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Feeding ecology and activity patterns of African Spoonbill (*Platalea alba*) in and around Lake Ziway, Ethiopia

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Abstract:
Feeding ecology, activity patterns and habitat association of the African spoonbill (*Platalea alba*) in Lake Ziway were studied during March-September, 2011. A total of 28 individuals of African Spoonbills were recorded in both wet and dry seasons. They spent more time for stirring and feeding than other diurnal activities. The durations spent on stirring, feeding, movement and resting were statistically significant between seasons (χ^2 =29.9, p<0.001, χ^2 = 38.1, p<0.001, χ^2 =11.1, p<0.001, χ^2 = 57.3, p<0.001, respectively). However, the time engaged in preening, wing display and defecation did not show significant difference between seasons. Additional studies were made in four different study sites, where the species was frequently observed. The time devoted for different activity patterns in wet and dry seasons in the study sites was statistically significant (χ^2 = 639.31, $P < 0.0001$). The activity patterns of African Spoonbill could influence substantially by tidal stage, rise and fall of water level in foraging sites, and other related environmental factors.

Keywords: African Spoonbill, activity patterns, diet.

1. Introduction

Among the birds in Ethiopia, the African spoonbill (*Platalea alba*) is the most commonly adapted species in most wetland areas, including Lake Ziway. According to Syvertsen (1995), there are various species of waterfowls in and around Lake Ziway. The marshy ground around the lake supports several Palaearctic wader species and Afro-tropical water bird species. Most recent waterfowl survey showed the presence of around 5 5 wetland bird species in and around Lake Ziway (EWNHS, 1996). Of the birds identified around the lake, 16 are Palaearctic migrants, 17 residents with breeding proof and 11 residents with no breeding proof. These facts make Lake Ziway one of the most important avian habitats in Ethiopia. It comprises of several foraging and roosting sites. African spoonbills feed in shallow waters. Their diet consists of insects, insect larvae, crustaceans, mollusks, small fish and amphibians (Elliot *et al*., 1992). Investigation on majority of aves in Ethiopia are yet to be under data (EWNHS, 1996). Only few researchers have conducted studies on the diversity and ecology of avian species in Ethiopia (Mengistu Wondafrash, 2003). Hence, the present investigation was aimed to study the ecology and activity patterns of the African spoonbill in and around Lake Ziway.

2. The Study area and Methods

2.1 The study area

The present investigation was carried in and around Lake Ziway, Ethiopia. This area is within the Central Ethiopian Rift Valley, located at 160 km south of Addis Ababa, the capital of Ethiopia.. The study area lies at an altitude range of 1,650- 1, 850 m asl., at 7° 56' 0" N latitude 38° 43' 0" E longitude, in the sub-tropical agro-climatic zone. Lake Ziway is a shallow freshwater lake, which covers an area of around 442 km^2 (Fig. 1).

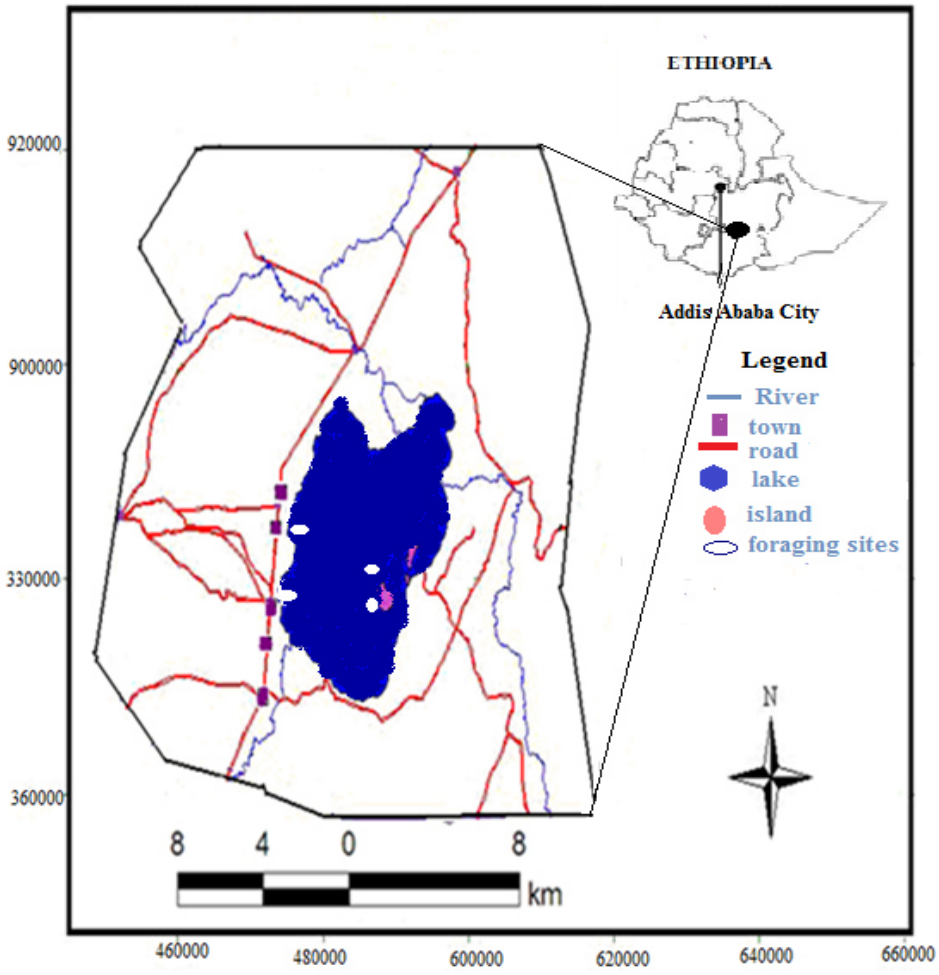


Figure 1. Map of the study area

The monthly maximum temperature ranges from 25 to 30°C and the minimum temperature between 10 and 20°C. The rainfall pattern is largely influenced by the annual oscillation of the inter-tropical convergence zone, which results in warm and wet summers (with most of the rainfall occurring from June to September) and dry, cold and windy winters. A short rainy season occurs during March- May. The mean annual precipitation is 650 mm. The area around the Lake Ziway is now left with only patches of remnant wood and bush lands. The dominant tree species seen around are *Acacia tortilis, A. seyal, A. snegal, A. etbaica, A. albida* and *Dichrostachy cinerea.* The area is also known for its swamp vegetation. The lake is highly dominated by phytoplankton and zooplankton that make the bulk of its aquatic life (Figure 1).

2.2. Methods

Based on the habitat types around the lake, point count method was used to collect data on activity patterns of African spoonbill (Bibby *et al.,* 1992; Pomeroy, 1992). Observations were made using binoculars and naked eyes by walking along all the study sites. Photographs were taken for further confirmation during the study period. Data were collected twice a day, morning (06:30 - 10:00 h) and late in the afternoon (16:00- 18:00 h), when most of the avian species were active.

Various activity patterns of the African spoonbill were recorded during both dry and wet seasons. The distance of observation varies from 10 to 30 m depending on the topography of habitat and individual behaviour of the species. Activity patterns were recorded and a behaviour category of each observation was assigned as agonistic (threat and appeasement displays), foraging (collecting food), body-care (preening and bathing), roosting (basking, sleeping and watching), perching and flying (Hertel, 1994). Time spent on each activity was recorded on the data sheet separately. For each activity, three minutes scan samples were taken at intervals of 15 minutes

(Hertel, 1994; Pomeroy, 1992).

In the case of feeding ecology, repeated observations were made to collect data on foraging. Time spent on foraging was recorded using focal sampling, following Pomeroy (1992), Hertel (1994) and Bhatt and Kumar (2001) for different individuals. Focal sampling consists of watching an individual for 10 minutes. Data on the type of food items consumed, time spent for foraging, wing display, perch (looking), stirring, resting and preening (scratching) were recorded. Individual bird was followed at a distance of 10 - 30 m, based on the habitat variability and accessibility of the study sites.

Chi-square test was used to assess differences in activity patterns of African spoonbill between wet and dry seasons. The time spent in each study sites for their major activities (stirring, feeding, resting, moving, perching and wing display) was sorted out based on its categories, and the percentage of time spent on each activity patterns was analysed using Wilcoxon's matched pair test.

3. Results

3.1. Habitat association

A total of 28 individuals were detected within 2,395 minutes of monitoring in the study sites. Of which, 39.29% the African spoonbill was recorded study site 1, followed by the second and third study sites 9 (32.14%), and 5 (17.86), respectively. While a small percentage African spoonbill was recorded at study site 4 (10.71%). Across all sites, there were no significant differences in the numerical abundance of the species (P>0.05) (Fig. 2).

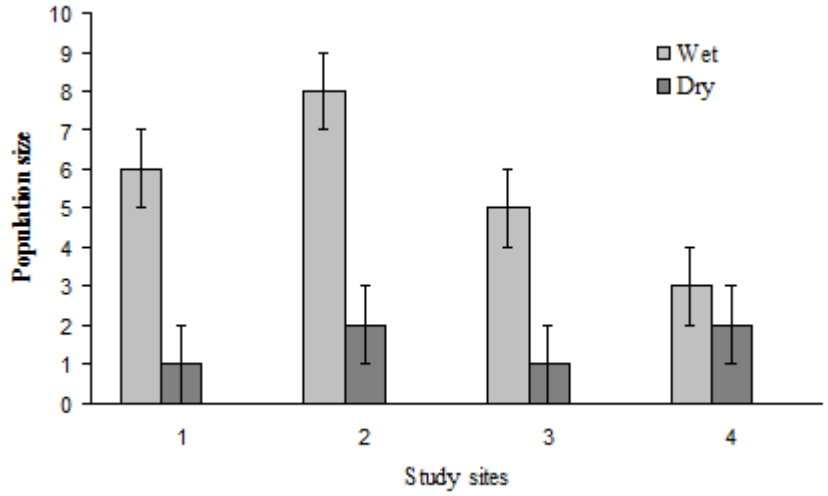


Figure 2. Habitat association of African spoonbill

3.2. Feeding

The overall food scrapers identified between sites were significant differences (χ^2 = 12.0, p<0.05). From the identified food scrapers, fish scrapers were significantly higher than other food items (χ^2 =2.0, p<0.05), where as frogs (χ^2 =4.5, p<0.05), and insect percentage (χ^2 = 5.3, p<0.05), however, the unidentified food items did not show differences across the sites (χ^2= 4.5, p<0.05). The numerical percentage of each prey types during the study period showed significant pair-wise differences with correlation (r), 0.43 and-0.23 at significant level 0.09 and 0.38, respectively (Fig. 3).

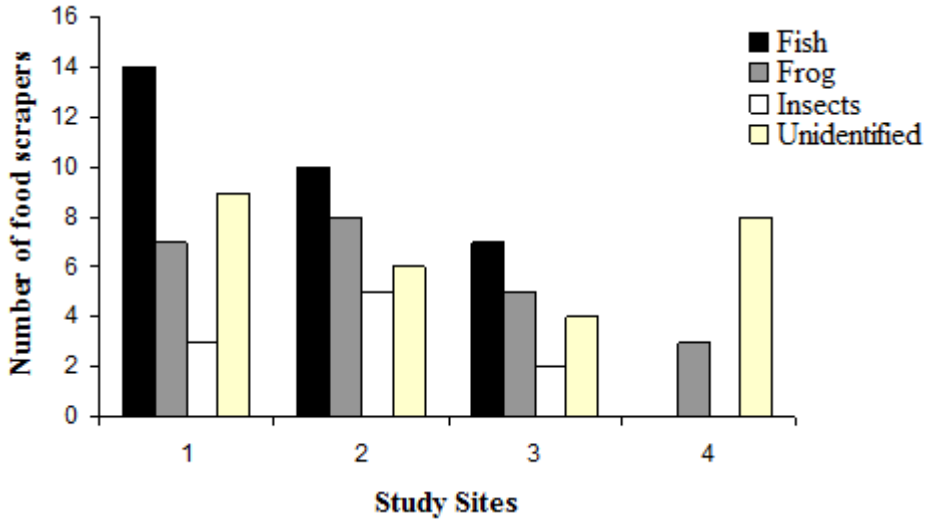


Figure 3. Food items/scrapers recorded in the study sites

3.3. Activity budget

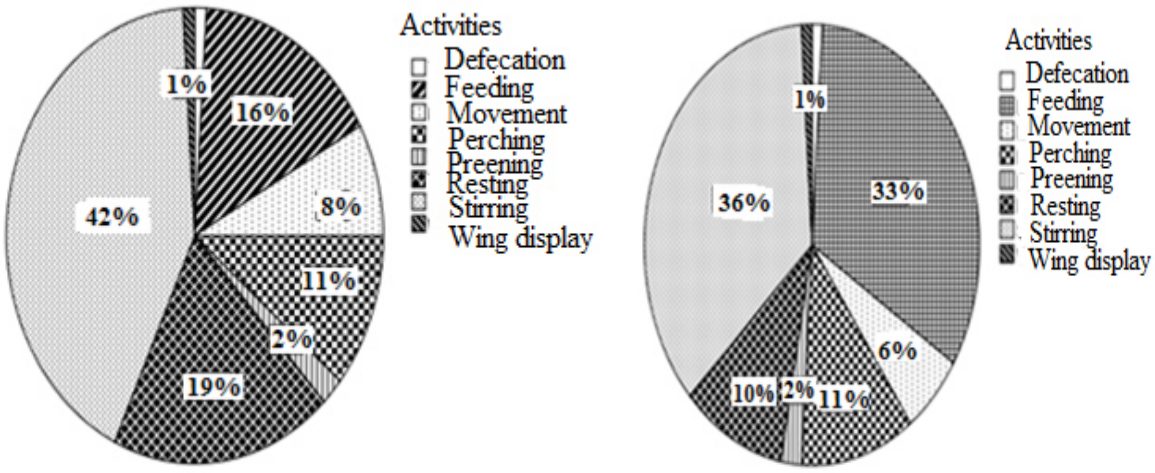
Out of the total 2,395 minutes of monitoring of the diurnal time budget during the study period, stirring was the main activity (39.3 %), followed by feeding (23.38 %), resting (16.49 %), perching (10.81%), movement (6.97 %), preening (2.34 %), wing display (1.34 %) and defecation (1.13 %) (Table 1).

Table 1. Time spent on different activity patterns by African spoonbill during wet and dry seasons

	No. of occurrences		Total time in min	% of time spent
Activity patterns	Wet season	Dry season		
Perching	134	125	259	10.81
Stirring	555	387	942	39.33
Feeding	204	353	560	23.38
Preening	34	22	56	2.34
Wing display	18	14	32	1.34
Movement	105	62	167	6.97
Defecation	15	12	27	1.13
Resting	247	105	352	16.49
Total	**1315**	**1080**	**2395**	**100**

In the present investigation, the time engaged in activity patterns of African spoonbill was found to be different between seasons. They spent more time on stirring, resting and movements during the wet season than during the dry season. Less time was spent in resting, moving and stirring during the dry season. However, they devoted more time in feeding in the dry season than during the wet season. The time spent on stirring, feeding, movement and resting was statistically significant (χ^2 =29.9, p<0.001, χ^2 = 38.1, p<0.001, χ^2 =11.1, p<0.001, χ^2 = 57.3, p<0.001, respectively). Perching, preening, wing display and defecation, showed no significant difference between seasons (p>0.05). The total time engaged in perching, stirring, feeding, movement and resting was

statistically significant ($\chi^2 = 833.7$, $p<0.001$). However, preening, wing display and defecation, showed no significant difference ($p>0.05$). The proportion of different activities of the African spoonbill during the wet and dry seasons is given in Figure 4a and b. During the wet season, stirring was the dominant activity, followed by resting. Time spent in feeding had the second highest mean value (33%), after stirring (36%) during the dry seasons. The time spent for feeding between seasons was statistically significant ($\chi^2 = 5.9$, $p<0.05$). Other daily activities such as resting, perching, stirring, wing display, preening, defecation and movement, showed no significant difference between wet and dry seasons ($p>0.05$).



(4a, wet season) (4b, dry season)

Figure 4a and b. Activity patterns of African spoonbill during wet and dry seasons

Discussion

Maheswaran and Rahmani (2001), reported that the difference in the habitat use by the spoonbill and other wading birds due to the differences in the magnitudes of lunar tides and a seasonally induced change in water level of their habitats. Similarly, habitat use pattern of African spoonbill was consistent with the water-level and availability of prey. In the present study, the African spoonbill was frequently observed in study site 1 and 2. This probably related with the activity patterns of prey abundance in these sites. Moreover, the tidal range was limited as compared to study sites 3 and 4. These were the causes of frequent occurrence of the species in study site 1 and 2. The species was less frequently observed in study sites 3 and 4, this was probably due to high tide occurrence and low food availability.

In regarding with activity patterns, the African spoonbill spent more time on stirring and feeding than other diurnal activities. The time devoted to wing display and defecation was relatively similar in both seasons. Several studies indicated that the African spoonbill and other wading birds devoted most of their time in feeding and stirring. As Boulkhssaim *et al*. (2006) reported, spoonbill devoted over half their time on feeding and stirring. Moreover, Hancock *et al*. (1992) reported that the time engaged in resting and perching by the African spoonbill and other wading birds was lower than feeding and stirring. In this regard, the African Spoonbill spent a much smaller proportion of their time resting (16.49 %), and to a lesser extent, perching (10.81%) during the day as compared to stirring and feeding. Boulkhssaim *et al*. (2006) have reported that the time spent in feeding by spoonbill and wading birds significantly differ between wet and dry seasons. This was correlated with the

fluctuation of water level in the study sites. Similarly, the highest percentage of time spent in feeding was recorded during the dry season than wet season. This was probably due to unstable water current. High levels of tide during the wet season make the water more turbid.

In this case, spoonbill entirely devoted its time for stirring. As a result the time engage in stirring was significantly higher than other diurnal activities. Even though the prey availability of most water bodies often increases during the wet season, water is usually more turbid because of high level of tide. In addition, the annual grass cover around the lake increases. These factors make the prey hidden and unable to access. Following stirring, resting and feeding took a great proportion of time of the African spoonbills during the wet season. Soni *et al*. (2010) reported that in the dry season the prey availability of most tropical aquatic ecosystems decrease. This makes the African spoonbill to spend more time for feeding than other diurnal activities. Similarly, during the present study in dry season, the time engaged in feeding was higher than other diurnal activities. This was due to low prey availability, which necessitated more time in scale of food in the lake. Soni *et al*. (2010) also stated that most wading birds have high foraging success before the midday, because of low dissolved oxygen levels in water during the morning, soon after sunrise. Dissolved oxygen increases due to the diurnal portion of plant respiration and capture rates decreased rapidly. Similarly, in the present investigation in Lake Ziway, the time to spent in feeding by the African spoonbills was high during the morning hours. Powell (1987) stated that a seasonally induced change in the mean water level between seasons has a greater impact on the time engaged in feeding and other daily activities of spoonbills. Moreover, water levels are determinant to allow birds to forage during the dry season and in the beginning of the wet season. By the latter part of the wet season, however, water levels are consistently high for foraging of the African spoonbills. Similarly, fluctuation of water levels between seasons, enabled to change the time engaged in different activities during wet and dry seasons. However, certain activities like preening, wing display and defecation did not show any change between seasons.

Conclusion

African spoonbills were frequently observed in shallow water, or wetland around the lake with less depth. They frequently observed in foraging juvenile fishes, frogs and insects. The variation of time engaged in different activities during the study was associated with the rise and fall of water level, seasonal fluctuation of tide and food availability.

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