

Although the four swallow species we discuss here regularly roost communally (Weatherhead, pers. observ.), they only form clusters under highly stressful conditions. We propose that, for these species, clustering is a last ditch, high risk behavior with net benefits being realized by only some of the participants. Some birds that roost communally regularly do so in clusters. It would be interesting to examine the structure of clusters in these species to see how individuals avoid the risks we have reported for swallows.

Finally, we point out the importance of nests as foci for cluster formation and the species-specificity of this association. Our observations were made before the breeding season. Also, Tree Swallows are common migrants but seldom breed at Delta Marsh. Thus, the birds' use of nests was apparently independent of any reproductive association. Furthermore, with regard to minimizing heat loss, Barn Swallows had better locations available in which to cluster than their open nests. Safety from predators or association of nests with warmth are two possible explanations for the formation of clusters in nests.

We thank J. M. Shay and the University of Manitoba for allowing us to use facilities of the University of Manitoba Field Station. T. Quinney provided weight data on Tree Swallows. We made these observations while conducting research funded by the Natural Sciences and Engineering Research Council of Canada. This paper is Contribution No. 110 of the University of Manitoba Field Station (Delta Marsh).

The Condor 87:444-445
© The Cooper Ornithological Society 1985

DUNKING OF PREY BY BREWER'S BLACKBIRDS: A NOVEL SOURCE OF WATER FOR NESTLINGS

WALTER D. KOENIG

Small birds lose relatively more water through evaporative respiration than do larger birds (Bartholomew and Cade 1963). As a result, nestlings can generally be expected to be under greater water stress than adults. One well known method of supplying nestlings with free water, in addition to that provided in their food, is for the adults to soak their belly feathers at watering sources; this behavior has been described in several species of sandgrouse (*Pterocles namaqua* and *P. burchelli* of the Kalahari Desert, as well as *P. alchata* and *P. senegallus* of Iraq; Cade and Maclean 1967, Maclean 1968) and in the Egyptian Plover (*Pluvianus aegyptius*; Howell 1979), and may occur in other species as well. Here, I describe a novel and potentially important method of supplying free water to young by Brewer's Blackbirds (*Euphagus cyanocephalus*): dunking of prey.

My observations were made at "Blompond," a small stockpond, about 350 m², built in 1970 adjacent to Hastings Reservation, Monterey County, California. This area has a Mediterranean climate with less than 2% of the average annual precipitation falling in June through September (Bradford 1974); during this season, the availability and occurrence of surface water are critical for much of the local avifauna (Williams and Koenig 1980). Brewer's Blackbirds have been recorded as nesting at Hastings in only five years since 1939, most recently in 1984. Nests have invariably been in a small colony of 5 to 10 pairs on

LITERATURE CITED

- ANDERSON, D. W. 1965. Spring mortality in insectivorous birds. *Loon* 37:134-135.
- DENCE, W. A. 1946. Tree Swallow mortality from exposure during unseasonable weather. *Auk* 63:440.
- GRUBB, T. C. 1973. Absence of "individual distance" in the Tree Swallow during adverse weather. *Auk* 90:432-433.
- SEALY, S. G. 1966. Swallow mortality at Moose Mountain. *Blue Jay* 24:17-18.
- SMITH, A., N. LANE, H. PATMORE, B. ROBINSON, D. BARNES, AND M. MCCOWAN. 1984. Twenty-third annual nestbox report from Brandon, Manitoba. *Blue Jay* 42:44-46.
- WHITMORE, R. C., J. A. MOSHER, AND H. H. FROST. 1977. Spring migrant mortality during unseasonable weather. *Auk* 94:778-781.
- ZUMETA, D. C., AND R. T. HOLMES. 1978. Habitat shift and roadside mortality of Scarlet Tanagers during a cold wet New England spring. *Wilson Bull.* 90:575-586.

Department of Biology, Carleton University, Ottawa, Ontario K1S 5B6, Canada. Address of second and third authors: Department of Zoology, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada. Current address of third author: Department of Biology, University of Calgary, Calgary, Alberta T2N 1N4, Canada. Received 21 November 1984. Final acceptance 16 April 1985.

or near a knoll, approximately 0.25 km away from what is now Blompond.

Every day between 24 June and 5 July 1984, during which time nestlings were being fed, I watched Brewer's Blackbirds in the vicinity of the pond. Their activities included drinking, bathing, and foraging in the grasses surrounding the pond, primarily for grasshoppers (Orthoptera: Acrididae). A large proportion of birds, however, apparently came to the pond to dunk grasshoppers in the water before flying to their nests and feeding the grasshoppers to their young.

I monitored the birds from 09:00-10:15, 12:00-13:45, and 15:00-16:15 on 30 June and from 14:00-15:30 on 2 July (5.5 h), and recorded their activities at the pond. A total of 48 visits by birds were observed: of these, two (4%) birds bathed, six (12.5%) drank, another six foraged at the pond's edge, and 35 (73%) arrived at the pond carrying grasshoppers and dunked them before returning to their nests (one after having foraged and caught prey along the edge of the pond). Birds often dunked prey repeatedly: the mean (\pm SD) number of dunkings was 3.4 ± 1.7 ($n = 12$). Both males and females engaged in dunking behavior: of the 35 cases recorded, 14 (40%) were performed by males. Birds were not seen to eat the grasshoppers following dunking, nor did they appear to swallow water while they were dunking prey. Thus, I infer that dunking behavior was directly associated with feeding of nestlings. Because these birds were not marked, I could not determine the frequency of dunking trips by individuals. The colony consisted of only about 10 nests, however, and it appeared as though individuals were repeatedly engaging in dunking behavior.

In order to measure the potential importance of this behavior, I captured 15 grasshoppers, weighed them, dunked them while holding them with a pair of tweezers, and then measured their weight gain (the amount of water picked up by dunking). The mean amount of water picked up was 0.062 ± 0.058 g per grasshopper, which was 34% of the prey's mean live weight (0.208 g). The average dry body mass of grasshoppers at Hastings was about 0.045 g (mean of 18 grasshoppers caught in insect traps at Has-

tings). If none of the water acquired by dunking blows off in transit to the nest, each dunked grasshopper fed to a nestling would contain an average of 0.225 g water, of which 28% would originate from the dunking behavior itself.

Dunking behavior may have been an important way of providing free water for nestlings in this colony of Brewer's Blackbirds. Other species that nest in seasonally dry environments with some source of free water relatively near their nests may also dunk their prey. (Wind and evaporation would largely deplete water accumulated through dunking if the water source were too far from the nest, as discussed for sandgrouse by Cade and Maclean [1967].) That such behavior has gone previously unreported is not surprising, given the ease with which it might be missed by researchers who focus on adults while the birds are feeding young rather than while they are foraging.

I thank R. Noyce and L. Berta for permission to work at Blompond; S. Albano and A. Peters for help in catching grasshoppers; and P. Williams and the reviewers for comments on the manuscript.

LITERATURE CITED

- BARTHOLOMEW, G. A., AND T. J. CADE. 1963. The water economy of land birds. *Auk* 80:504-539.
- BRADFORD, D. F. 1974. Water stress of free-living *Peromyscus truei*. *Ecology* 55:1407-1414.
- CADE, T. J., AND G. L. MACLEAN. 1967. Transport of water by adult sandgrouse to their young. *Condor* 69:323-343.
- HOWELL, T. R. 1979. Breeding biology of the Egyptian Plover, *Pluvianus aegyptius*. Univ. Calif. Publ. Zool. 113:1-76.
- MACLEAN, G. L. 1968. Field studies on the sandgrouse of the Kalahari Desert. *Living Bird* 7:209-235.
- WILLIAMS, P. L., AND W. D. KOENIG. 1980. Water dependence of birds in a temperate oak woodland. *Auk* 97:339-350.

Hastings Reservation and Museum of Vertebrate Zoology, University of California, Star Route Box 80, Carmel Valley, California 93924. Received 10 December 1984. Final acceptance 19 April 1985.

The Condor 87:445
© The Cooper Ornithological Society 1985

RECENT PUBLICATIONS

Birds of Nebraska.—Coordinated by Jon Farrar. 1985. NEBRASKAland Magazine, Vol. 63, No. 1. Nebraska Game and Parks Commission, Lincoln. 146 p. Paper cover. \$6.00. Source: NEBRASKAland, P.O. Box 30370, Lincoln, NE 68503. This is a special issue of the NEBRASKAland Magazine, devoted to a popular account of the State's birdlife. Its 21 chapters, by a variety of authors, present the birds according to major habitats or taxonomic groups. Easily readable, they concentrate on natural history and wisely eschew descriptions for field identification. The closing chapters look at Nebraska's endangered species and the character of its avifauna. Lavishly illustrated with high-quality color photographs. No references or index. Aimed for general readers, this attractive magazine can be effective for raising their appreciation of birds in the north-central states. As a companion publication, an annotated checklist of Nebraska birds is available (\$0.50) from the above address.

Birds of the northern Rockies.—Tom J. Ulrich. 1984. Mountain Press Publishing Co., Missoula. 158 p. Paper cover. \$7.95. Source: Mountain Press Publishing Co., P.O. Box 2399, Missoula, MT 59806. This is intended as a field guide to 170 species of birds that can be found from the Canadian Rockies south along the Rocky Mountain chain to the Tetons of Wyoming. It is illustrated with more than 220 color photographs, most of them by the author. The one-paragraph species accounts give general information about field marks and habits, but no specific details about occurrence in the region. The text suffers from poor writing, banalities, and anthropomorphisms. Ulrich is to be commended for his efforts in taking the photographs, yet his book does not seem to offer any advantages over existing field guides. Index.