

The Preliminary Study of Nanjing Xuanwu Lake Little Grebe (*Trachybaptus Ruficollis*) on the Distribution of the Spring Diurnal Time

Jie Wang¹, Lu Cao¹, Chenling Zhang*²

¹Jiangsu Animal Husbandry & Veterinary College, Animal Science and Technology, Taizhou, Jiangsu, 225300,

²Jiangsu Second Normal University College of life Sciences, Nanjing, Jiangsu, 210013

Abstract

*In order to find out the Nanjing Xuanwu Lake little grebe (*Trachybaptus ruficollis*) distribution on spring diurnal time, From February to April in 2016 year, the author used instantaneous scanning sampling methods, got data about the little grebe how to exercise in 30days at NanJing XuanWu lake, and had an analysis and research about time behavior assignment model. The result indicated: (1) in the day of small grebe breeding early to the breeding period, exercise behavior accounting for the vast majority of 63.5%, others following the rest of the 9.9%, and 12.3 % miscellaneous, feather 7.4%, 4.5% feeding, breeding 1.4%, alert 1%. (2) the breeding behavior of little grebe had 3 obvious peak time were 11:00-11:30, 14:00-14:30 and 15:30-16:00; vigilance behavior had 3 obvious peak time were 9:30-10:00, 14:00-14:30 and 15:00-15:30; there were 4 obvious feeding peak time, respectively in 8:30-9:30 and 12:00-13:00 two peak time. (3)The time distribution of little grebe affected by the seasonal and diurnal rhythm changes, other factors such as itself and environment and so on, had a certain impact on the allocation of time.*

Keywords— Xuanwu Lake; *Trachybaptus ruficollis*; behavior observation; time distribution;

I. INTRODUCTION

The little grebe (*Trachybaptus ruficollis*), belong to the little grebe genus of the grebe family of (Podicipedif-ormes), a small grebe of the genus [1]. The species has been enrolled in the IUCN red list of birds and The state forestry administration of the People's Republic of China has published on August 11, 2000 on {A list of terrestrial wildlife that is intentionally protected by the state or has important

economic and scientific research value}. And then, the related work on small grebe behavior how to exercise, in recent years, is also concerned and carried out. The domestic research on small grebe mostly concentrated in ecology, Sang (2008) observed the over wintering waterfowl at ChongMing Dongtan, the study found that the small grebe was significantly correlated with the temperature factor [2]. Zhao (2004) devoted to the study of Chongming Dongtan wetland ecological restoration and reconstruction, according to the observation of the survey area in winter, the grebe birds distributed in pond and reed zone [3]. Pavol Prokop (2011) study further proved that the little grebe covered nest habits, not only has the protection and preservation, and is more likely to harm a defense against natural enemies to [4].

This paper is to study the allocation of time on little grebe daytime behavior, which can provide valuable scientific data for the study of ecology waterfowl behavior, so as to improve and develop waterfowl behavior research mode.

II. DESCRIPTION OF STUDY AREA

The study area is located in Xuanwu Lake, Nanjing(118.79431E, 32.07479N). Xuanwu Lake is located at the core of Nanjing, with a total area of about 10 km², a length of 2.4 km from north to south, and a width of about 2 km at the widest point of things. The whole lake area is 4.73 km², of which the lake area is 3.68 km², and the land area is 1.05 km².

The research area is located in the Xuanwu Lake area, and the geographical coordinates of observation points are as follows: 32°03'51.9"-32°03'51.1"N, 118°47'40.9"-118°47'56.4"E.

III. EXPERIMENTAL METHOD.

A. Instrument

(1) GPS (Model GARMIN GPS 72), Details of the location of the study site.

(2) A single telescope with adjustable focal length for scanning and observing.

(3) Telephoto camera was recorded on the little grebe behavior.

(4) Stopwatch, time to record the little grebe diving behavior.

B. Behavior Record.

Select the small grebe activity is more frequent in Xuanwu Lake as the study, pre observation in the formal observation before 5 d of little grebe behavior in the field near the frequent activities of the corresponding observation points set up at open places. When the observation can distinguish little grebe behavior categories, try not to affect the observed behavior [5]. In the preliminary

observation stage, being familiar and mastered with the behavior and activities of the little grebe, classifies and studies the little grebe behavior, building action spectrum (ethogram). Finally, 7 kinds of behaviors, including feeding, regulating, breeding, resting, movement, vigilance and miscellaneous, were determined. The detailed description was shown in table 1. The individual behavior referred to in the table refers to the posture or movement of a single organism in order to maintain its normal life activity, [6].

Table 1, The Behavior spectrum of little grebe

Behavior	Description
Food	Including food and drinking water (swallow), before the head into the points below the surface of the water while swimming and looking for food, until all the heads were into the water, or dived to capture food (shrimp and fish and other small aquatic animals and plants) .
Preening	In the water or on the shore with the beak, foot grooming, or occipital friction and the nape of the neck and back, and shaking wings, wings or flush feathers in water. [6].
Breeding	Including , courtship, mating, oviposition, nesting, repairing the nest hatching, chicks shading behavior [7].
Resting	The body crouched down in the water, the bulging object or the shore, or the shore ,head and neck naturally shrunk into the feathers of not containing eggs or feeding and lying.
Exercise	Including diving, walking, running, swimming, low flying and other physical position of the mobile process [8].
Warning	The act of holding up the neck and looking around, (it could appear in feeding, movement, disposition, reproduction, ect.) mostly occurred in a new environment, after mating, and by expelling an invader.
Others	Other acts of activities more than the 6 typical behavior that have been mentioned above, or distinguishable or indistinguishable behavior.

The formal observation is by instantaneous and scans sample observation on diurnal activity rhythm, recording once every 5minutes on the little grebe behavior, scanning 12 times per hour. Since the end of February 2016, while working and observing activity status of little scanning telescope. Every day , observing from 8:00 am to 4:00pm, was total 8 hours (With the permission of the visibility, the observation time was appropriately extended as supplement data, observing 96 times in the whole day ,totally accumulating for more than 30 days) At the same time as the little grebe diving behavior was very common, using semi quantitative method that the 5 grade evaluation method, with 5 plus and 1 plus as many as few records. Records are evaluated based on the frequency of behavior occurring over a period of time, such as 5 minutes or 10 minutes.

C. Data Acquisition and Analysis

The data acquisition time is 8:00am to 16:00, with totally more than 30 days, using Excel statistical analysis software for little grebe time allocation and the behavior occurrence frequency, all the data were input into Excel software for data analysis and chart processing. At the same time the little grebe was recorded its diving frequency every time, contrasting master behavior rhythm and behavior characters of little grebe diving.

In the case of little grebe breeding period, in order to better study the breeding habits, we must be to find a nest for the premise of observation [9]. The activities in the near of the little grebe nest, set up some observation points, and through the telescope to record the target. While reorganizing the record, through photos reproducing the situation,

summarizing and analysing, and repeating verification in order to accurately correct.

IV. RESEARCH FINDINGS AND DATA ANALYSIS

A. The analysis of behavior

From February 20 to April 18 in 2016, the cumulative observation of 30 days, a total of 96 times a day observation, recording data 2880 (Table 1).

Table.1 The numbers of each behavior for 30 days

Date	Feeding	Preening	Breeding	Resting	Moving	Alerting	Others
2.20	5	17	0	16	52	2	4
2.21	6	13	0	11	63	1	2
2.23	4	8	0	11	67	1	5
3.3	6	7	0	11	66	0	6
3.4	5	7	0	12	64	2	6
3.5	4	11	0	12	57	4	8
3.6	3	11	0	21	51	3	7
3.7	4	8	0	16	59	0	9
3.10	4	9	1	10	62	1	9
3.13	5	7	0	10	62	1	11
3.16	6	5	1	7	68	1	8
3.17	5	5	2	6	62	1	15
3.18	5	6	2	7	61	1	14
3.20	5	12	0	10	56	0	13
3.21	6	14	1	10	52	1	12
3.26	3	4	2	9	66	0	12
3.27	3	6	2	5	67	1	12
3.31	4	5	3	8	64	0	12
4.3	4	6	1	7	61	0	17
4.4	3	3	1	8	65	1	14
4.7	3	3	2	8	62	1	17
4.8	4	3	2	11	60	2	14
4.9	3	4	2	8	61	1	17
4.10	4	5	3	7	62	0	15
4.11	4	7	3	7	60	0	15
4.14	3	5	2	9	60	1	16
4.15	5	3	3	8	61	2	14
4.16	4	7	3	8	58	0	16
4.17	4	7	3	7	61	1	13
4.18	4	6	2	6	59	0	19

B. The average daily behavior time allocation of the little grebe.

In the little grebe breeding prophase to the breeding season daytime activities, feeding 128 times, accounting for 4.5%, preening 214 times, accounting for 7.4%,breeding41times, accounted for 1.4%, the rest 286 times, accounting for 9.9%, exercise1829 times, accounting for 63.5%, warning 29 times, accounting for 1%, miscellaneous 353 times, accounting for 12.3% (Figure 1).

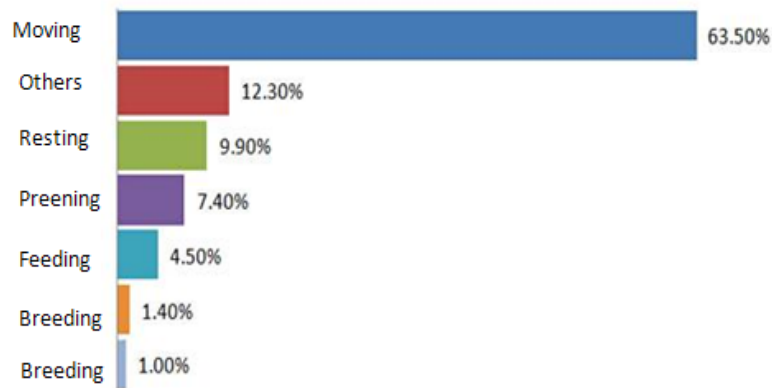


Figure.1 Average Time Budget of the Little Grebe

From the figure 1, the majority time budget of the little grebe was exercise (63.5%), following by miscellaneous (12.3%). Miscellaneous activities included clusters and tweets and other acts, with the arrival of breeding season, accounting for a larger proportion. Secondly, for rest (9.9%), preening (7.4%), feeding (4.5%), breeding (1.4%), vigilance (1%). Although some little grebe has entered the breeding period, but the observation of little grebe population, there are still some having not yet entered the breeding period, observing with instantaneous scan method was not easy to observe the reproductive behavior, reproductive behavior is the proportion of small.

C. Time Distribution in Different Time Groups of Little Grebe

The little grebe in the early breeding period to the time allocation activities time between the breeding period in the table 3-2. You can see from figure 3-7, little grebe in diurnal motion was more frequent, exercise more frequently in the morning than in the afternoon; preening, miscellaneous activities and exercise behavior was on the contrary, the afternoon more frequent than in the morning , and miscellaneous activities two trough time are respectively 11:30-12:00 and 12:00-12:30. Reproductive behavior had 3 obvious peak time were 11:00-11:30, 14:00-14:30 and 15:30-16:00; vigilance behavior had 3 obvious peak time were 9:30-10:00, 14:00-14:30 and 15:00-15:30; resting behavior distribution was more dispersed, there were 3 obvious troughs, respectively 8:00-8:30, 11:30-12:00 and 12:00-12:30; there were 4 peaks of feeding obviously, 8:30-9:00 and 9:00-9:30, respectively in 12:00-12:30 and 12:30-13:00. (Figure. 2)

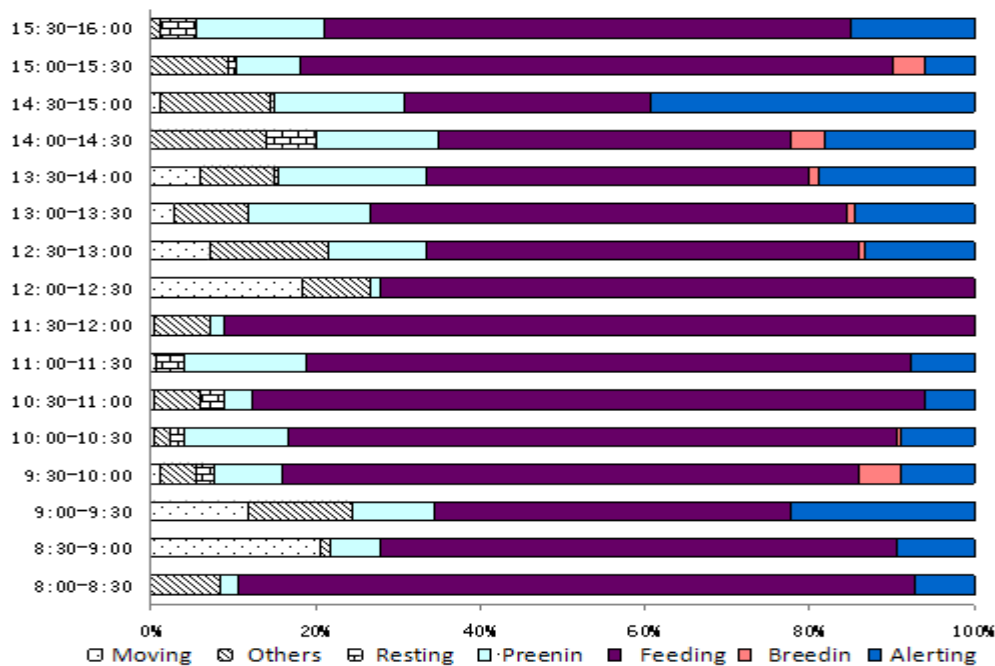


Figure. 2 Time Budget of the Little Grebe in Different Time

D. The Diurnal Rhythm of the Little Grebe

By the time recording time methods, would observe the grebe experiment period was divided into a number of equal intervals, only a fixed period of time to record whether a certain behavior occurs. Through the method of 0-1 sampling, observing and recording the little grebe resting behavior during the observation time in 8:00-16:00 every 5 minutes was whether to happen. Take April 8, 2016 for example, the little grebe resting behavior curve represented the periodic variation (Figure 3), the afternoon period was shorter in the morning than in the afternoon period, that morning activities more frequently.

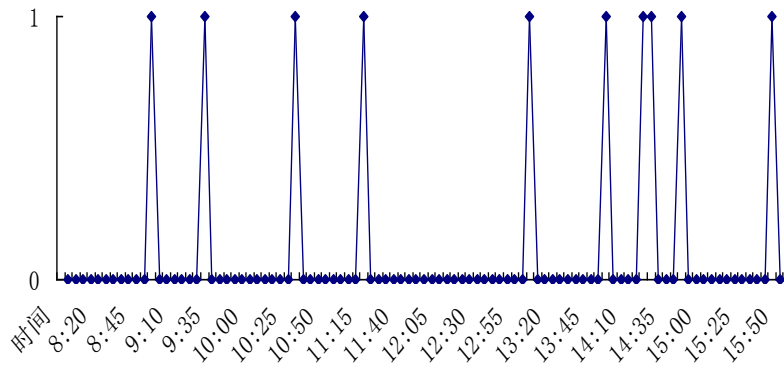


Figure. 3 One-Zero Sampling of Resting at 8th of April 2016

E. Semi Quantitative Analysis of Small Grebe Diving Behavior

At the same time as the little grebe diving behavior was very common, using semi quantitative method, namely the five grade evaluation method, with five plus stands for high frequency, one plus stands for low frequency. Records were recorded according to the frequency of behavior occurring over a period of time, such as 5 or 10 minutes (Table. 2).The little grebe diving behavior happened in the morning higher frequency than in the afternoon ,and high frequency period in diving behavior was precisely that predator. Predator behavior and diving behavior had certain correlation.

Table. 2 Semi-Quantitative Analysis of Diving Behavior

Time	Diving	Time	Diving	Time	Diving	Time	Diving
8:00	+++	10:00	+++++	12:00	+++++	14:00	+++++
8:05	+++	10:05	+++++	12:05	+++++	14:05	++
8:10	++	10:10	+++++	12:10	+++++	14:10	+
8:15	++	10:15	+++++	12:15	+++++	14:15	+
8:20	+++++	10:20	+++++	12:20	+++++	14:20	+
8:25	+++++	10:25	+++++	12:25	+++++	14:25	+
8:30	++	10:30	+++++	12:30	++	14:30	+
8:35	+++++	10:35	+++++	12:35	+	14:35	+++
8:40	+++++	10:40	+++++	12:40	++	14:40	++
8:45	+++++	10:45	+++++	12:45	++	14:45	+
8:50	+++++	10:50	+++++	12:50	++	14:50	+
8:55	+++++	10:55	+++++	12:55	++++	14:55	+++
9:00	++++	11:00	+++++	13:00	+++	15:00	++
9:05	++	11:05	+++++	13:05	+++	15:05	+++++
9:10	+	11:10	+++++	13:10	+++	15:10	+++++
9:15	++	11:15	+++++	13:15	+++++	15:15	+++++
9:20	++	11:20	+++++	13:20	+++++	15:20	+++++
9:25	++	11:25	+++++	13:25	+++++	15:25	+++++
9:30	++	11:30	+++++	13:30	+++	15:30	+++++

9:35	++	11:35	+++++	13:35	++	15:35	+++
9:40	+	11:40	+++++	13:40	++++	15:40	++
9:45	++++	11:45	+++++	13:45	+++	15:45	++
9:50	+++++	11:50	+++++	13:50	+++	15:50	++
9:55	+++++	11:55	+++++	13:55	+++	15:55	++

V. DISCUSSION

The distribution behavior of birds is a time to adapt to the environment, but also affect the overall performance of animal behavior activities of all the factors [8], and its food richness [9], temperature [10], are related to climate change and other factors. Especially, in the breeding season, in order to achieve the maximum reproductive success rate, the behavior time allocation strategy is often adjusted. Xuanwu Lake little grebe has gradually entered the breeding period in March, little grebe in the early breeding period and reproductive period, foraging time extend from the original 1:00 PM end to the 2:00 or later. Foraging time is also increasing; especially the little grebe has entered into breeding period. In order to accumulate more energy during the breeding period, and use more time for exercise, mainly to expand the area of feeding to obtain more food.

The little grebe effect of biological factors including small interaction within populations and influence the niche of other species with the same or similar. In the little grebe movement process, appeared the phenomenon of cluster. At the same time, when a little grebe made an action in the first action, the other little grebe would choose to make the same action. In the little grebe niche, moorhen appeared more frequently. When the black moorhen swam by the little grebe, the little grebe would choose to avoid swimming or diving, and sometimes choose to rest motionlessly. Human disturbance had a great impact on little grebe time allocation, the warning behavior frequency of little grebe is higher due to human behavior is always intentionally or unintentionally caused. At the end of week, a sharp rise in the number of visitors to XuanWu Lake, increasing the number of cruise, little grebe visible on the lake fell sharply. Human disturbance on small grebe was extremely unfavourable, not only disturb normal activities of little grebe, but also is not conducive to the accumulation of energy. There is also a bias in the scanning sampling method, which is prone to more obvious and easily observable multiple behaviours. In order to reduce errors, when doing preliminary observation, make sure whether the behaviors are frequent or rare.

There has occasional warning behavior of little grebe before diving. Diving process was usually accompanied with swimming, water, such as preening behavior, diving after a period of time, little grebe would rest and relax exhaustion. During the

peak of predation, more of the purpose of diving was to catch prey. Predation was also accompanied with water, fruit and preening. General little grebe would tweet at resting or swimming, which was associated with the visible behavior.

The grebe lives mostly in the water, there was almost no little grebe walking on land. In winter, with the sewage discharging into water, especially around of the University of Forestry surrounding, ammonia nitrogen total phosphorous concentration accumulated up until late March, with the arrival of spring, the sharp rise in temperature, light intensity, water, the bacteria multiply continued soaring. Bacteria decompose organic compounds in water, while multiplying, part of the bacteria aging, death become silt deposition, so that the river bed was higher and higher, reeds and other plants landing. Habitat changes resulted in little grebe activities have changed, had to choose the center of the lake area was far from the river bank activities.

REFERENCES

- [1]. Zhang, J., J.C.,Jin. Research and development of behavioral ecology in China [J]. Journal of china west normal university (Natural Sciences) .2003,(03). 325-329.
- [2]. SANG, L.L., Zhen-ming, GE En-le, PEI. Behavior observation of wintering waterfowl in Constructed Wetlands at Chongming Dongtan. Chinese Journal of Ecology, 2008(06). : 940-945 .
- [3]. Zhao, Ping. The Ecological Research in the Wetland Restoration Projectin the Eastern Tidelands of Chongming Island, Shanghai — — A Case of Waterbirds ,Plant ,Ecological Benefits. East China Normal University. 2004
- [4]. Pavol Prokop, Alfre'd Trnka. Why do grebes cover their nests? Laboratory and field tests of two alternative hypotheses[M]. J Ethol, 2011. 29:17-22.
- [5]. Cheng Tso-hsin. A complete checklist of species and subspecies of the Chinese birds, Beijing Science Press, 1994.
- [6]. Zhang, C.Z., B.Z. Pang. Chinese birds, [M]., China Forestry Press, 1997.5
- [7]. SANG, L.L., Zhen-ming, GE En-le, PEI. Behavior observation of wintering waterfowl in Constructed

- Wetlands at Chongming Dongtan. Chinese Journal of Ecology, 2008(06). : 940-945 .
- [8]. Yang, X.J., Lan. Yang., The preliminary observation of captive green peafowl activity time distribution [J]. Journal of animal (Current Zoology), 1996, 42: 106-111.
- [9]. Enoksson B. Time budgets of Nuthatches *Sitta europaea* with supplementary food[J]. Ibis, 2010, 132(4):575-583.
- [10]. Verbeek N A M. Daily and Annual Time Budget of the Yellow-Billed Magpie[J]. Auk, 1972, 89(3):567-582.
- [11]. Turner A K. Timing of Laying by Swallows (*Hirundo rustica*) and Sand Martins (*Riparia riparia*)[J]. Journal of Animal Ecology, 1982, 51(1):29-46.