Diurnal Activity Budgets of Nonbreeding Waterfowl and Coots Using Catfish Ponds in Mississippi

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Abstract: We quantified diurnal time activity budgets of 4 waterfowl species and American coots (*Fulica americana*), using catfish ponds in the Delta Region of Mississippi from November to March 1983–84 and 1984–85. Within each species, activity budgets were similar ($P > 0.05$) between seasons (1983–84 vs. 1984–85). Primary activities of lesser scaup (*Aythya affinis*) included foraging (34.6%) and resting (27.7%). Shovelers, (*Anas clypeata*) mostly foraged (69.0%) and courtship and interaction activities increased in late winter. Primary activities of ring-necked ducks (*Aythya collaris*) were foraging (35.9%) and resting (33.7%). Ruddy ducks (*Oxyura jamaicensis*) mostly rested (58.4%) and foraged (23.9%), while American coots spent much of their time foraging (47.9%) and in locomotion (35.6%). Time budgets of shovelers and ring-necked ducks were each jointly dependent ($P < 0.05$) on month, time of day, and sex and those of coots were dependent on month and time of day. Catfish pond habitat appears to adequately supply the habitat needs of these 5 species and specific habitat management may conflict with catfish farming.

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Populations of >100,000 waterfowl inhabiting catfish ponds were estimated by Christopher (1985) and Dubovsky and Kaminski (1987) and average yearly populations appear to be increasing. There is an abundant literature base documenting dabbling duck activities (Southiere et al. 1972, Tamisier 1976, Eadie et al. 1979, Jorde 1981, Paulus 1984, Quinlan and Baldassarre 1984) and European studies documented diving duck activities (Kilma 1966, Folk 1971, Pedroli 1982), but other

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than a bulletin we distributed to catfish farmers (Kaminski et. al. 1984), no published reports have focused on how waterfowl may function within an extensive man-made aquacultural ecosystem (Wellborn 1983). Our study quantified the diurnal time-activity budgets of ducks and coots inhabiting catfish ponds to better understand how catfish ponds and similar impoundments are used by waterfowl in the flood plain of the lower Mississippi River.

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Methods

We studied lesser scaup (*Aythya affinis*), northern shovelers (*Anas clypeata*), ring-necked ducks (Aythya collaris), ruddy ducks (*Oxyura jamaicensis*), and American coots (*Fulica americana*), on 7 catfish farms within the Delta Region of Mississippi (alluvial valley) during 1983–84, and 3 of the previously studied fish farms during 1984–85. These farms ranged in size from 104 to 850 ha and were located in Humphreys and central Washington counties.

Time-activity budget data were collected during 3 2-hour observation sessions 2–4 days per week from 4 November 1983 to 15 March 1984 and 3 November 1984 to 10 March 1985. We randomly selected each 2-hour observation session that started on the hour, each within one of the following diurnal time frames: 0600–0800 (early morning), 1000–1200 (mid-day), and 1400–1600 (late afternoon).

We made 1 scan sample (Altmann 1974) of all birds present on a catfish pond and recorded species, sex, and activity for each bird observed. Once all birds on a pond were scanned, additional ponds were scanned until the observation session was completed. Activities were categorized as resting, sleeping, comfort movements, alert, foraging, interaction, courtship (Johnsgard 1965), and locomotion. Each bird was observed only once during an observation session to insure independence of observations.

We divided each winter into 4 monthly blocks (Nov, Dec, Jan, Feb) and one 2-week block (Mar) and aggregated observations within each of these blocks. Time-activity budgets were calculated as percentages of time spent in each activity for each species, sex (except coots), month, and diurnal time frames (time) for each year sampling (1983–84, 1984–85). Chi-square likelihood ratio statistics were used to test for differences between years. Since no yearly differences were detected ($P > 0.05$), seasonal data were pooled across years and the percentages of time spent in each activity were recalculated for the categorical variables. For ease of presentation in this report, data were pooled across diurnal time frame and sex. A more detailed treatment of the data was presented in Christopher (1985).

For simplicity, the data were presented as the percentage of time each species spent in categorical activities. Log-linear models employing a chi-square likelihood

ratio statistics (G^2) for 3- and 4-way tables (Sokal and Rohlf 1969, Fienberg 1977, Dixon 1981), tested for joint independence of categorical variables (activity, time of day, sex and month; for coots, the gender variable was eliminated). Critical values for chi-square tests were taken from Thompson (1941). Spearman's rank correlation was used to test for association between activity and month ($N = 30$) for both winters (Siegal 1956).

Results

The major activities of lesser scaup during winter were foraging (34.6%), resting (27.7%), comfort movements (18.5%), and locomotion (17.4%) (Table 1). Chi-square likelihood ratio tests suggest that activity budgets were jointly independent of time, sex and month ($G^2 = 182.0$, df $= 196$, $P > 0.05$).

The major shoveler activities were foraging (69.0%), resting (11.2%), locomotion (10.1%), and comfort movements (9.6%) (Table 1). Chi-square likelihood ratio tests ($G^2 = 381.2$, df $= 196$, $P < 0.05$), indicated that activity was jointly dependent on time of day, sex and month. Time spent in comfort movements ($r = 0.78$, $P < 0.05$), interactions ($r = 0.55$, $P < 0.05$), courtship ($r = 0.78$, $P < 0.05$), and locomotion ($r = 0.37$, $P < 0.05$) increased during winter. A possible relationship among shoveler activities and seasonal and diurnal changes, and perhaps sex, is suggested.

Ring-necked duck activities were primarily foraging (35.9%), resting (33.7%), locomotion (16.4%), and comfort movements (12.5%) (Table 1). A chi-square likelihood ratio showed activities to be jointly dependent on time of day, sex, and month ($G^2 = 562.2$, df $= 155$, $P < 0.05$). Seasonal trends in activities included decreases in resting ($r = -0.47$, $P < 0.05$, $N = 24$), and alert ($r = -0.79$, $P < 0.05$) activities. Seasonal factors with some combined efforts across levels of day-time period and sex were associated with the activity budgets of ring-necked ducks.

Major activities of ruddy ducks were resting (58.4%), diving (23.9%), comfort movements (12.2%), and locomotion (5.2%) (Table 1). Activities were independent of sex, time of day, and month ($G^2 = 98.6$, df $= 196$, $P > 0.05$) and showed very little variation across time frame, month and sex.

The major coot activities were locomotion (35.6%), foraging on land (13.5%), comfort movements (12.7%), and foraging by diving (7.4%) (Table 1). Feeding on land (Table 1) (levees) increased ($r = 0.60$, $P < 0.05$) while diving activity decreased ($r = -0.88$, $P < 0.05$) as the winter progressed. The chi-square likelihood ratio test indicated that activities of American coots were jointly dependent on time of day and month ($G^2 = 382.3$, df $= 92$, $P < 0.05$). These results suggested that variations in daily and seasonal factors may be associated with coot activities.

Table 1. Percent time spent in activities by non-breeding ducks and coots using catfish ponds in Mississippi from November through March 1983–84 and 1984–85.

Month	Resting	Comfort movements	Alert	Foraging[a]	Inter-action	Courtship	Loco-motion	Surface foraging	Land foraging	*N*
					Lesser scaup					
Nov	37.5	20.9	2.5	23.6	0.2	0.0	15.5			3,532
Dec	25.7	19.3	1.2	34.7	0.3	0.0	18.9			5,142
Jan	23.2	14.9	1.4	38.1	0.1	0.4	21.9			6,895
Feb	28.3	18.1	1.1	36.2	0.1	0.1	16.2			7,715
Mar	24.2	19.4	1.4	40.2	0.1	0.0	14.8			4,967
Mean	27.7	18.5	1.5	34.6	0.2	0.1	17.4			
					Northern shovelers					
Nov	14.0	9.0	0.2	70.0	0.0	0.0	6.9			7,790
Dec	11.5	7.7	0.2	71.3	0.1	0.0	9.3			10,530
Jan	7.4	7.0	0.2	75.1	0.2	0.0	11.5			8,482
Feb	13.3	10.1	0.1	64.3	0.6	0.8	12.3			5,086
Mar	9.5	14.3	0.4	64.6	0.8	1.8	10.2			4,212
Mean	11.2	9.6	0.2	69.0	0.3	0.5	10.1			
					Ringed-necked ducks					
Nov	50.5	13.7	3.0	23.3	0.1	0.1	8.7			2,482
Dec	28.1	11.6	0.5	47.8	0.0	0.0	12.1			2,821
Jan	26.0	10.7	0.3	36.4	0.1	0.0	26.5			2,405
Feb	30.4	12.8	0.5	35.8	0.5	1.9	18.1			1,433
Mean	33.7	12.5	1.1	35.9	0.2	0.5	16.4			
					Ruddy ducks					
Nov	55.6	10.9	0.5	26.2	0.1	0.0	6.8			6,135
Dec	57.3	12.8	0.6	23.0	0.0	0.0	5.6			11.981
Jan	61.1	9.5	0.8	24.4	0.1	0.0	4.8			10,233
Feb	60.7	12.2	0.2	23.4	0.0	0.0	3.5			6,549
Mar	56.9	15.7	0.0	22.2	0.0	0.0	4.4			3,478
Mean	58.4	12.2	0.4	23.9	0.0	0.0	5.2			
					American coots					
Nov	4.3	14.7	0.0	14.5	0.5	0.0	29.2	33.5	3.2	4,089
Dec	4.3	14.6	0.0	11.7	0.1	0.0	25.4	34.2	9.9	4,921
Jan	3.6	14.2	0.0	4.8	0.1	0.0	48.3	18.2	10.7	1,577
Feb	4.8	10.6	0.0	2.1	0.3	0.0	36.1	17.7	28.5	1,583
Mar	0.0	9.3	0.0	4.0	0.8	0.0	38.9	31.4	15.1	566
Mean	3.4	12.7	0.0	7.4	0.4	0.0	35.6	27.0	13.5	

[a]Foraging activity consists of dabbling in shovelers and diving among all other species.

Discussion

Lesser scaup foraged intensively throughout the study periods, and this activity was concentrated near pond corners and edges. Perhaps macroinverebrates or small fish were abundant in these zones. Scaup were observed consuming freeze-killed or injured fish, particularly small gizzard shad (*Dorosoma cepedianum*) and green sunfish (*Lepomis cyanellus*) caught at the surface. They were not observed defending foraging areas as was reported by Alexander and Hair (1979). Theories associated with noctural feeding, such as predation and human disturbance, (Tamisier 1976, Pedroli 1982) seemed inappropriate for catfish ponds, but we could not rule out noctural feeding as a scaup activity. Movements at dusk indicated some ponds were used for roosting; concentrations of 500–2,500 scaup roosting on ponds were observed on 3 occasions. Courtship activities were noted during January and February 1983–84, but comprised a minor portion of scaup activities.

Lesser scaup in the Delta Region of Mississippi apparently used catfish ponds as major wintering habitat. Populations calculated during aerial surveys (Christopher 1985, Christopher et al. 1987, Dubovsky and Kaminski 1987) and counts recorded by state and Federal biologists suggest that scaup inhabit catfish ponds more than other wetlands.

Shovelers normally foraged by filtering on pond surfaces for plankton (Bellrose 1978). During November through early February, shovelers formed feeding "pinwheels" in which several dozen birds would orient their heads together and the whole group would move around the central point of the group. Presumably, this behavior mutually facilitated the collection of plankton. The circular foraging flocks broke up during late winter as shovelers began foraging in pairs or singularly.

Hepp and Hair (1983) noted that courtship and aggressive activities of shovelers were initiated during December in coastal North Carolina, and that 96.7% of the females were paired during February. No courtship activity was observed on catfish ponds until February, and then only 39.7% of the females were paired. The scan-sampling technique used in this study could have limited observation of some courtship activity.

Diving with little or no surface feeding was the primary form of foraging by ring-necked ducks. Their diving differed from that of the lesser scaup as it often occurred in the central area of ponds containing growths of southern naiad (*Najas guadalupensis*) and they were not observed consuming fish. Some feeding occurred in pond corners and along pond levees covered with tall grasses, and smartweeds (*Polygonum spp.*). Esophagus contents of 1 female collected while feeding along a pond levee confirmed the consumption of smartweed seeds. Other studies have shown that vegetation is a major component to the ring-necked ducks diet (Kerwin and Webb 1971). The relative lack of vegetational food items possibly influenced ring-necked duck activities.

Groups of ruddy ducks slept and rested in the center of ponds intermixed with individuals preening, swimming, and diving. Swimming was mostly associated

with diving, disturbance, or comfort movements. Diving activity was mostly near the pond edges and corners, but foraging was not intensive within specific areas.

American coots were observed consuming southern naiad and occasionally catfish feed during November and early December. Coots fed by pecking on vegetation just below the water surface. Cold weather combined with persistent feeding appeared to substantially reduce the amount of vegetation by early and mid-winter. During late winter, relatively more coots were observed foraging and grazing on levees and exposed mud flats and less foraging on water surface and diving were observed (Table 1). Resting activity by coots was rarely observed. More sleeping activity was observed during cold weather than at other times, but it still made up a small part of the activity budget.

Eddleman et al. (1985) reported some interactions associated with foraging on vegetation between coots and ducks. They suggested that interspecific interactions were minimal. Coots using catfish ponds occasionally interacted with other coots or ducks especially while foraging.

Foraging activity among scaup, ruddy ducks, and ring-necked ducks did not differ widely (Table 1), although ruddy ducks consistently foraged less and rested more. Shovelers foraged much more than the diving ducks. In general, diving ducks activities were more evenly divided among resting, diving, comfort movements, and locomotion. The combined foraging activity of coots was greater than any other species, except shovelers, and their resting activity was substantially less. Shovelers engaged in slightly more courtship activity than the other species, but courtship was a small part of all activity budgets.

Activity budget data for lesser scaup, ring-necked ducks, and ruddy ducks were similar to those reported for these 3 species wintering in South Carolina (L. D. Vanglider and R. T. Hoppe, unpubl. rep.). Activity budget data for ring-necked ducks were similar to those for ring-necked ducks wintering in Florida (Jeske 1985). Lesser scaup in South Carolina, preened, foraged, and rested less, but locomotion was increased. Ring-necked duck foraging, resting, and locomotion were similar, but comfort movements were less in South Carolina. Ring-necked ducks in Florida had almost identical time budgets. Ruddy ducks in South Carolina foraged and swam more and rested and preened less than ruddy ducks on catfish ponds. Activity budgets for northern shovelers during the spring (Afton 1979) were characteristic of the large amounts of time foraging by shovelers on catfish ponds.

Conclusions

Based on the time-activity budgets of waterfowl in this study, catfish ponds in the Delta Region of Mississippi provided a permanent water, migration and wintering habitat for lesser scaup, shoveler, ring-necked ducks, ruddy ducks, and coots. The time-activity strategies documented the lack of movement from catfish ponds to other wetland habitats. The activity budgets of these species did not differ widely from those documented in other studies of waterfowl using natural wetlands, therefore catfish ponds may meet the winter habitat needs of these species. Use of man-

made wetlands by these species was almost exclusive of other surrounding wetlands except during brief periods when high precipitation made natural wetlands and agricultural fields available (Christopher 1985). With the continuing trend towards loss of wetlands in the Delta Region of Mississippi, catfish ponds may become a relatively more important waterfowl habitat. Information in this study should provide the basis for subsequent efforts to determine suitability and management potential of such ponds for over-wintering waterfowl. Our observations suggest that active habitat management may conflict with aquaculture. Burning or mowing pond levees infrequently may be used to encourage annual grasses and legumes and habitat for macro-invertebrates. Educating landowners of the extensive use of catfish ponds by waterfowl may encourage them to allow hunting and non-consumptive use of the resource.

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