Some Ecological Aspects of the Red-neck ostrich (*Struthio camelus*) during the dry season in Dinder National park – Sudan

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Abstract

The Present study was conducted in the Dinder National Park (D.N.P), during early and late dry seasons (2018-2019). Three meadows of the Park (RasAmir, Abdelgani and Einalshams) were chosen to conduct the study. The mean flock size, numbers of male, female, adult and young ostriches, as well as time consumed in grazing, drinking and rest were determined. The research methods included an informal questionnaire and direct observation of the bird at the meadows / mayas twice daily (morning and evening) at each meadow, for 10-15 days in early and late dry season. Data collected form observation was subjected to tabular statistical procedure (mean, min-max).The highest grazing time (hr) in the morning rearing period (early dry season) was registered for Maya 'Abdelgani (3.90 hr), followed by RasAmir and Einalshams (3.10) and (2.71 hr) respectively. Mean of the total for grazing was (3.30 hr). The highest mean drinking time was at Abdelgani (49.00 min), which was higher than mean of the total, where as the largest flock size for morning rearing period in the early dry season was recorded for RasAmir (30.50 min), as well as the highest male: female ratio.In the evening rearing period of the early dry season, the mean grazing time was, more or less, similar as1, 86, 1, 87, 1.50 (hr) for RasAmir, Abdelgani and Einalshams, respectively. The drinking time (min) in the evening period of early dry season was the highest at Einalshams (29.30 min). Rest time (min) recorded the highest value at Abdelgani (13, 00) min. In the evening period of early dry season, the highest flock size was at RasAmir with a mean of (23, 40) which is higher than flock size (18.87). In this part of the dry season, the lowest mean flock size was registered for Einalshams for (13, 50). Mean number of young was not detected for maya Ras Amir in the evening rearing period but it was higher for Einalshams compared with Abdelgani. Males: Female's ratio was about 2: 1 for three Mayas. In the morning rearing period of late dry season, the grazing time was 3.47 and 1.73min for RasAmir and Abdelgani respectively, while mean value of the total was (2.31). In this part of the study, mean flock size was not detected for Einalshams. The drinking time (min) was 112.00 in RasAmir compared to (65.17) for Abdelgani, while it is no detected for Einalshams. Rest time (min) was not detected for Einalshams and registered values for RasAmir and Abdelgani were 53, 40 and 24.88, respectively. Number of different sexes, in the morning of total dry seasongave valuesof flock size, young, male and female (28.07, 9.00, 9.67 and 18.40) Vs.11.43, 5.25, 4.72 and7.20 for RasAmir and Abdelgani, respectively. Values for these parameters were not detected for Einalshams. Grazing time (hr), drinking time (min), and rest time (min) were not detected for maya Abdelgani and Einalshamsin evening rearing period of late dry season. The mean values were 1.27(hr), 108 (min) and 10.50 (min) in RasAmir for grazing time, drinking time and rest time, respectively. The numbers of different sexes were not detected for Abdelgani and Einalshams in the evening rearing period in late dry season. The registered mean values at Ras Amir were (27.70, 8.60, 9.80 and 17.27) for flock size, young, males, and females respectively. From the present study it was concluded that the Mayas constitute the major source of water and forage for ostrich is DNP in the dry season. It is clear that the ostrich is territorial in habits. Some of the Mayas con not provides rearing conditions for the ostrich in the whole dry season, especially in late dry season. Human disturbance and fish anglers form in convenience of ostrich flocks.

Keywords: Dinder National Park; Red-neck Ostrich

Introduction

Dinder National Park (**DNP**) was established in 1935following the London Convention of 1933. In 1979 it was claimed as Biosphere Reserve. At that time the global significance of DNP is that it lies between two important ecological zones; the Sudano-Sahelian and the Ethiopian. The DNP

was designated as a Ramsar site in 2001. The Mayas are oxbow lakes along the meandering rivers; they are subject to floods and contain green fodder and water up to the end of the dry season.

The National Park supports 27 species of mammals, more than 160 species of birds and 32species of fishes, reptiles and amphibians. There are about 58 species of shrubs and trees (**HCENR, 2001**) (kenyi 2002, Fernandez 2003,) observed that there had been fluctuations in the structure and densities of animals in DNP in the previous years; these fluctuations were attributed to habitat deterioration, poaching and anthropogenic activities. As human population has increased, demand for food also has increased,

That has exerted pressure on the land and its resources. The dry season in DNP extends (November - April) and the wet season (May - October) with an average rainfall of 800mm/ annum.

Ostriches are large, flightless birds with Long legs and a long neck. Wild ostriches live in the dry, hot savannas and woodlands of Africa.

The Ostrich which has been distributed throughout northern Africa was severely persecuted during the twentieth century and population are believed to be in rapid decline. Causes of decline include intensive hunting, and habitat destruction in the form of overgrazing by domestic and feral livestock (Dasmann, 1972)

Studies on behavior are important for evaluation of the welfare of animals such as ostriches.

The African ostrich is a social species; therefore, it thrives better in groups (kenyi 2002). Bertram,(1980) reported that ostriches spend long times in grazing in the wild, when they feed in groups.

The present studyis intended to determine the ostrich numbers, grazing, drinking and resting times, in DNP in early and late dry season (2018-2019).

Material and Methods

Study area:

Dinder National Park (DNP) lies at a distance of 500 km; In the south east of Khartoum,(Capital of Sudan).It is situated on the border line between Sudan and Ethiopia and located between lat.12º N and 13º N and long. 34º and 35ºE approximately (Appendix 1). The Area of the park is 10,291 Km2.It is generally a flat plain with occasional hills in the south eastern direction. DNP is traversed by two seasonal rivers (Dinder and Rahad) descending from the Ethiopian plateau during the wet season (May-Nov). The meadows Mayas are oxbow lakes along the meandering rivers. They are subject to floods and maintain forage and water throughout the dry season, butmay runshort of water in drought years.There are about 40 mayas in DNP, but some of them (old meadows) get flat bed without water. Three of the mayas were chosen for conduct of the study. They are Ras Amir,Abdelgani and Einalshams. Transect lines, starting from the park center (Galego) were made to each of the three mayas for observation of Ostrich numbers and rearing behaviors.

The climate conditions of DNP are characterized by being cool and dry in winter and wet and warm in autumn. The wet season (May-Nov) has an annual range of rainfall (600 -800 mm) (Dai, 1982).

Tools:

A pen and a data sheet were used to record numbers and behaviors of Ostrich as requested. A

pair of binoculars used of observing Ostriches at distances.

Data collection.

Direct observation

Road–side counts as reported by Hashm and Nimir (1979), were executed on the road , and at mayas; Ras Amir, Abdelgani and Einalshams to detect numbers of ostriches (Flock size, young, male and female) and some behavioral activities (grazingtime, drinking time, resttime). Counts were made in early and late dry season and in the morning andevening respectively. The periods (Nov 2018 –Feb 2019) and (March 2019 – May 2019) represent early and late dry seasons respectively.

Data Analysis:

Tabular statistic procedure was used to analyze the data collected, by recording the minimum – maximum and mean values.

Results

Table 1 shows the mean grazing time (hr) for Maya Ras Amir was 3.10 with 2-5 min-max, being second in descending order to Abdelgani with the highest value 3.90 hr. The least value of grazing was registered for Einalshams 2.71 (hr) the 3-5 (hr) as min-max.On the other hand, maya Ras Amir has 39.60 min as mean drinking time while the least and highest drinking were shown by Einalshams and Abdelgani(49.00) ad (38.50) min, respectively, as for rest time (min), values for the three meadows there were no significant differences.Table 2 shows the observation in the three mayas in early dry season at morning periods, with the highest mean flock size in Ras Amir (30.50) individuals. While the lowest flock size was observed in Abdelgani (17.00) individuals. The highest mean of Young was registered for Ras Amir (7.67) individuals. While Abdelgani and Einalshams have equal mean of young number (5.33) for each. RasAmir got the highest number of males and females 10.40 and 20.10 for both sexes respectively, while Abdelgani and Einalshams have (5.56 and 12.78),(8.90), and (13.50) numbers for each of the two Mayas respectively.

Table 1. Statistics ofstudied ostrich behavior in different mayas at morning in early dry season

	Studied mayas						Total		
	Ras Amir		Abdelgani		Einalshams				
Studied behavior	Mean	Min.-Max.	Mean	Min.-Max.	Mean	Min.-Max.	N	Mean	Min.-Max.
Grazing time (hour)	3.10	2-5	3.90	3-5	2.71	1-4	27	3.30	1-5
Drinking time (min.)	39.60	17-60	38.50	22-70	49.00	30-60	30	42.37	17-70
Rest time (min.)	96.30	3-180	90.00	60-120	31.60	20-60	30	72.63	3-180

Table 2. Numbers of different sexes of ostrich in different mayas at morning in early dry season

Sex group	Studied mayas						Total		
	Ras Amir		Abdelgani		Einalshams				
	Mean	Min.-Max.	Mean	Min.-Max.	Mean	Min.-Max.	N	Mean	Min.-Max
Flock size	30.50	12-60	17.00	5-40	22.40	11-40	30	23.30	5-60
Young	7.67	5-10	5.33	2-8	5.33	4-8	9	6.11	2-10
Males	10.40	5-20	5.56	2-13	8.90	2-16	29	8.38	2-20
Females	20.10	6-40	12.78	5-27	13.50	7-24	29	15.55	5-40

Table3 shows the statistic of different Mayas at the evening in early dry season mean grazing time (hr) was similar for RasAmir and Abdelgani(1.86) and (1.8)hr respectively, drinking time (min)was highest at Einalshams (29.30) min and the lowest was recorded for RasAmir (21.40) min. While RasAmir showed the lowest value for rest time (7.50) min. However, the rest time is almost the same for Abdelgani and Einalshams (13.00) min respectively.

Table 3 Statistics of studied ostrich behavior in different mayas at evening in early dry season

Studied behavior	Studied mayas						Total		
	Ras Amir		Abdelgani		Einalshams				
	Mean	Min.-Max.	Mean	Min.-Max.	Mean	Min.-Max.	N	Mean	Min.-Max.
Grazing time (hour)	1.86	1-3	1.87	1-2.33	1.50	1-2	27	1.73	1-3
Drinking time (min.)	21.40	2-40	27.00	10-60	29.30	10-60	29	25.86	2-60
Rest time (min.)	7.50	5-13	13.00	12-14	12.20	8-17	11	10.64	5-17

Table 4; shows the number of flock size male: female in different mayas at evening in early dry season. The highest flock size was recorded for Ras Amir (23.24) individuals, with the least number at Abdelgani (13.50). The young Ostriches were not detected at Ras Amir with mean values of (3.00 and 6.00) at Abdelganiand Einalshams respectively. Male: female ratio was approximately 1.00:2.00 at RasAmir as well as it was for Abdelgani and Einalshams.

Table 4. Numbers of different sexes of ostrich in different mayas at evening in early dry season

Sex group	Studied mayas						Total		
	Ras Amir		Abdelgani		Einalshams				
	Mean	Min.-Max.	Mean	Min.-Max.	Mean	Min.-Max.	N	Mean	Min.-Max.
Flock size	23.40	10-46	13.50	3-22	19.70	6-40	30	18.87	3-46
Young	ND	ND	3.00	2-4	6.00	4-8	6	4.00	2-8
Males	7.70	3-15	4.50	2-11	6.80	2-15	28	6.46	2-15
Females	15.70	7-34	9.63	4-13	12.90	4-27	28	12.96	4-34

ND=Not detected

Table (5) the mean grazing time (hr) was (3.47) and (1.73) for RasAmir and Abdelgani respectively. This behavior was not detected for Einalshams. Mean drinking time (min) was (112.00 and 65.17) for Ras Amir and Abdelgani respectively, but it was not detected for Maya Einalshams. Mean rest time, (min) was higher at Ras Amir (53) as compared with Abdelghani (24.88) min.

Table 5. Statistics of studied ostrich behavior in different mayas at morning in late dry season

Studied behavior	Studied mayas						Total		
	Ras Amir		Abdelgani		Einalshams				
	Mean	Min.-Max.	Mean	Min.-Max.	Mean	Min.-Max.	N	Mean	Min.-Max.
Grazing time (hour)	3.47	1-5	1.73	1-3	ND	ND	45	2.31	1-5
Drinking time (min.)	112.00	60-180	65.17	1-180	ND	ND	45	80.78	1-180
Rest time (min.)	53.40	30-90	24.88	10-66	ND	ND	32	38.25	10-90

ND=Not detected

Table (6) shows that the mean flock size at RasAmir was (28.07) while it was (11.43) individuals for Abdelghani. The number of young was (9.00) as RasAmir and (5.25) at Abdelghani. Male: female ratio was 1:2 at Ras Amir while it was less than that for Abdelghani with values of

(4.72) and(7.20) for males and females respectively. All the fore mentioned traits were not detected for Einalshams all the above mentioned values were at the morning in late dry season.

Table 6. Numbers of different sexes of ostrich in different mayas at morning in late dry season

	Studied mayas						Total		
	Ras Amir		Abdelgani		Einalshams				
Sex group	Mean	Min.-Max.	Mean	Min.-Max.	Mean	Min.-Max.	N	Mean	Min.-Max.
Flock size	28.07	3-60	11.43	3-30	ND	ND	45	16.98	3-60
Young	9.00	3-13	5.25	3-8	ND	ND	12	6.50	3-13
Males	9.67	1-20	4.72	3-15	ND	ND	44	6.41	1-20
Females	18.40	2-40	7.20	3-16	ND	ND	30	12.80	2-40

ND=Not detected

Table 7; shows the statistic of studied Ostrich behaviors in different mayas at evening in late dry season. The mean grazing time (hr) in Ras Amir was (1.5), and mean drinking time (min) was 15 while rest time (min) was 600.No values were detectedfor these behaviors in either Abdelganior Einalshams.

Table 7. Statistics ofstudied ostrich behavior in different mayas at evening in late dry season

	Studied mayas						Total		
	Ras Amir		Abdelgani		Einalshams				
Studied behavior	Mean	Min.-Max.	Mean	Min.-Max.	Mean	Min.-Max.	N	Mean	Min.-Max.
Grazing time (hour)		1.27	ND	ND	ND	ND	15	1.27	1-2
Drinking time (min.)		108.00	ND	ND	ND	ND	15	108.00	60-180
Rest time (min.)		10.50	ND	ND	ND	ND	6	10.50	7-17

ND=Not detected

Table (8) which shows the different ostrich in different sexes of the ostrich in the three mayas at evening in late dry season, the mean values 07 of flock size, young, males and females in Ras Amir were 15.5 and15 and individuals respectively. No values were detected for Abdelgani and Ein alshamsmayas.

Table 8. Numbers of different sexes of ostrich in different mayas at evening in late dry season

Sex group	Studied mayas						Total		
	Ras Amir		Abdelgani		Einalshams				
	Mean	Min.-Max.	Mean	Min.-Max.	Mean	Min.-Max.	N	Mean	Min.-Max.
Flock size	15	27.07	ND	ND	ND	ND	15	27.07	7-60
Young	5	8.60	ND	ND	ND	ND	5	8.60	2-19
Males	15	9.80	ND	ND	ND	ND	15	9.80	2-25
Females	15	17.27	ND	ND	ND	ND	15	17.27	5-35

ND=Not detected

Discussion:

The mean grazing time (hr) in early dry season in the morning rearing period at Maya Ras Amir was 3.10, whereas it was 3.90 and 2.71 at Mayas Abdelgani and Einalshams respectively. So Abdelgani got the highest time (min) which might be attributed to rich pasture conditions and the Same interpretation can be applied to Ras Amir. The longest drinking time in early dry season in the morning was at Einalshams (49.00) min, followed by Ras Amir (39.60) min, although Ras Amir maya has higher quantity of water as compared to Einalshams. The only convincing reason for that was the increasing of human disturbance at Ras Amir which stimulates ostrich flock to leave it after a short time. It was reported by kenyi (2002) who lamid that exposure of ostrich flocks to human disturbance increase their vulnerability to extinction risk.

Fernandez –Juricic et al .2002; reported that larger bodied species are more wary and initiate flight at greater distances, than smaller species.

Rest time in the morning rearing period during early dry season (min) was 96.30, 90.00 and 31.60 at RasAmir, Abdelgani and Einalsahms respectively. Rest time at Einalshams being the least which may be attributed to decrease in number of tree cover availing shade.

The variation in numbers of different sexes of the ostrich is depending on the range of observed ostriches in different Mayas for different observation e.g(12-60) at RasAmir., (5-40) at Abdelgani, and (11-40) at Einalshams. Therefore arbitrarily, the largest flocks size is registered in Ras Amir (30.50) followed by Einalshams (22.40) and the smallest flock size observed at Abdelgani (17.00). This result may be affected by other factors as distance and direction of roosting places from the Maya. Number of young in the three mayas was numerically greater in Ras Amir (7) and (5.33) in each of Abdelgani and Einalshams which confirms the reasons for the variation. Male; female ratio for ostrich in the Mayas in early dry season and morning rearing period is ―1:2 in Ras Amir and Abdelgani (10.40:20.10) and (5.56:12.78) respectively. Here the variation is clear Einalshams (8.90-13.50).

No clear-cut interpretation is available for the variation in male: female ratio.

The statistic of the studied ostrich behavior in different Mayas at evening in early dryseason, clearly, showed the link between the range and mean of observations.So the result will be more or lessnumerical, but of course it reflects that some degree of variation is always there.The mean of grazing time (hr) was1.86, 1.87 and 1.50 for mayas: Ras Amir, Abdelgani and Einalshams respectively. Other factors also work, for these

results, including environmental conditions at Mayas, presence of predators, human disturbance etc. Drinking time (min) registered 21.40, 27.00 and 29.30 for RasAmir, Abdelgani and EinAlshams respectively. These results are quite different from those recorded for the same behavior, same rearing period in early dry season.

The variation could be attributed to: the fact that the amount of water, needed for ostrich flock to drink, became lesser because they satisfied part of their thirst for water from succulent plants in the range.

The rest time at the mayas in the same season and rearing period (min) was 7.50, 13.00 and 12.20 for Ras Amir,Abdelgani and Einalshams, which could be used to reflect the prevailing security conditions. It is known that Maya Ras Amir is characterized by being, the least secure Maya due to the increasing human disturbance of the visitors.

The flock size in Maya Ras Amir at the evening rearing period in early dry season has a mean (23.40), and the means for Abdelgani and Einalshams were 13.50and 19.70 respectively it was noticed that the flock size mean value is directly proportional to the extent of the range. Number of young was not detected for Ras Amir, and it was 3-00 and 6-00 for Abdelgani and Einalshams respectively. The ratio male: females was approximately 1:2 for Ras Amir and Abdelgani but it was lesser for Einalshams.

The ostriches live in groups, not only in breeding, but also for water and food (Burger and Goshfold, 1988., Bertram, 1992). It was reported by Sauer and Sauer, 1966a. Musi et al 2008 that the adult male has no any specialized pattern for social behavior and seen to be in herd of 10-20 ostriches. Gender pairing was observed in1:1 to 1:4 ratios.

In the statistics for ostrich behavior, no data is available for Einalshams. The mean grazing (hr) was 3.47 for Ras Amir and 1.73 for Abdelgani, due to wider range for Ras Amir (1-5) as compared to Abdelgani (1-3). Drinking time (min) was (112.00) for Ras Amir and (65.17) for Abdelgani.Rest time (min) was (53.40) for Ras Amir and(24.88) for Abdelghani. Both behavioral activities are higher for larger flock size. Brown (1973) stated that the African ostrich is a social species, therefore it thrives better in groups it was reported by Bertram,(1980) that ostrich spend long periods of time foraging in the wild. This time increase in direct proportion to flocksize. The possible reason for the increase in foraging time is the reduction in the individual ostrich vigilance when with companions.

The rest time, in this part of the present study, was 53.40 and 24.88(min) for Ras Amir and Abdelgani respectively. This variation must be due to the difference in flock size. In late dry season in the evening session, there was no detection for the different sexes of the ostrich in Einalshams Maya and there is data only for Ras Amir and Abdelgani. The mean flock size in RasAmir was 28.07 with a rangeof 3-60 while the mean for Aabdelgani was 11.43 with a range of 3-30. The mean for young was 9.00 and 5.25 for the two mayas respectively. Male: female ratio is approximately 1:2 for Ras Amir and closer to that ratio at Abdelgani. The studied ostrich behavior and numbers of different sexes presented data, only,at RasAmir while no data were detected in Abdelgani and Einalshams with mean grazing (hr) for RasAmir 1.27 and mean drinking time (min) 108.00 and mean rest time (min) 10.50.Whereas numbers of different sex also not detected for Abdelgani and Einalshams with menas (27.07) ,(8.60) , (9.80) and(17.27) flock size young , males and female considerable numbers of ostriches throughout early dry and late dry season for both rearing periods .On the other side there was fluctuations of ostrich numbers at mayasAbdelgani and Einalshams, sometimes ostrich flocks were altogether absent

at these two meadows.In the opinions of the authors that the variation between Ras Amir and the latters was due to the early dryness of Abdelgani and Einalshams, being old mayas, and their beds were covered with silt for decades. So, they keep lesser amounts of water. At sometime the increase in Ostrich numbers at Ras Amir in the late dry season may indicate that ostrich flocks of Abdelgani andEinalshams join Ostrich groups of Ras Amir in search of water and forage.

Conclusion

1- The mayas constitute the major source of water and forage for Ostriches in the dry season.
2- The Ostrich are territorial in their habits.
3- Some of mayas cannot provide rearing conditions for Ostrich for the whole dry seasons especially in late dry season.
4- Human disturbance and fish anglers form serious threat for convenience of the Ostrich flocks.

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