

Nacional (Rio de Janeiro) and to H. Schouteden for data on specimens in the Musée Royale de l'Afrique Centrale, Tervuren. I express my gratitude to G. E. Watson and W. J. L. Sladen for their critical reviews and bibliographical suggestions.

## LITERATURE CITED

- BECK, J. R. 1968. An early record of a Pomarine Jaeger in Marguerite Bay. Brit. Ant. Survey Bull., 18: 83.
- CHUBB, C. 1916. The birds of British Guiana. London, Quaritch.
- DALQUEST, W. W. 1958. Pomarine Jaeger from the interior of Texas. Condor, 60: 258.
- ESCALANTE, R. 1970. Aves marinas del Río de la Plata y aguas vecinas del Océano Atlántico. Montevideo, Barreiro y Ramos S.A.
- KOEPKE, M. 1970. The birds of the Department of Lima, Peru. Wynnewood, Pennsylvania, Livingston Publ. Co.
- OLROG, C. C. 1967. Observaciones sobre aves migratorias del Hemisferio Norte. Hornero, 10: 292-298.
- PHELPS, W. H., AND W. H. PHELPS, JR. 1958. Lista de las aves de Venezuela con su distribución. Vol. 2, No-passeriformes. Caracas, Editorial Sucre.
- ROBERTSON, W. H., JR. 1969. Transatlantic migration of juvenile Sooty Terns. Nature, 223: 632-634.
- SLADEN, W. J. L. 1954. Pomarine Jaeger in the Antarctic. Ibis, 96: 315-316.
- WATSON, G. E. 1966. Pomarine Jaeger near Lake Saranac. Kingbird, 16: 25.
- WELLS, D. R. A. 1966. A Pomarine Skua inland. Bull. Nigeria Ornithol. Soc., 3: 97.
- WETMORE, A. 1965. The birds of the Republic of Panama, part 1. Smithsonian Misc. Coll., 150: 1-483.
- WILLIAMS, L. E., JR. 1965. Jaegers in the Gulf of Mexico. Auk, 82: 18-25.
- WYNNE-EDWARDS, V. C. 1935. On the habits and distribution of birds on the North Atlantic. Proc. Boston Soc. Nat. Hist., 40: 233-346.
- RODOLFO ESCALANTE, *Guayaquí 3425, Apto. 301, Montevideo, Uruguay*. Accepted 30 Jun. 71.

**Effect of water depth on diving times in the American Coot (*Fulica americana*).**—A number of feeding waterfowl show notable variations in their diving times (Heintzelman, 1963; Heintzelman and Newberry, 1964; Dow, 1964; Stewart, 1967; Jenni, 1969). Some of these authors (Heintzelman, 1963; Heintzelman and Newberry, 1964; Jenni, 1969) point out that "local ecological factors" such as water depth or amount of vegetation may influence the duration of foraging dives. Although authors sometimes give or try to approximate water depth when reporting the diving times of various foraging water birds, none has yet, to our knowledge, attempted to measure directly the variations of an ecological parameter (e.g. water depth) and the effects, if any, that these variations might produce on the foraging behavior of waterfowl.

On 9 and 12 April 1971 we recorded the number of foraging dives per minute and measured diving times and pause times in a group of American Coot (*Fulica americana*). On the 2 days approximately 200 and 230 birds in Orleans Parish, Louisiana, were feeding on a small freshwater pond 2 ha in extent, 6.7 km east of Paris Road on Interstate Highway 10 and about 50 m south of the highway. A strip of grassy tussocks about 10 m wide divided the pond into two discrete areas of 1.5 ha (pond I) and 0.4 ha (pond II). Small waterways and channels through the median grassy area connected both ponds and coots often swam from one to the other.

To obtain more accurate locational records we established a grid of 20 × 20-m

quadrats in both ponds. Numbered stakes pushed into the mud marked the corners of the quadrats and facilitated recording the locations of individual birds. We confined our observations to birds feeding in three quadrats in pond I and to one quadrat in pond II. From prior knowledge we knew that the water in pond I was shallower in most places than in pond II. Measurements of the water depths of the four selected quadrats made 28 April after the diving data had been compiled showed a difference of about 27 cm between the mean depths of the study quadrats in ponds I and II. In pond I we recorded a minimum and maximum of 25 and 45 cm respectively with a mean depth of  $36.8 \pm 0.3$  cm while in pond II the minimum and maximum were 52 and 74 cm respectively and a mean depth of  $60.1 \pm 0.7$  cm.

From our observation point on top of a bridge that overlooked the entire pond, we could watch the coots dive, surface with "strings" of vegetation in their bills, and proceed to consume the vegetation while surfaced. This material was predominantly the alga *Chara* sp. (pond I) and the pondweed *Najas* sp. (pond II).

We recorded the diving times and pause times between successive dives with a stopwatch during active feeding bouts. Pause times were tabulated only for feeding bouts that contained a series of at least three consecutive dives. The average diving times of four coots in pond I ranged from  $1.3 \pm 0.2$  to  $1.5 \pm 0.2$  seconds while the mean diving time of four other coots in pond II ranged from  $2.5 \pm 0.2$  to  $3.5 \pm 0.4$  seconds. A Student's *t*-test on all comparisons (Simpson et al., 1960) showed the differences in the diving times, pause times and number of dives performed per minute (Table 1) to be significant. Coots stayed under water longer in the deeper places, took longer pauses between successive dives, and dove less frequently than birds in the shallower water. These data indicate, therefore, that an ecological factor such as water depth can indeed influence diving behavior.

The calculated dive/pause ratios for the two areas are 0.11 (pond I) and 0.13 (pond II), which is approximately the same as the dive/pause ratio of 0.2 reported for the European Coot (*Fulica atra*) by Dow (1964 [after J. M. Dewar, The bird as a diver, London, Witherby, 1924]). Thus although we found that a difference in water depth affected the diving times and the pause times of the American Coot, our data show no difference in dive/pause ratios between ponds I and II. These results support Dow's (1964) statement: "if the durations of the dive and pause are mainly functions of water depth, it follows that the dive/pause ratio for a species should remain approximately constant."

It should be pointed out that, although a variation in water depth did not alter the coot's diving efficiency (dive/pause ratio), it could possibly affect the foraging efficiency, as the optimal diet for an animal is basically determined by the net amount

TABLE 1  
DIVES PER MINUTE AND PAUSE TIMES BETWEEN SUCCESSIVE DIVES  
IN *F. AMERICANA*<sup>1</sup>

	Pond	Minimum	Maximum	Mean $\pm$ SE	
Dives/minute	I	0.7	4.2	$2.8 \pm 0.3$	$P < 0.01; t = 3.36$
	II	0.9	1.6	$1.2 \pm 0.1$	
Pause times between successive dives (seconds)	I	1.0	63.0	$12.9 \pm 0.7$	$P < 0.001; t = 6.04$
	II	7.0	50.0	$24.6 \pm 1.9$	

<sup>1</sup> Data are based on 214 dives by 10 coots in pond I and 34 dives by 5 birds in pond II.

of energy gained from the item as compared to the energy expended searching for it (Emlen, 1966; MacArthur and Pianka, 1966). Much work remains to be done on this aspect.

We thank Glen Montz for his help in identifying the vegetation and Peter Politzer for reading the original manuscript and making several helpful suggestions.

#### LITERATURE CITED

- DOW, D. D. 1964. Diving times of wintering water birds. *Auk*, 81: 556-558.
- EMLEN, J. T. 1966. The role of time and energy in food preference. *Amer. Naturalist*, 100: 603-609.
- HEINTZELMAN, D. S. 1963. Diving times of a Common Goldeneye. *Wilson Bull.*, 75: 91.
- HEINTZELMAN, D. S., AND C. J. NEWBERRY. 1964. Some waterfowl diving times. *Wilson Bull.*, 76: 291.
- JENNI, D. A. 1969. Diving times of the Least Grebe and Masked Duck. *Auk*, 86: 355-356.
- MACARTHUR, R. H., AND E. R. PIANKA. 1966. On optimal use of a patchy environment. *Amer. Naturalist*, 100: 603-609.
- SIMPSON, G. S., A. ROE, AND R. C. LEWONTIN. 1960. *Quantitative zoology*. New York, Harcourt, Brace and Co.
- STEWART, P. A. 1967. Diving schedules of a Common Loon and a group of Oldsquaws. *Auk*, 84: 122-123.

JOHN C. BATULIS, 5128 Cunningham Ct., New Orleans, Louisiana 70126, and SALVATORE F. BONGIORNO, Department of Biology, Fairfield University, Fairfield, Connecticut 06430. Accepted 30 Jun. 71.

**Wilson's Phalaropes forming feeding association with Shovelers.**—A number of waterbirds are known to exploit the normal feeding behavior of other species. In so doing they increase the performance rate of certain of their own motor patterns for feeding. More specifically, Williams (Condor, 53: 158, 1953) has described Wilson's Phalarope (*Steganopus tricolor*) forming a commensal association with American Avocets (*Recurvirostra americana*).

In May 1971, while observing Wilson's Phalaropes and Shovelers (*Anas clypeata*) in a flooded meadow (mainly whitetop *Scolochloa festucacea*) at Delta, Manitoba, we noted an obvious and common feeding association between these birds. A group of some 25 Shovelers and a flock of some 60 phalaropes spent the whole of every day (sunrise to sunset) in the meadow. The depth of the water varied, but generally did not exceed 70 mm, permitting the phalaropes either to wade or swim for brief periods. The Shovelers fed mainly by alternately raising and submerging their heads while paddling steadily forward. It seemed obvious that the feeding actions of the Shovelers stirred up invertebrates, which the phalaropes nearest the ducks seized by quick thrusts of their beaks. Grebes (*Podiceps* spp.) have been reported as improving their feeding by associating with Shovelers (*A. clypeata* and *A. smithii*) (see Siegfried, *Ibis*, 113: 236, 1971).

The data presented in Table 1 suggest that, while attending a feeding Shoveler, an individual phalarope pecked at prey at a rate almost three times that measured for a phalarope feeding alone, and a little less than twice the rate obtained for a phalarope feeding as a member of a flock of conspecifics. The mean pecking rates are significantly different ( $P < 0.01$ ). As we could not distinguish between successful and unsuccessful