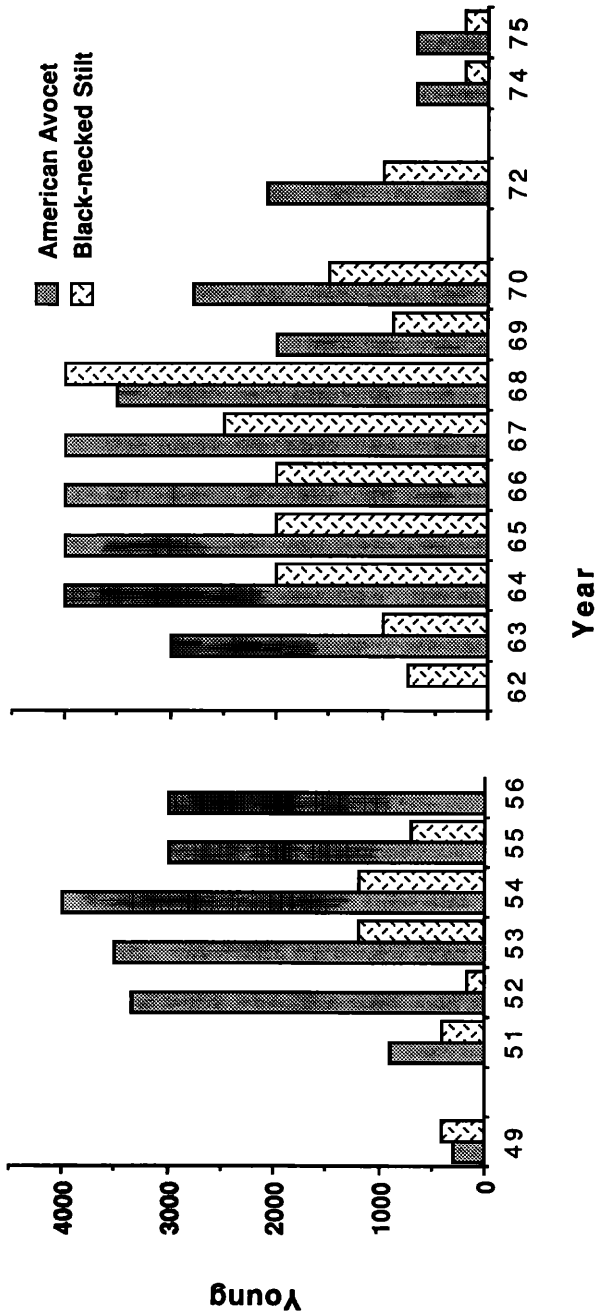


Figure 2. Estimated counts of young American Avocets and Black-necked Stilts at SWMA, 1949-1975. Only years when young were counted are shown. Source, SWMA Annual or Quarterly Narrative Reports. Because SWMA estimates were made uniformly in most of these years, data from other secondary sources, such as Kingery (1974), are not included here.

1800, and 675 avocet young and 1300, 1000, 720, and 225 stilt young from 1971 to 1974, respectively. Though actual counts are unavailable for these years, numbers of recurvirostrids in the Lahontan Valley declined during the 1976–1977 drought (Rogers 1977, Kingery 1977) and during the current drought (Bill Henry unpubl. data). In the 1976 and 1977 breeding seasons, recurvirostrids increased at Great Basin wetlands in Oregon and Utah, suggesting they had moved from drought-stricken areas such as the Lahontan Valley (Kingery 1977, Rogers 1977)

Limited data on breeding success in the Lahontan Valley suggest that few young shorebirds have been produced since the current drought began. Stanton (1988) observed “moderate” stilt hatching success at SWMA but no young later in the season. Stilts did not fledge at SWMA in 1989 (Kingery 1989), and “fared poorly” there in 1990 (Kingery 1990). Avocets established only four nests at SWMA in 1989, all of which failed (Kingery 1989). Thus it is surprising that Kingery (1990) reported “excellent nesting success” for 2700 avocets in the Lahontan Valley, though he gave no counts of young.

These data show that in many years thousands of avocet and stilt young are produced in the Lahontan Valley. During the drought years of 1988 to 1990, numbers of breeding recurvirostrids and their success were reduced, except in 1990, when avocets apparently had appreciable success in spite of the drought.

Recurvirostrid Breeding Numbers, 1991

Several wetlands where recurvirostrids nested in previous years (Bill Henry and Larry Neel unpubl. data) were dry in 1991, including Sheckler Reservoir, large portions of SWMA (including Stillwater National Wildlife Refuge), and much of Carson Lake (see Figure 1). Only about 52 avocets and 16 stilts nested.

At the Canvasback Gun Club on 27 May, I saw 22 prenesting avocets, an island with many scrapes, and two avocet nests on hummocks of cattail (*Typha latifolia*) detritus. However, by 14 June, nests had been depredated and avocets were no longer exhibiting breeding behavior. Behavior of a stilt pair suggested that they had a nest on 14 June, but the pair disappeared 8 days later.

At Carson Lake on 27 April, I counted 319 prenesting avocets on Sprig Pond, 179 on the east side of Rice Unit, and 30 along canal banks. Because no water was delivered to Carson Lake wetlands until mid-July, Rice Unit dried up by 29 May, preventing breeding there. Although I regularly searched for nests at Sprig Pond, I never found any. By 10 June all breeding behavior had ceased, and from 1240 to 3000 avocets remained as nonbreeders through June. Breeding behavior by avocets along canals ceased at approximately the same time. I counted 50 stilts at Carson Lake on 10 June but saw no evidence of reproduction.

The only other Lahontan Valley sites where recurvirostrids attempted breeding were Mahala Slough (between Fallon and Hazen) and a seep area behind S-Line Reservoir (Figure 1). Nest initiation chronology at these sites for nests with known clutch initiation dates is shown in Figure 3a. At Mahala

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Slough there were 59 total avocet nests (including renestings) and 10 stilt nests. Mahala Slough began to dry up from 50 ha on 31 May; by 30 June

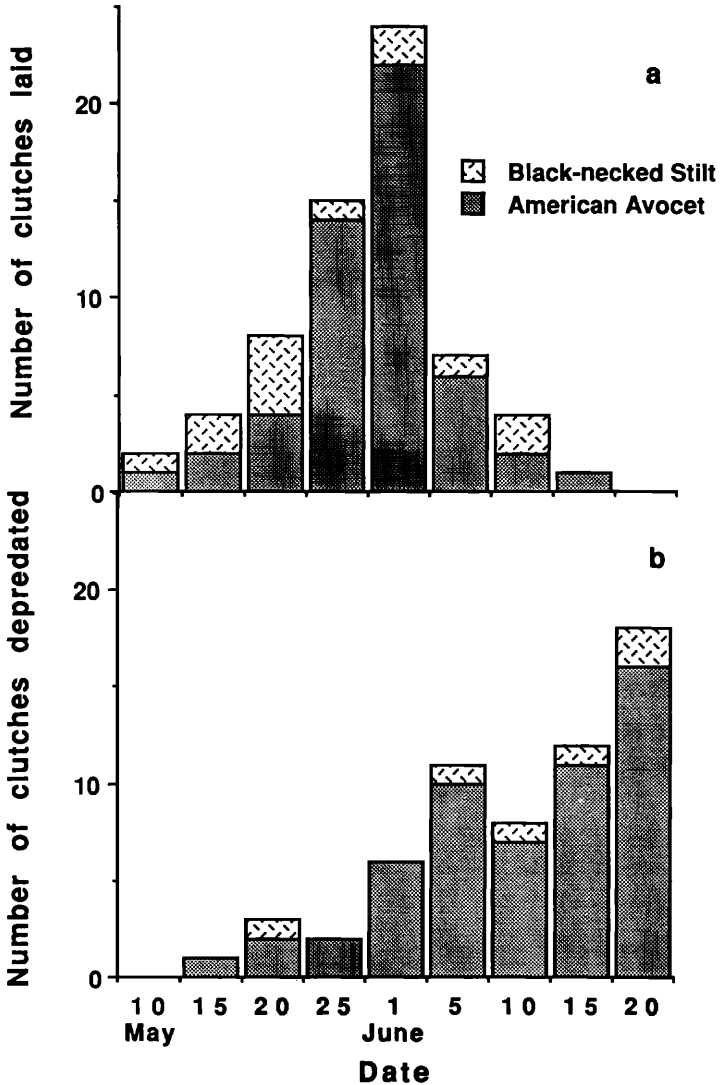


Figure 3. a, Clutch initiation dates; and b, deprecation dates for American Avocets and Black-necked Stilts at Mahala Slough and S-Line Reservoir seep, 1991. Clutches included are those for which initiation or deprecation dates could be approximated.

all but several roadside borrow pits (<100 m² in total area) were completely dry. At S-Line Reservoir seep, where water was stable at 4 ha, there were one avocet and six stilt nests.

It is difficult to assess how the drought will affect future recurvirostrid numbers in Nevada. Site fidelity of avocets and stilts (Sordahl 1984) suggests previous experience affects breeding site choices. If birds breed elsewhere during drought conditions and choose not to return, it may take many wet years before breeding populations are comparable to those of the 1960s and 1970s.

Recurvirostrid Breeding Success, 1991

All 59 avocet nests at Mahala Slough were unproductive. Of these, 13 were depredated by coyotes (*Canis latrans*), 42 were known or suspected to have been depredated by birds, three were abandoned, and in one the eggs failed to hatch. Of 10 stilt nests at Mahala Slough, two were depredated by birds, four were abandoned, and in four the eggs hatched. At S-Line seep the single avocet nest was depredated by a bird; of six stilt nests there, four were depredated by an unknown predator (probably a bird), and in two the eggs hatched. The Common Raven (*Corvus corax*) was the primary avian species that preyed on nests. California Gulls (*Larus californicus*) were probably occasional nest predators (e.g., Hill 1988), but I had no evidence confirming predation by gulls. Nest depredation chronology at Mahala Slough and S-Line seep combined is shown in Figure 3b.

Nest persistence time was not significantly correlated with distance to land, number of avocets in the colony, number of stilts in the colony, or distance to nearest neighbor (Spearman rank correlations, $P > 0.3$, $n = 50$ for all). Stilt nesting success was related to water depth, as five of six successful nests were surrounded by water deeper than 0.75 m. There was no change in nest depredation probability over the nesting cycle (constant slope of Figure 4), suggesting that depredation was independent of changes in incubation and defense behavior over the nesting cycle (e.g., Sordahl 1986). I resighted 11 of the 21 stilt chicks several weeks after hatching.

Effect of Drought on Predation

Several conditions associated with drought might have increased nest vulnerability and predation rates on recurvirostrid nests in the Lahontan Valley. As Mahala Slough dried up, I observed (from tracks and direct sightings) increasing coyote traffic around nesting areas, coupled with an increase in nest predation by coyotes. As the ponds dried up, nests initiated on hummocks surrounded by water soon became accessible via land or by shallow wading.

A drought-induced shortage of typical prey items may have prompted ravens to increase their predation on avocet and stilt eggs. In the Lahontan Valley, ravens are usually major predators of duck (*Anas* sp.) and Canada Goose (*Branta canadensis*) eggs and chicks (Herron 1986). In 1991, all goose nests were depredated early, and I knew of only three duck nests (two Cinnamon Teal, *A. cyanoptera*, and one Mallard, *A. platyrhynchos*) at Mahala Slough. It appears that predation pressure on recurvirostrid nests in

the Lahontan Valley varies from year to year. At Carson Lake in 1986 (Herron 1986), ravens preyed heavily on duck nests but not on recurvirostrid nests. By contrast, in 1991, most recurvirostrid nest depredations were attributable to ravens. Active management to create additional breeding habitat by releasing water into wetlands earlier in the season could have increased reproductive success of recurvirostrids and other wetland-dependent species in 1991. Many wetlands that were not used by breeding birds in 1991 began receiving water in late July and August. Although these fall releases create habitat for migratory shorebirds and waterfowl, spring releases would have enhanced breeding habitat and reduced overall predation pressure.

SUMMARY

I monitored breeding American Avocets and Black-necked Stilts in the Lahontan Valley, Nevada, during the fifth year of drought. There were few sites suitable for breeding, and at sites where birds did breed, nest depredation was extremely high. In a non-drought year there would be thousands of breeding recurvirostrids in the area I monitored; in 1991 there were fewer than 100. Only six pairs of stilts hatched chicks, and avocets failed entirely.

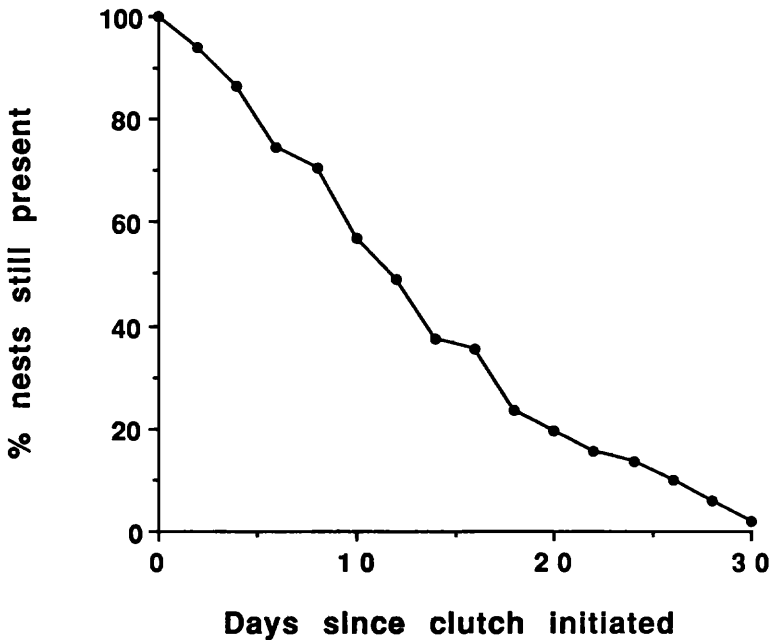


Figure 4. Proportion of total recurvirostrid nests remaining at Mahala Slough over the 1991 nesting period.

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Nest predation pressure is probably higher in drought years because nests are more accessible to coyotes, and duck eggs and other prey items for ravens are limited. Antipredator behaviors seemed ineffective under such pressure.

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LITERATURE CITED

- Alcorn, J. R. 1988. The Birds of Nevada. Fairview West, Fallon, NV.
- Cadbury, C. J. and Olney, P. J. S. 1978. Avocet population dynamics in England. *Br. Birds* 71:102-121.
- Gibson, F. 1971. The breeding biology of the American Avocet (*Recurvirostra americana*) in central Oregon. *Condor* 73:444-454.
- Hamilton, R. B. 1975. Comparative behavior of the American Avocet and the Black-necked Stilt (*Recurvirostridae*). *Ornithol. Monogr.* 17.
- Harrington, B. A., Myers, J. P., and Grear, J. S. 1989. Coastal refueling sites for global bird migrants, in *Coastal Zone '89: Proceedings of the Sixth Symposium on Coastal and Ocean Management* (O. T. Magoon, H. Converse, D. Miner, L. T. Tobin, and D. Clark, eds.), pp. 4293-4307. Am. Soc. Civil Engineers, New York.
- Herron, G. B., ed. 1986. Raven predation on shorebird nests at Carson Lake, Churchill County, in *Population surveys, species distribution and key habitats of selected nongame species. Job Performance Report, Federal Aid in Wildlife Restoration Project W-53-R-14, Study I, Jobs I through VI*, pp. 9-12. Nev. Dept. Wildlife, 1100 Valley Rd., Reno, NV 89512.
- Hill, D. 1988. Population dynamics of the Avocet (*Recurvirostra avosetta*) breeding in Britain. *J. Anim. Ecol.* 57:669-683.
- Hoffman, R. J., Hallock, R. J., Rowe, T. G., Lico, M. S., Burge, H. L., and Thompson, S. P. 1990. Reconnaissance investigation of water quality, bottom sediment, and biota associated with irrigation drainage in and near Stillwater Wildlife Management Area, Churchill County, Nevada, 1986-87. *U.S. Geol. Surv. Water-Resources Investigations Rep.* 89-4105.
- Kingery, H. E. 1974. The nesting season. Great Basin-central Rocky Mountain region. *Am. Birds* 28:929-933.
- Kingery, H. E. 1977. The nesting season. Mountain West region. *Am. Birds* 31:1027-1031.
- Kingery, H. E. 1989. The nesting season. Mountain West region. *Am. Birds* 43:1345-1349.
- Kingery, H. E. 1990. The nesting season. Mountain West region. *Am. Birds* 44:1161-1164.

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- Myers, J. P., Morrison, R. I. G., Antas, P. Z., Harrington, B. A., Lovejoy, T. E., Sallaberry, M., Senner, S. E., and Tarak, A. 1987. Conservation strategy for migratory species. *Am. Scientist* 75:19-26.
- Rogers, T. H. 1977. The nesting season. Northern Rocky Mountain-Intermountain region. *Am. Birds* 31:1162-1166.
- Schaefer, E. 1991. Water shortage pits man against nature. *Nature* 350:180-181.
- Sordahl, T. 1984. Observations on breeding site fidelity and pair formation in American Avocets and Black-necked Stilts. *N. Am. Bird Bander* 9:8-11.
- Sordahl, T. 1986. Evolutionary aspects of avian distraction display: Variation in American Avocet and Black-necked Stilt antipredator behavior, in *Deception: Perspectives on Human and Nonhuman Deceit*, pp. 87-112. State Univ. N. Y. Press, Albany.
- Sordahl, T. 1990. Sexual differences in antipredator behavior of breeding American Avocets and Black-necked Stilts. *Condor* 92:530-532.
- Stanton, J. 1988. The general feeding and nesting ecology of Black-necked Stilts on the Stillwater Wildlife Management Area. Research report submitted to Stillwater Wildlife Management Area Biologist, Stillwater National Wildlife Refuge, P. O. Box 1236, Fallon, NV 89406.
- Westerkov, K. 1950. Methods for determining the age of game bird eggs. *J. Wildlife Mgmt.* 14:56-67.
- Yésou, P., and Girard, O. 1988. Effet de la chronologie de la reproduction sur le recensement d'une colonie d'avocettes (*Recurvirostra avosetta*). *Gibier Faune Sauvage* 5:459-466.

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Photo by Kenneth W. Gardiner

American Avocets