

SOME BEHAVIORAL ACTIVITIES OF *GALLINULA CHLOROPUS* (COMMON MOORHEN) IN MEIKTILA UNIVERSITY CAMPUS

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Abstract

In the study period from January 2019 to December 2019, five behavioral activities of Common Moorhen were studied under four different diurnal periods. Concerning different diurnal periods, the relative percentage of time spent on locomotion and foraging was highest in the early morning. Grooming and reproductive behavior were highest in the late morning. The relative percentage of time spent resting behavior was highest in the mid-day. The time spent on locomotion varied among four different diurnal periods ($P < 0.05$). Grooming activity differed among four different diurnal periods ($P < 0.05$). Diurnal time spent on foraging activity varied among four different diurnal periods ($P < 0.05$). No significant differences were found in resting activity in the time blocks of the day ($P > 0.05$). Reproduction activity was not varied in the time blocks of the day ($P > 0.05$). Throughout the study period, the dominant behavior was foraging and the contrary was reproduction. The next to foraging was locomotion and grooming because after the feeding peak in a place they usually change feeding place to search for more foods which increases their movement. Moving peak at next hour of foraging and feeding peak could be the reason for this. The minimum activity throughout the study period was reproductive behavior. Although Common moorhen breed all year, it breeds three broods in one year during the study period were recorded. Thus reproductive behavior among the behavioral activities was minimized. Among five behavioral activities of Common Moorhen throughout the study period was varied ($P < 0.05$).

Keyword: behavioral activities, four different diurnal periods, *Gallinula chloropus*

Introduction

Bird's activity study is significant in understanding its life history, physical condition, food availability, social structure, as well as ecological condition (Sultana and Sarker, 2016). Behavior is also believed to be consisting of various expressions of a bird in response to the internal stimuli mainly related to the physiological needs. Bird's visual signals are communicated by the movements of the head, body, tail, wings and body feathers (Najafi *et al.*, 2012). Calls are vocal displays of birds whereas the extrinsic stimuli depend on the biotic and abiotic factors of the habitat (Quader, 2003). Behaviors may be regarded either as events or as states. Events are instantaneous and states have appreciable durations (Altmann, 1974). Activity pattern studies quantify the time allocation of animals performing behavioral activities (Rave and Baldassarre, 1989).

The amount of time allocated to various behaviors is therefore critical in understanding the ecological needs of a species and the pressures acting upon individuals of that species. The patterns of daily activity and behavior often vary among and within species (Jeschke and Tollrian, 2005); as a result, these activity patterns help us to study the life history and ecological adaptations of birds (Hamilton *et al.* 2002). The time-activity patterns of birds vary greatly according to the type of habitats they inhabit and the food they eat (Ali and Asokan, 2015).

The common moorhen (*Gallinula chloropus*) is a medium-sized member of the rail family found in aquatic environments. It has gray-black feathers and a red bill with a yellow tip. It has white stripes on its sides. They live in freshwater and brackish marshes and ponds with cattails and other aquatic vegetation. They are omnivorous and feed while walking on plants or on the edge of the water or while floating on the water (Robson, 2015).

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A man-made pond on the Meiktila University Campus is a favorable habitat with emergent vegetation and various food resources for Common Moorhen, so that they are found throughout the year as common resident and breeds in this pond. Therefore, Common Moorhen was selected as a target species for behavioral study, and the present study was carried out with the following objectives:

- to study the different behavioral activities of the Common Moorhen (*Gallinula chloropus*)
- to assess the relative monthly percentage time spent in different diurnal periods and throughout the study period

Materials and Methods

Study Design

Behavioral activities of Common Moorhen (*Gallinula chloropus*) in a man-made pond on Meiktila University Campus were observed once a week. Observations were carried from a vantage point on the bank of the pond and consisted of four different diurnal periods at two hours sessions per period following the focal animal sampling method (Altmann, 1974). The four period consisted of two periods in the morning and two in the afternoon and commenced from early morning (6:00-8:00 am), and late morning (9:00 -11:00 am), followed by mid-day (12:00-2:00 pm) and afternoon (3:00-5:00 pm) respectively.

Focal animal sampling means all occurrences of behaviors of interest are recorded for a particular individual during an entire sample period. This method was chosen because it allows the observer to record the time in minutes of each behavioral act. This sampling was carried out at intervals of fifteen minutes for a total observation period of 192 hours from January 2019 to December 2019 involving 48 different days and resulting in 768 focal samples.

A particular bird was followed and its activities were noted down. The duration of each activity was recorded using a stopwatch. When the bird under the observation was moved out of sight another bird was focused. The birds were observed with the camera or binoculars or naked eyes and photographic record and video were taken as much as possible. Activities were categorized as locomotion, grooming, foraging, resting, and reproduction followed by Wallau *et al.*, 2010.

Time spent for each behavioral category recorded was pooled for predetermined each of the diurnal periods and converted into the proportion of time spent in all behavior for each diurnal period, monthly and throughout the study period.

Statistical analysis

Statistical analysis was done using Statistical Package for the Social Science (SPSS), version 26. Normality tests were done before the analysis. Non-parametric ANOVA test (Kruskal-Wallis test) was used to find the significant differences among the activities.

Identification

The identification of Common Moorhen was conducted with reference to Robson, 2015. The identification of behavioral categories of Common Moorhen was based on Wallau *et al.*, 2010.



A map of Meiktila University Campus showing the study site (Google Earth, 2007)

Results

The behavior of Common Moorhen (*Gallinula chloropus*) was observed from January 2019 to December 2019. A total of 15 behavioral acts were described, grouped into five categories: locomotion (N=5 acts; walking, running, jumping, flying, and swimming), grooming (N=4 acts; Bathing, shaking the feathers, preening the feathers, and cleaning the beak), foraging (N=2 acts; eating and drinking), resting (N=2 acts; sprawling and wings open/half-open/beating) and reproduction (N=2 acts; courting and copulating) (Table 1, Plate 1). Weekly diurnal activity budgets of Common Moorhen were pooled into monthly and then throughout the study period.

Relative percentage time spent of Common Moorhen in different diurnal periods throughout the study period

Concerning predetermined four different diurnal periods, the maximum percentage time spent evaluated for locomotion was 33.62 % in the early morning and the minimum was 19.76 % in the mid-day (Table 2). There was a significant difference among four different diurnal periods in locomotion ($P < 0.05$). The highest percentage time spent for grooming in the late morning indicates 29.75 % and the lowest was 20.63 % in the afternoon (Table 3). Grooming activity differed among four diurnal periods ($P < 0.05$). Foraging was highest in the early morning 31.77 %, and then decreased in late morning 17.56 % (Table 4). Diurnal time spent on foraging activity varied among four different diurnal periods ($P < 0.05$). The observed birds that spent most of the time resting were mid-day 33.55 % and least in the early morning 19.35 % (Table 5). No significant differences were found in resting activity in the time blocks of the day ($P > 0.05$). The evaluated dominant time spent in reproduction was 10.31 % in the early morning and increased to 35.05 % in the late morning. It was found to be gradually decreased to 27.84% and 26.8% in the mid-day and afternoon respectively (Table 6). Reproduction activity was not varied in the time blocks of the day ($P > 0.05$).

Total percentage time spent for different behavioral activities of Common Moorhen throughout the study period

The five behavioral activities observed for Common Moorhen throughout the study period were also varied. During the study period, the evaluated dominant behavior was foraging which

indicates 34.34 %, and the contrary was reproduction at 1.77% (Table 7, Fig. 1). Five behavioral activities of Common Moorhen throughout the study period were varied ($P < 0.05$).

Table 1 Behavior activities of *Gallinula chloropus* (Common Moorhen)

Behavior categories	Behavior acts
Locomotion	1. walking 2. running 3. jumping 4. flying 5. swimming
Grooming	6. bathing 7. shaking the feathers 8. preening the feathers 9. cleaning the beak
Foraging	10. eating 11. drinking
resting	12. sprawling 13. wing open/ half-open/ beating
Reproduction	14. courting 15. copulating

Table 2 Relative percentage time spent of *Gallinula chloropus* for locomotion in different diurnal periods throughout the study period

Month	Early morning (min)	Late morning (min)	Mid-day (min)	Afternoon (min)	Total (min)
January	51	34	33	44	162
February	44	24	28	22	118
March	41	31	34	41	147
April	36	20	12	25	93
May	58	38	37	53	186
June	58	38	36	56	188
July	39	24	23	36	122
August	55	20	27	32	134
September	42	23	17	23	105
October	52	35	41	44	172
November	57	45	39	48	189
December	59	31	21	34	145
Total	592	363	348	458	1761
%	33.62	20.61	19.76	26.01	

Table 3 Relative percentage time spent of *Gallinula chloropus* for grooming in different diurnal periods throughout the study period

Month	Early morning (min)	Late morning (min)	Mid-day (min)	Afternoon (min)	Total (min)
January	30	44	59	37	170
February	42	34	5	39	120
March	14	39	28	12	93
April	20	28	30	27	105
May	30	33	35	26	124
June	31	44	40	37	152
July	28	49	34	18	129
August	36	41	52	27	156
September	45	49	46	21	161
October	29	54	48	40	171
November	23	31	40	21	115
December	15	24	24	21	84
Total	343	470	441	326	1580
%	21.71	29.75	27.91	20.63	

Table 4 Relative percentage time spent of *Gallinula chloropus* for foraging in different diurnal periods throughout the study period

Month	Early morning (min)	Late morning (min)	Mid-day (min)	Afternoon (min)	Total (min)
January	49	27	45	55	176
February	45	7	33	48	133
March	55	20	48	49	172
April	58	58	40	57	213
May	53	18	27	47	145
June	49	35	39	42	165
July	45	31	33	39	148
August	41	21	31	38	131
September	36	14	21	33	104
October	50	24	29	44	147
November	57	44	35	47	183
December	59	31	28	44	162
Total	597	330	409	543	1879
%	31.77	17.56	21.77	28.9	

Table 5 Relative percentage time spent of *Gallinula chloropus* for resting in different diurnal periods throughout the study period

Month	Early morning (min)	Late morning (min)	Mid-day (min)	Afternoon (min)	Total (min)
January	1	3	13	2	19
February	2	3	7	0	12
March	1	1	0	1	3
April	2	1	2	1	6
May	1	1	1	2	5
June	5	9	4	4	22
July	4	4	7	8	23
August	4	2	5	7	18
September	2	1	7	5	15
October	3	3	2	2	10
November	3	5	3	5	16
December	2	1	1	2	6
Total	30	34	52	39	155
%	19.35	21.94	33.55	25.16	

Table 6 Relative percentage time spent of *Gallinula chloropus* for reproduction in different diurnal periods throughout the study period

Month	Early morning (min)	Late morning (min)	Mid-day (min)	Afternoon (min)	Total (min)
January	5	10	4	3	22
February	0	0	0	0	0
March	0	0	0	0	0
April	0	7	4	5	16
May	0	5	6	4	15
June	0	0	0	0	0
July	0	0	7	5	12
August	0	0	0	0	0
September	0	0	0	0	0
October	0	7	6	4	17
November	0	0	0	0	0
December	5	5	0	5	15
Total	10	34	27	26	97
%	10.31	35.05	27.84	26.8	

Table 7 Total percentage time spent for different behavioral activities of *Gallinula chloropus* throughout the study period

Month	Locomotion (min)	Grooming (min)	Foraging (min)	Resting (min)	Reproduction (min)	Total (min)
January	162	170	176	19	22	549
February	118	120	133	12	0	383
March	147	93	172	3	0	415
April	93	105	213	6	16	433
May	186	124	145	5	15	475
June	188	152	165	22	0	527
July	122	129	148	23	12	434
August	134	156	131	18	0	439
September	105	161	104	15	0	385
October	172	171	147	10	17	517
November	189	115	183	16	0	503
December	145	84	162	6	15	412
Total	1761	1580	1879	155	97	5472
%	32.18	28.87	34.34	2.83	1.77	

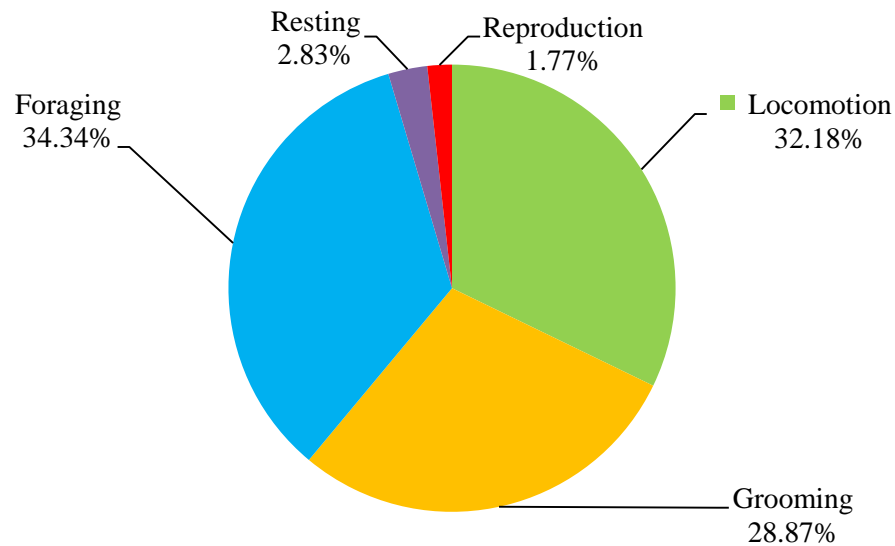


Figure 1 Overall activity budget of *Gallinula chloropus* (Common Moorhen)



A. Walking



B. Running



C. Jumping



D. Flying



E. Swimming



F. Bathing



G. Shaking the feathers



H. Preening the feathers



I. Cleaning the beak



J. Eating



K. Drinking



L. Sprawling

M. Wing open/
half-open/
beating

N. Courting



O. Copulating

Plate 1 Behavioral acts of *Gallinula chloropus* (Common Moorhen)

Discussion

The activity budget is defined as the proportion of time an animal spent in different activities that are important for its survival in reproduction. In the present study, the diurnal time spent of Common Moorhen was evaluated for four different diurnal periods and throughout the study period. With regard to different diurnal periods throughout the study period, the relative percentage of time spent on Common Moorhen showed that locomotion and foraging were found to be highest in the early morning because, most of the feeding activities were usually found in the early morning due to the lack of human disturbance and low temperature. Thus, both of these behaviors were found to be highest in the early morning. After overnight fasting, they try to maximize foraging, feeding, and locomotion during the early morning as reported in Akhtar *et al.*,

2013. A similar result found in the behavior of the Common Moorhen reported by Wallau *et al.*, 2010. On the other hand, minimum foraging activity was found in the late morning and locomotion was in the mid-day. Therefore locomotion and foraging were mainly concentrated in the morning and decreased as the day proceeded. This may be due to the rising temperature in the late morning and they gradually go back to the shelter in the mid-day and is similar to the finding of Acquarone *et al.*, 2001. Evaluated grooming and reproductive behavior (courting and copulating) were highest in the late morning. The reason for grooming is that Common Moorhen made the grooming just after most of the activities of foraging and locomotion. Akhtar *et al.*, 2013 described that grooming is usually found to increase after swimming and it is one of the important body-maintenance activities of birds. Bathing and preening, scratching with the claws, help allay itching, remove ectoparasites, and clean the feathers. Preening with oil from the uropygial gland helps them to maintain their feather very well. Minimum time spent for grooming activity was found in the afternoon for that they spent much time for grooming in the late morning.

Moorhen devoted the most time to reproductive behavior was in the late morning because reproductive activities are energetic and assumed to make after feeding. A similar concept was found in the research reported by Frost, 2008 that continuous breeding is realized as a consequence of a primarily favorable and availability of food supply and is the ultimate factor in triggering opportunistic breeding. Akhtar *et al.*, 2013 stated that after the first bout of feeding, they were found to use their energy in breeding activities. The contrary was found in the early morning.

Common Moorhen spent less time in resting behavior. The peak of resting activity was evaluated in the mid-day. This can be assumed that Moorhen became dormant and take a rest most of the time in the mid-day. It could be also explained as to minimize their energy expenditure at the mid-day when the temperature became higher. Akhtar *et al.*, 2013 reported that the resting peak was at mid-day and on the mid-day to avoid hot weather especially during summer. On the other hand, minimum resting and reproduction activities were found in the early morning. This may be due to actively foraging in the early morning.

Throughout the study period, five behavioral activities observed for Common Moorhen were also varied. The evaluated dominant behavior was foraging and the contrary was reproduction. The next to foraging was locomotion because after the feeding peak in a place they usually change feeding place to search for more foods which increases their movement. Moving peak at next hour of foraging and feeding peak could be the reason for this. A similar result was found in the activity pattern of white-breasted waterhen reported by Akhtar *et al.*, 2013. The minimum activity throughout the study period was reproductive behavior. Although Common moorhen breed all year, it breeds three broods in one year during the study period. Thus reproductive behavior among the behavioral activities was minimized.

The present finding showed that Common Moorhen spent a different proportion of time in different activities and activity patterns significantly varied in different hours of the day as well as in different months which help them to avoid interspecific conflicts with other wetland birds in the same feeding and breeding habitats.

Conclusion

The behaviors of Common Moorhen were observed from a pond on Meiktila University Campus. Throughout the study period, 15 behavioral acts under five behavior categories were recorded. The time-activity patterns of birds vary greatly according to the type of habitats they inhabit and the food they eat. Time-budget studies quantify the time animals allocate to different activities, and the resulting information can increase our understanding of strategies in different activities and habitat needs of common moorhen. The present finding will play an important role for the management and conservation of this bird as well as other wetland birds.

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