below the 20 days that could be expected from figures calculated by Sowls.—ANDERS BJÄRVALL, *Dept. Zoology, University of Stockholm, Rådmansgatan 70 A., Stockholm Va, Sweden.* *29 September 1967 (additions 22 October 1968).*

Build-up of grit in three pochard species in Manitoba.—Grit from the esophagus, proventriculus, and gizzard of 305 of 345 Canvasbacks (*Aythya valisineria*), Redheads (*A. americana*), and Lesser Scaup (*A. affinis*) examined for food contents was measured as part of an investigation of the summer foods and feeding habits of diving ducks in Manitoba (Bartonek, unpubl. Ph.D. thesis, Univ. Wisconsin, Madison, 1968).

The average volume of grit, as measured by water displacement, in the esophagi of the 305 birds, juveniles and adults combined, was only 0.007 ± 0.004 ml (95 per cent C.L.). Some trichoptera larvae, Molannidae in particular, incorporate particles of sand and gravel into their cases, and when consumed by the ducks indirectly contributed to the amount of grit ingested. Among juveniles, the quantity of grit in the gizzards increases with the age of the birds (Table 1). Juvenile ducks were classified to age according to the method of Gollop and Marshall (Mississippi Flyway Council Tech. Sect. Rept., 1954). The gizzards of juvenile Lesser Scaup contained more (but not always significantly more) grit than those of Redheads and Canvasbacks. Among adults, the gizzards of Redheads contained significantly more (95 per cent C.L.) grit than those of either Canvasbacks or Lesser Scaup.

Grit and other mineral matter varied in size from gravel (> 2 mm) to clay (colloidal). Four juveniles, three of which were 2–3 days old and the other 2 weeks old, did not have grit in their gizzards.

That gizzards retain grit longer than food is evident by the grit to food ratios for these three segments of the digestive tract: 1:122 in the esophagus, 1:7 in the proventriculus, and 1:1 in the gizzard.

Of the 345 waterfowl examined, only 6 contained lead shot in their gizzards. Two juvenile Canvasbacks, one juvenile Redhead, and two adult Canvasbacks had one lead shot each in their gizzards; another juvenile Canvasback contained three lead shot. The incidence of shot among these birds collected on the breeding ground is lower than that summarized by Bellrose (Illinois Nat. Hist. Surv. Bull., 27:261–262, 1959) for

TABLE 1
AVERAGE VOLUMES (ML) OF GRIT IN THE GIZZARDS OF CANVASBACKS, REDHEADS, AND LESSER SCAUP (With 95 Per Cent Confidence Limits and with Sample Sizes in Parentheses)

Species	Average volume of grit in gizzards				
	Juveniles			Adults	
	Class I	Class II	Class III and flying	Female	Male
Canvasback	0.32 ± 0.17 (22)	1.19 ± 0.25 (47)	1.52 ± 0.33 (37)	1.45 ± 0.43 (23)	1.60 ± 0.37 (18)
Redhead	0.46 ± 0.20 (27)	1.25 ± 0.34 (15)	1.86 ± 0.54 (10)	2.71 ± 0.53 (19)	3.06 ± 0.56 (22)
Lesser Scaup	0.83 ± 0.26 (21)	1.72 ± 0.30 (11)	2.05 ± 0.39 (11)	1.62 ± 0.51 (11)	1.33 ± 0.42 (11)

birds taken during the hunting season in the United States and Canada, where he reported percentages of Canvasbacks, Redheads, and Lesser Scaup containing lead shot to be 13, 20, and 10 per cent, respectively.

One juvenile Canvasback's gizzard contained a bent, much-eroded nail. The nail had neither caused apparent damage to the gizzard nor impaired the bird's health. Olney and Beer (Wildfowl Trust Ann. Rept., 12:169–170, [208], 1961) report five ducks that either became sick or were killed after various ingested metal objects pierced the digestive tracts.

Support during during field studies and preparation of the manuscript was given, in parts, by the Department of Wildlife Ecology, University of Wisconsin, Madison, Wisconsin, the Delta Waterfowl Research Station, Delta, Manitoba, and the Bureau of Sport Fisheries and Wildlife.—JAMES C. BARTONEK, *Northern Prairie Wildlife Research Center, Bureau of Sport Fisheries and Wildlife, Jamestown, North Dakota 58401, 14 February 1968.*

Time frequency between successive drumming performances of Ruffed Grouse.—Drumming counts have been and continue to be used in two ways: by game biologists to census Ruffed Grouse (*Bonasa umbellus*) intensively on small areas where observers tally individual birds, and extensively where the frequency of drumming at several listening stations during predetermined time intervals constitutes a population index. The latter method is usually used during a roadside census.

Petraborg, et al. (J. Wildl. Mgmt. 17:292, 1953) while attempting to establish criteria for running roadside drumming counts timed the intervals between successive drums of individual males, apparently to the nearest one-half minute, and concluded the mean to be slightly over 4 minutes. These same workers also noted that " . . . in the morning drumming begins shortly after 4 A M, reaches a maximum between 5 and 6 A M, then levels out to a plateau between 5 and 10 A M. After 11 A M drumming falls sharply to approximately zero." A minor drumming activity period in late afternoon was also noted.

During an approximate 3-week period in the spring of 1961 I noted the time of day, to the second, that Ruffed Grouse started individual drumming performances on 4-160-acre study units of the Gratiot-Saginaw State Game Area, Michigan.

In early April I found an active drummer and for several mornings well before daybreak, I set up a tape recorder within about 30 yards of the drumming log, turned the device on, and departed to work elsewhere. The time of start was recorded and when I later monitored the tapes, the precise time of drumming and therefore the time interval between drums was recorded. While engaged in locating other drumming sites, I simply noted the precise time that individual performances began.

Altogether, I was able to record 415 time intervals between successive drums of 11 individual male Ruffed Grouse that spring. In no instance did I record the last drum of the morning for any bird. The data presented here represent drumming during the early morning period only, and represent the behavior of a composite of cocks located throughout the habitat being studied. These data are pooled for all mornings and represent a variety of climatic conditions, although I did no field work on very windy or rainy mornings.

The mean interval between drumming performances was 4.05 ± 0.28 minutes (confidence limits are expressed as 2 standard errors of the mean).

I subdivided the morning period into 10, 15-minute intervals related to sunrise time as follows: 1 hour or more before sunrise; between 1 hour and 45 minutes before