Water balance of the Oregon Junco.—Avian water economy studies have generally centered on birds found in extreme environments, particularly desert regions (Bartholomew and Cade, Auk, 80: 504, 1963). Miller (Proc. 13th Intern. Ornithol. Congr., 666, 1963) points out that these studies have tended to overlook certain physiologic preadaptations of birds to the desert extremes. Water economy of species inhabiting less extreme environments has received but scant attention. This study investigated several aspects of the water economy of the Oregon Junco (*Junco oreganus*), an inhabitant of moist coniferous or mixed forests in the Pacific northwest.

All experimental birds were collected by mist net during March 1968 in the William L. Finley National Wildlife Refuge, 10 miles south of Corvallis, Benton County, Oregon. They were housed in cages measuring 16 $\times$ 11 $\times$ 9 inches. All experiments were conducted at a constant temperature (20°C); photoperiod was controlled by a Paragon time switch to approximate local day length (13½ hours light, 10½ hours dark). All birds were provided with chicken starter mash *ad libitum* throughout the experimental period. The birds ate about 2.6 g per day (*ca.* 9.0 per cent water).

Ad libitum water was provided in graduated cylinders equipped with L-shaped drinking tubes to 10 birds for 9 days (after Bartholomew and Dawson, Physiol. Zool., 26: 162, 1953). The birds were weighed to the nearest 0.1 g shortly before the light came on each day. At the same time the water levels were read to the nearest 0.5 ml. One drinking device was used as a control to correct for evaporation. The effect of reduced water availability was measured on birds offered 2 or 4 mls of water per day.

Mean *ad libitum* water consumption of the 10 experimental birds was 7.50 ml $\pm$ SE 0.42 ml per day, comprising an average of 36 per cent of the body weight. Seven Oregon Juncos, given 4 ml of water per day for a 9-day period lost weight for the first 3 days, then stabilized at 83 per cent of their original body weight during the 4th day. Birds given only 2 ml of water per day were unable to maintain their body weight. Four birds were removed from the regime after losing 35 per cent of their body weight in 7 days (a loss of 5 per cent per day). The remaining three birds died on the 8th day.

Two groups (five birds each) were deprived of free water. The first group was provided with 40 *Tenebrio* larvae (*Tenebrio molitor*) each day in addition to the regular diet of chicken mash, while the second group was given only chicken mash. Birds fed *Tenebrio* larvae, which contain 62 per cent water, lost 3.6 per cent of their original body weight each day for the first 3 days, stabilizing at 89 per cent of their original body weight. Juncos in the second experimental group lost 7.9 per cent of their body weight per day and died after 4 or 5 days.

The respiratory water loss of six birds was determined using the open circuit method described by Bartholomew and Dawson (1953). A bird was placed in the chamber portion of the device 1 hour prior to testing. Feces excreted during the experiment fell into an oil bath below the wire mesh on which the bird stood. Dry CO_2-free air was supplied to the bird. Respiratory water loss was determined by measuring the increase in weight from water absorption of three drying tubes containing Magnesium Perchlorate (Anhydrous). The tubes were weighed to the nearest mg. The temperature was 20°C inside the chamber after the bird had been in it 1 hour. This temperature remained constant throughout the 1-hour test period. Pressure in the chamber averaged between 8.4 and 8.8 millibars above atmospheric pressure. Blank tests were run prior to each new set of runs and after each test of two birds. All birds were deprived of food for 2 hours prior to being in the chamber and while in the chamber.

Table 1 summarizes the data on respiratory water loss and metabolic rate as mea-

TABLE 1
RESPIRATORY WATER LOSS OF SIX OREGON JUNCOS AT 20°C FOR 24 HOURS

Bird	Weight (g)	A Resp. H_2O loss (g)	CO_2 exhaled (g)	Heat prod. (kcal)	B Max. met. H_2O prod. (g)	B/A resp. H_2O by metab. (%)
1	20.29	3.504	4.378	14.93	1.687	48
2	22.62	3.609	5.256	17.92	2.025	56
3	20.60	2.942	5.093	17.37	1.962	66
4	18.94	3.672	4.887	16.62	1.879	51
5	21.69	3.720	4.896	16.69	1.887	51
6	19.46	3.365	5.126	17.48	1.975	58
Mean	20.60	3.419	4.938	16.83	1.903	55

sured by CO_2 production of the six birds. All respiratory water loss and carbon dioxide production values were converted to daily rates. Heat production is assumed to be proportional to the production of carbon dioxide. These values will vary with the nature of the food being utilized. The smallest value will result from the use of carbohydrate (2.57 kcal/g CO_2) and the largest from use of fats (3.41 kcal/g CO_2) (see Dawson, Auk, 82: 106, 1965). As no food was consumed during the experiment and for a 2-hour fast period before, it is assumed that fats were being metabolized —thus the value of 3.41 kcal/g was used in the calculation of heat production.

Metabolic water production was estimated from the data on CO_2 production utilizing the gram body weight. This rate would be highest if birds were using fats in their metabolism. Multiplication of the heat production by 0.113 (Dawson, 1965) yields the maximum metabolic H_2O produced. Dividing this figure by the evaporative water loss shows the probable respiratory water loss that is produced in metabolism. An average of 55 per cent of the respiratory water loss of the experimental juncos came from metabolic water, the remaining 45 per cent from water consumption.

The excretory water loss was estimated from the dry weights of 24-hour collections of droppings. Samples were collected from eight birds for 6 days, giving 48 samples. Five droppings were then obtained from each bird and weighed immediately after defecation. These samples were dried and reweighed to determine the water content. The total water loss during a 24-hour period was then determined by comparing the wet and dry weights of the samples obtained immediately after defecation with the dry weights of the samples obtained during 24-hour periods.

TABLE 2
WATER BALANCE IN OREGON JUNCOS AT 20°C

Gain		Mean Body Wt.	Loss
Ad libitum consumption	: 36.41 % Body wt. →	Mean	→ Excretory : 30.15 % Body wt.
Metabolic production	: 9.22 % Body wt. →	Body Wt.	
Chicken mash	: 1.12 % Body wt. →	20.60 g	→ Respiratory : 16.60 % Body wt.

Oregon Junco droppings contained 81.78 per cent water. When the birds were provided water *ad libitum,* the excretory water loss was 6.21 g excreted per day (30.10 per cent of the mean body weight). As Table 2 shows, during a 24-hour period Oregon Juncos lost 16 per cent of their body weight through respiratory water loss and 30.10 per cent of their body weight through excretory loss.

The author greatly appreciates the helpful suggestions of R. R. Moldenhauer, A. W. Pritchard, and J. A. Wiens. Support for this study was supplied in part under NSF Grant GB6606.—STANLEY H. ANDERSON, *Department of Zoology, Oregon State University, Corvallis, Oregon 97331.*

An excessively large but unfinished Starling nest.—On 25 June 1968 Leon Frazier reported to Connell the presence of a mysterious accumulation of dry vegetative material on the ground beside a wall in his tobacco curing shed near Henderson, North Carolina. Connell immediately visited the shed and found the material being brought into the shed by a pair of Starlings (*Sturnus vulgaris*) trying to build a nest on a ledge 4 inches wide about 18 feet above the ground, just beneath the ridge of the roof. The pile of material continued to grow until the birds ceased their nest-building activities about 15 July.

Before the Starlings stopped carrying material, they had accumulated a pile about 6 feet high and 3½ feet in diameter at the base. The main pile was on top of a heating pipe, 14 inches in diameter, lying on the ground, but material fell around the sides of the pipe to the ground. The material, all of which was reasonably dry, weighed 67 pounds and consisted mostly of pine needles, lawn clippings, and soybean stalks. These were available at the following approximate distances from the shed: pine needles, 40 feet; lawn clippings, 60 feet, soybean stalks, 100 feet.

The Starlings entered the building through a small hole beneath the ridge of the roof. The birds were not banded or otherwise marked, but apparently only one pair was involved and both members of the pair worked on the nest. As the birds no longer entered the building after they stopped accumulating nest material, we assumed that they laid no eggs. We did not climb to the nesting ledge in the course of nest-building activities, but we could see from the ground that little or no nest cup was formed before the nesting material fell to the ground. The pile of material increased in height about 10 inches between 25 June and 15 July.

Bent (U. S. Natl. Mus., Bull. 197: 190, 1950) reports a smaller but still excessively large Starling nest in Lyndonville, New York, so large "a bushel basket would not begin to hold it." Unlike the birds building our "nest," the New York birds reared a brood of young successfully.—PAUL A. STEWART, *Entomology Research Division, Agricultural Research Service, USDA, Oxford, North Carolina 27565,* and J. P. B. CONNELL, *811 South Garnett Street, Henderson, North Carolina 27536.*

Head-scratching method of the Swainson's Warbler.—Ficken and Ficken (Auk, 85: 136, 1968) suggest that the "Head-scratching method may prove a valuable addition to the set of complex characters that can be used in defining genera," and that field observers should continue to fill gaps in our knowledge of this behavior. In the course of a series of observations of Swainson's Warblers (*Limnothlypis swainsonii*) in the Dismal Swamp, Virginia, I saw head-scratching in three individuals, four times in one, three in another, and once in the third. All three birds used the direct method, bringing the foot forward and under the wing.—BROOKE MEANLEY, *Patuxent Wildlife Research Center, U. S. Department of the Interior, Laurel, Maryland 20810.*